# AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

| | | | | | |
|---|---|---|---|---|---|
| | | | **Reference:** | CA18/2/3/10378 | |
| **Aircraft Registration** | **ZS-JKE** | **Date of Accident** | 21 October 2023 | **Time of Accident** | 0722Z |
| **Type of Aircraft** | Beechcraft Sundowner C23 | | **Type of Operation** | Private (Part 91) | |
| **Pilot-in-command Licence Type** | Private Pilot Licence (PPL) | | **Age** | 21 | **Licence Valid** | Yes |
| **Pilot-in-command Flying Experience** | | **Total Flying Hours** | ±111.7 | **Hours on Type** | ±19.3 |
| **Last Point of Departure** | Bram Fischer International Airport (FABL), Free State Province | | | | |
| **Next Point of Intended Landing** | Wonderboom Airport (FAWB), Gauteng Province | | | | |
| **Damage to Aircraft** | Destroyed | | | | |

**Location of the accident site with reference to easily defined geographical points (GPS readings if possible)**

One kilometre east of Bram Fischer International Airport (FABL) RWY 20 at Global Positioning System (GPS) co-ordinates determined to be 29º04'47.98" South 026º18'46.83" East, at an elevation of 4 409 feet (ft).

| | |
|---|---|
| **Meteorological Information** | Wind direction: 320°; Wind speed: 20kts; Visibility: 10km; Temperature: 27°C; Cloud cover: Nil |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Number of People On-board** | 2 + 0 | **Number of People Injured** | 1 | **Number of People Killed** | 1 | **Other (On Ground)** | 0 |

## Synopsis

On Saturday, 21 October 2023 at 0715Z, two pilots on-board a Beechcraft Sundowner C23 aircraft with registration ZS-JKE were on a private flight from Bram Fischer International Airport (FABL) in the Free State province to Wonderboom Airport (FAWB) in Gauteng province. The flight plan was filed for this flight which was planned to be conducted under visual flight rules (VFR) and under visual meteorological conditions (VMC) by day. The provisions of Part 91 of the Civil Aviation Regulations (CAR) 2011 as amended were to be followed.

The pilot seated on the left was the pilot flying (PF) and the pilot seated on the right was the pilot monitoring (PM). The PF took off from FABL Runway 02 (RWY 02). Whilst the aircraft was climbing and at approximately 350 feet (ft) above ground level (AGL), the engine lost power. The PM who was more experienced took control of the aircraft and made a right turn to conduct a forced landing on an open field. The aircraft lost height rapidly and crash-landed outside the grounds of FABL before it burst into flames. The PM was assisted by the eyewitness to vacate the aircraft; however, the PF remained trapped inside the aircraft.

The PF was fatally injured, and the PM sustained serious injuries. The aircraft was destroyed by impact and post fuel-fed fire that erupted.

Post-accident engine teardown inspection revealed that the exhaust valve of the number four (4) cylinder was stuck in an open position, which resulted in a loss of compression on the number 4 cylinder.

## Probable Cause/s and/or Contributory Factors

**Probable Cause**

The engine lost power during the climb as a result of a loss of compression on cylinder number 4 (four) which was caused by the exhaust valve that was stuck in open position. A forced landing was initiated, which was unsuccessful.

**Contributing factor**

The pilot's decision to depart FABL with a known engine defect.

| | | | |
|---|---|---|---|
| SRP Date | 10 September 2024 | Publication Date | 13 September 2024 |

**Occurrence Details**

| | |
|---|---|
| **Reference Number** | **:** CA18/2/3/10378 |
| **Occurrence Category** | **:** Accident Category 1 |
| **Type of Operation** | **:** Private (Part 91) |
| **Name of Operator** | **:** 4 AVIATORS |
| **Aircraft Registration** | **:** ZS-JKE |
| **Aircraft Make and Model** | **:** Beechcraft Sundowner C23 |
| **Nationality** | **:** South African |
| **Place** | **:** 1 kilometre east of Runway 20 threshold at FABL, Free State Province |
| **Date and Time** | **:** 21 October 2023 at 0722Z |
| **Injuries** | **:** One fatal; one seriously injured |
| **Damage** | **:** Destroyed |

**Purpose of the Investigation**

*In terms of Regulation 12.03.1 of the Civil Aviation Regulations (CAR) 2011, this report was compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents and not to apportion blame or liability.*

*All times given in this report are Co-ordinated Universal Time (UTC) and will be denoted by (Z). South African Standard Time is UTC plus 2 hours.*

## Investigation Process

The Accident and Incident Investigations Division (AIID) was notified of the occurrence on 21 October 2023 at 0815Z. The occurrence was classified as an accident according to the CAR 2011 Part 12 and the International Civil Aviation Organisation (ICAO) STD Annex 13 definitions. Notifications were sent to the State of Registry, Operator, Design and Manufacturer in accordance with the CAR 2011 Part 12 and the ICAO Annex 13 Chapter 4. The States did not appoint an accredited representative and/or advisor. Investigators were dispatched to the accident site for this investigation.

*Notes:*

1. *Whenever the following words are mentioned in this report, they shall mean the following:*
   *Accident — this investigated accident*
   *Aircraft — the Beechcraft Sundowner C23 involved in this accident*
   *Investigation — the investigation into the circumstances of this accident*
   *Pilot — the pilot involved in this accident*
   *Report — this accident report*

2. *Photos and figures used in this report were taken from different sources and may have been adjusted from the original for the sole purpose of improving clarity of the report. Modifications to images used in this report were limited to cropping, magnification, file compression; or enhancement of colour, brightness, contrast; or addition of text boxes, arrows, or lines.*

## Disclaimer

This report is produced without prejudice to the rights of the SACAA, which are reserved.

## Table of Contents

| Abbreviation | Description |
|---|---|
| °C | Degrees Celsius |
| AGL | Above ground level |
| AIID | Accident and Incident Investigations Division |
| AMO | Aircraft Maintenance Organisation |
| ARCC | Airport Rescue and Fire Fighting |
| ATC | Air Traffic Control |
| ATO | Aviation Training Organisation |
| C of A | Certificate of Airworthiness |
| C of R | Certificate of Registration |
| CAR | Civil Aviation Regulations |
| CPL | Commercial Pilot Licence |
| CRS | Certificate of Release to Service |
| CVR | Cockpit Voice Recorder |
| EMS | Emergency Medical Service |
| FABL | Bram Fischer International Airport |
| FABW | Karoo Gateway Airport |
| FACT | Cape Town International Airport |
| FAEO | Ermelo Aerodrome |
| FASX | Swellendam Airport |
| FAWB | Wonderboom Airport |
| FDR | Flight Data Recorder |
| Ft | Feet |
| GPS | Global Positioning System |
| hPa | Hectopascal |
| km | Kilometres |
| Kt | Knots |
| M | Metres |
| METAR | Meteorological Routine Aerodrome Report |
| MHz | Megahertz |
| PPL | Private Pilot Licence |
| QNH | Barometric pressure adjusted to sea level |
| RPM | Revolutions per Minute |
| RWY | Runway |
| SACAA | South African Civil Aviation Authority |
| SAWS | South African Weather Service |
| UTC | Co-ordinated Universal Time |
| VMC | Visual Meteorological Conditions |
| Z | Zulu (Term for Universal Co-ordinated Time - Zero Hours Greenwich) |

## 1. FACTUAL INFORMATION

### 1.1. History of Flight

1.1.1 On Saturday, 21 October 2023 at 0715Z, two pilots on-board a Beechcraft Sundowner C23 aircraft with registration ZS-JKE were on a private flight from Bram Fischer International Airport (FABL) in the Free State province to Wonderboom Airport (FAWB) in Gauteng province. The pilot seated on the left was the pilot flying (PF) and the pilot seated on the right was the pilot monitoring (PM). The flight plan was filed for this private flight which was planned to be conducted in visual flight rules (VFR) and under visual meteorological conditions (VMC) by day. Part 91 of the Civil Aviation Regulations (CAR) 2011 as amended was followed.

1.1.2 The PM stated that a pre-flight inspection was conducted on the aircraft and nothing abnormal was found. The PM contacted the air traffic control (ATC) officer on the very high frequency 114.10-Megahertz (MHz) and informed him of their intentions. Later, the PF started the engine and allowed it to run for a few minutes. After making sure that the engine indications were within the green arch, the PF taxied the aircraft to the holding point of Runway (RWY) 02. The PF performed the pre-take-off checks and then taxied the aircraft to the threshold of RWY 02. The PF opened the throttle to 2 400 revolutions per minute (RPM) and commenced with the take-off run. During the climb at approximately 350 feet (ft) above ground level (AGL), the engine power reduced to 1 600 RPM. The PM, who was more experienced than the PF, took control and steered the aircraft to the right to perform a forced landing on an open field (grass area) outside the grounds of FABL. The aircraft impacted the ground and spun 180º; thereafter, it burst into flames. The flames also set alight the grass at the accident site, which was outside of the airport, approximately 1 kilometre (km) east of RWY 20 threshold. The PF was fatally injured, and the PM sustained serious injuries. The aircraft was destroyed by impact and post fuel-fed fire that erupted.

1.1.3 The eyewitness who was positioned on the gravel road near the accident site stated that he saw the right wing drop before the aircraft descended and impacted the ground, and the fire ensued. He stated that the aircraft was approximately 120 metres (m) from his position when it crashed. He ran to help and was able to assist the PM who had managed to crawl out of the aircraft, he found him kneeling on the ground. As the fire was approaching fast towards them, he decided to move him to a safe distance. When he was about to rescue the PF, the fire had already intensified, and it was impossible for him to help the PF out of the aircraft. Moments later, the Airport Rescue and Fire Fighting (ARFF) personnel arrived at the scene, they sprayed the foam to extinguish the blaze. The Emergency Medical Services (EMS) personnel also arrived at the scene and administered first aid to the PM who had sustained substantial injuries. The PF was declared deceased at the scene.

1.1.4 The aircraft maintenance engineer (AME) at the operator's facility in Cape Town stated that the pair had attempted the first take-off, however, were unsuccessful due to the engine that lost power during the take-off run. The take-off was aborted, and the aircraft was taxied to the apron. The AME reported that he advised the pair to ground-run the engine; and it was found to be within the acceptable parameters. The AME also advised them to verify the selection of the fuel pump switches, thus, changing the fuel tanks to ensure that the cause for engine power loss was not fuel related. After the engine run, the PM reported that there were no indications of a magneto drop and that the engine was running smoothly with static maximum RPM at 2400. The pair was satisfied, and they requested clearance to depart. This was followed by the take-off which resulted in this accident.

1.1.5 The accident occurred during daylight at Global Positioning System (GPS) co-ordinates determined to be 29º04'47.98" South 026º18'46.83" East, at an elevation of 4 409 feet (ft).


**Figure 1**: Aerial view of the crash site outside of the grounds of FABL. (Source: Google Earth)

## 1.2. Injuries to Persons

| Injuries | Pilot | Crew | Pass. | Total On-board | Other |
|---|---|---|---|---|---|
| Fatal | 1 | - | - | 1 | - |
| Serious | 1 | - | - | 1 | - |
| Minor | - | - | - | - | - |
| None | - | - | - | - | - |
| **Total** | **2** | **-** | **-** | 2 | **-** |

Note: Other means people on the ground.

## 1.3. Damage to Aircraft

1.3.1. The aircraft was destroyed by post-impact fuel fed-fire that erupted.

**Figure 2:** Aerial view of the wreckage at the accident site. (Source: Operator)

## 1.4. Other Damage

1.4.1. None.

## 1.5. Personnel Information

1.5.1. Pilot Flying (PF)

| | | | | | |
|---|---|---|---|---|---|
| Nationality | Pakistani | Gender | Male | Age | 21 |
| Licence Type | Private Pilot Licence (PPL) | | | | |
| Licence Valid | Yes | Type Endorsed | No | | |
| Ratings | Night rating | | | | |
| Medical Expiry Date | 31 December 2025 | | | | |
| Restrictions | None | | | | |
| Previous Accidents | None | | | | |

Note: Previous accidents refer to past accidents the pilot was involved in, when relevant to this accident.

**Flying Experience:**

| | |
|---|---|
| Total Hours | ±111.7 |
| Total Past 24 Hours | 6.9 |
| Total Past 7 Days | Unknown |

| | |
|---|---|
| Total Past 90 Days | Unknown |
| Total on Type Past 90 Days | Unknown |
| Total on Type | ±19.3 |

1.5.1.1 The PF was initially issued a Private Pilot Licence (PPL) by the Regulator on 14 October 2021. The licence was reissued on 18 September 2023 with an expiry date of 30 September 2025.

1.5.1.2 The PF was issued a Class 2 aviation medical certificate on 4 December 2020 with an expiry date of 31 December 2025.

1.5.2 Pilot Monitoring (PM)

| | | | | | |
|---|---|---|---|---|---|
| Nationality | South African | Gender | Male | Age | 24 |
| Licence Type | Commercial Pilot Licence (CPL) | | | | |
| Licence Valid | Yes | Type Endorsed | Yes | | |
| Ratings | Instrument and Instructor Grade 2 Ratings | | | | |
| Medical Expiry Date | 30 April 2024 | | | | |
| Restrictions | None | | | | |
| Previous Accidents | None | | | | |

Note: Previous accidents refer to past accidents the pilot was involved in, when relevant to this accident.

**Flying Experience:**

| | |
|---|---|
| Total Hours | 838 |
| Total Past 24 Hours | 6.9 |
| Total Past 7 Days | 7.2 |
| Total Past 90 Days | 177.4 |
| Total on Type Past 90 Days | 7.2 |
| Total on Type | 16.3 |

1.5.2.1 The PM was initially issued a Commercial Pilot Licence (CPL) by the Regulator on 15 June 2021. The licence was reissued on 29 August 2023 with an expiry date of 31 August 2024.

1.5.2.2 The PM was issued a Class 1 aviation medical certificate on 21 April 2023 with an expiry date of 30 April 2024.

1.5.3 Aircraft Maintenance Engineer (AME)

| | | | | | |
|---|---|---|---|---|---|
| Nationality | South African | Gender | Male | Age | 59 |
| Licence Type | Licenced Aircraft Maintenance Engineer (LAME) | | | | |
| Licence Valid | Yes | Type Endorsed | Yes | | |
| Ratings | Aeroplanes in group 4 and Engines in group 01 & 02. | | | | |

Note: Previous accidents refer to past accidents the pilot was involved in, when relevant to this accident.

1.5.3.1 The AME was initially issued an AME licence on 5 December 1994. The licence was reissued on 4 June 2023 with an expiry date of 7 July 2025.

## 1.6. Aircraft Information

1.6.1 Beechcraft Sundowner C23: (Source: Pilot Operating handbook [POH])

*The airplane is a four-place, low wing, single engine airplane equipped with fixed tricycle landing gear. The aircraft is powered by a four cylinder, normally aspirated, direct drive, air cooled, horizontally opposed Lycoming O-360-A2G engine rated at 180 horsepower (hp). Fuel tanks located in each wing's leading edge have a capacity of 30 gallons each for a total capacity of 60 gallons when full. A visual measuring tab below the filler neck of each tank allows the tank to be filled to a 15- or 20-gallon capacity. Fuel is fed from the desired tank to a fuel selector valve in the centre floorboard and then through a strainer to the engine-driven fuel pump. The electrical system is powered by an alternator and a 12-Volt, 25 Amp-hour battery.*


**Figure 3**: The file picture of the ZS-JKE. (Source: https://www.flightaware.com/photos)

**Airframe:**

| | | |
|---|---|---|
| Manufacturer/Model | Beech Aircraft Corporation / Sundowner C23 | |
| Serial Number | M-1708 | |
| Year of Manufacture | 1975 | |
| Total Airframe Hours (At Time of Accident) | 2 982.3 (Tachometer readings) | |
| Last Inspection (Date & Hours) | 2 904.6 | 29 March 2023 |
| Airframe Hours Since Last Inspection | 77.7 | |
| CRS Issue Date | 29 March 2023 | |
| C of A (Issue Date & Expiry Date) | 8 May 2023 | 7 May 2024 |
| C of R (Issue Date) (Present Owner) | 23 May 2023 | |
| Operating Category | Private (Part 91) | |
| Type of Fuel Used | Avgas 100LL | |
| Previous Accidents | (1) The aircraft had a landing accident at Karoo Gateway Airport (FABW) in Beaufort West on 28 June 2004. During approach for landing on a gravel runway in gusty wind conditions, the pilot had difficulty controlling the aircraft. The aircraft landed hard which caused the nose gear strut to collapse.<br>(2) The aircraft had a landing accident in Swellendam Airport (FASX) in the Western Cape which resulted in the collapse of the nose gear strut and the propeller struck the ground. This accident occurred on 3 December 2021 and was not reported to the AIID, as there are no records of this occurrence in any of AIID's database. | |

Note: Previous accidents refer to past accidents the aircraft was involved in, when relevant to this accident.

**Engine:**

| | |
|---|---|
| Manufacturer/Model | Textron Lycoming / O-360-A2G |
| Serial Number | L-20195-36A |
| Part Number | O-360-A4K |
| Hours Since New | 2973.3 |
| Hours Since Overhaul | 1242.3 |

**Propeller:**

| | |
|---|---|
| Manufacturer/Model | Sensenich / 76EM8S5-0-60 |
| Serial Number | 103965K |
| Part Number | 76EM8S5-0-60 |
| Hours Since New | 439.0 |
| Hours Since Overhaul | 8.3 |

## 1.7. Meteorological Information

1.7.1. The weather information below was obtained from the meteorological aerodrome report (METAR) that was issued by the South African Weather Service (SAWS), recorded at Bram Fischer International Airport (FABL) on 21 October 2023 at 0730Z.

| | | | | | |
|---|---|---|---|---|---|
| Wind Direction | 340° | Wind Speed | 04kts | Visibility | 9999m |
| Temperature | 25°C | Cloud Cover | CAVOK | Cloud Base | CAVOK |
| Dew Point | 07°C | QNH | 1016hPa | | |

## 1.8. Aids to Navigation

1.8.1. The aircraft was equipped with standard navigational equipment as approved by the Regulator (SACAA). There were no records indicating that the navigational equipment was unserviceable prior to the flight.

## 1.9. Communication

1.9.1 The aircraft was equipped with a standard communication system as approved by the Regulator. There were no recorded defects with the communication system prior to the flight.

## 1.10. Aerodrome Information

| | |
|---|---|
| Aerodrome Name | Bram Fischer International Airport (FABL) |
| Aerodrome Location | Bloemfontein, Free State Province |
| Aerodrome Status | Licensed |
| Aerodrome GPS coordinates | 29º05′38″South 26º18′14″East |
| Aerodrome Elevation | 4 457 feet |

| | |
|---|---|
| Runway Headings | 02/20 and 12/30 |
| Dimensions of Runway Used | 2 559 x 46 m |
| Heading of Runway Used | 02 |
| Surface of Runway Used | Asphalt |
| Approach Facilities | Runway lights, PAPI, NDB |
| Radio Frequency | 114.10 MHz |

## 1.11. Flight Recorders

1.11.1 The aircraft was neither equipped with a flight data recorder (FDR) or a cockpit voice recorder (CVR), nor was it required by regulation to be fitted on this aircraft.

## 1.12. Wreckage and Impact Information

1.12.1. Witness marks at the accident site showed that the aircraft impacted the ground hard with the right wing first, this resulted in the right main landing gear strut separating from the under fuselage. The aircraft came to rest in an upright position facing the direction from which it had taken off. The left main landing gear and the right flap also broke off during the 180° turn. The bladder fuel tanks raptured after impact and the aircraft burst into flames. The control surfaces were all accounted for at the accident site.


**Figures 4 and 5:** The right main landing gear assembly (left); and the left main landing gear assembly (right).

1.12.2. The left aileron, flap and part of the left wing were damaged by post-impact fire; they were still attached to the aircraft.


**Figures 6 and 7:** The damaged left aileron and flap (left). Closer-up picture of the left wing (right).

1.12.3. The engine and the propeller blades sustained substantial damage. The instrument panel, both control columns and the wiring behind the instrument panel were also damaged during the accident sequence.


**Figures 8 and 9**: The damaged engine and propeller (left), and instrument panel (right).

1.12.4. The left door had detached from its mounting point during the accident sequence. The overall examination of the wreckage showed that the aircraft was intact before the flight.

**Figure 10:** The left door that separated from the fuselage.

### 1.13. Medical and Pathological Information

1.13.1 A post-mortem examination was performed on the PF's body. The medico-legal postmortem report indicated that the head injuries and burns sustained after the crash were the cause of death.

### 1.14. Fire

1.14.1. A post-impact fire ensued and destroyed the aircraft. According to the Airports Company South Africa (ACSA) report, the ARFF arrived at the scene at approximately 0731Z (9 minutes later) and started extinguishing the fire that had erupted; they also attempted to rescue the deceased (PF). The report from ACSA also stated that a total of five vehicles from the neighbourhood watch had arrived at the scene at approximately 0744Z (22 minutes later) to assist in containing the fire.

**Figure 11:** The accident site that was ravaged by the fire. (Source: Operator)

## 1.15. Survival Aspects

1.15.1. The accident was considered not survivable because of the intense post-impact fire, as well as the impact forces that destroyed the aircraft's cabin area.

## 1.16. Tests and Research

1.16.1. The engine was removed from the airframe and sent to the SACAA-approved engine overhaul facility for inspection. After the valve covers were removed, it was discovered that the exhaust valve on the number four (4) cylinder was stuck in an open position; this resulted in a loss of compression on cylinder number 4 (see Appendix C).


**Figure 12:** Cylinder No 4 exhaust valve in open position.

1.16.2 A Service Bulletin (SB) number 388C was issued by the engine manufacturer (Lycoming), dated 22 November 2004, which required the inspection of the engine to ensure positive and trouble-free valve train operation every 400 hours on engines fitted to fixed wing aircraft.

1.16.3 According to the engine logbook, the approved maintenance organisation (AMO) complied with the SB on 18 June 2018 at 2 243.4 total engine time. Several mandatory periodic inspections (MPI) were conducted in the past during which the SB 388C was not due. However, during the MPI certified on 25 November 2021 at 2 895.70 hours, the SB was not conducted but was due. The engine had exceeded SB 388C by 252.3 hours which was issued by the manufacturer to assist in preventing engine failure due to excessive carbon build up between the valve guide and valve stem which led to sticking valves or broken exhaust valves from excessive wear (bell-mouthing) of the exhaust valve guide.

## 1.17. Organisational and Management Information

1.17.1. The flight was conducted in accordance with the provisions of Part 91 (General Aviation and Operating Flight Rules) of the CAR 2011 as amended.

1.17.2. The aircraft maintenance organisation (AMO) which conducted the last maintenance inspection on the aircraft prior to the flight had an AMO Certificate that was issued by the Regulator on 9 November 2022 with an expiry date of 30 November 2023.

1.17.3. The AMO which conducted the engine teardown inspection had an AMO Certificate that was issued by the Regulator on 31 May 2023 with an expiry date of 31 May 2024.

### 1.18. Additional Information

1.18.1. None.

### 1.19. Useful or Effective Investigation Techniques

1.19.1. None.

## 2. ANALYSIS

### 2.1. General

From the available evidence, the following analysis was made with respect to this accident. This shall not be read as apportioning blame or liability to any organisation or individual.

### 2.2. Analysis

2.2.1. Man

The pilots were properly licensed. There were no anomalies with their aviation medical records. Available information indicated that the pair had met all the requirements to undertake the flight. The AME who certified the last MPI on the aircraft was properly licensed. All available information revealed that the AME met all the requirements to perform maintenance on the aircraft model.

2.2.2 Weather

Clear weather conditions prevailed at the time of the flight. The surface wind was 340° at 4 knots. The weather did not contribute to this accident.

2.2.3 Machine

Examination of the engine post-accident revealed that the exhaust valve on the number four (4) cylinder was stuck in an open position. This resulted in a loss of compression on cylinder number 4. The investigation also revealed that SB 388C, dated 22 November 2004, issued by Lycoming was not complied with during the MPI that was conducted on 25 November 2021 at 2 895.70. The SB was last complied with on 18 June 2018 at 2 243.4 engine total time. The engine had operated 652.3 hours since the last SB was conducted. The SB on the engine was exceeded by 252.3 hours in operation at the time of this inspection.

## 3. CONCLUSION

### 3.1. General

From the available evidence, the following findings, causes and contributing factors were made with respect to this accident. These shall not be read as apportioning blame or liability to any organisation or individual.

To serve the objective of this investigation, the following sections are included in the conclusion heading:

- **Findings —** are statements of all significant conditions, events, or circumstances in this accident. The findings are significant steps in this accident sequence, but they are not always causal or indicate deficiencies.
- **Causes —** are actions, omissions, events, conditions, or a combination thereof, which led to this accident.
- **Contributing factors —** are actions, omissions, events, conditions or a combination thereof, which, if eliminated, avoided or absent, would have reduced the probability of the accident occurring, or would have mitigated the severity of the consequences of the accident. The identification of contributing factors does not imply the assignment of fault or the determination of administrative, civil, or criminal liability.

### 3.2. Findings

3.2.1 The PF was initially issued a Private Pilot Licence (PPL) on 14 October 2021. The licence was reissued on 18 September 2023 with an expiry date of 30 September 2025.

3.2.2 The PF was issued a Class 2 medical certificate on 4 December 2020 with an expiry date of 31 December 2025.

3.2.3 The PF's logbook was last updated on 23 September 2023.

3.2.4 The PM was initially issued a Commercial Pilot Licence (CPL) on 15 June 2021. The licence was reissued on 29 August 2023 with an expiry date of 31 August 2024.

3.2.5 The PM was issued a Class 1 medical certificate on 21 April 2023 with an expiry date of 31 April 2024.

3.2.6 The PM's logbook was last updated on 18 October 2023.

3.2.7 The last MPI of the aircraft was conducted on 29 March 2023 at 2904.6 Tachometer hours. The aircraft was issued a CRS on 29 March 2023 with an expiry date of 28 March 2024 or at 3004 Tachometer hours, whichever occurs first.

3.2.8 The AMO which conducted the last MPI prior to the accident flight had the approved AMO Certificate that was issued by the Regulator on 9 November 2022 with an expiry date of 30 November 2023.

3.2.9 The aircraft impacted the ground and burst into flames following an engine failure after take-off.

3.2.10 The SB 388C dated 22 November 2004 which was issued by Lycoming was not complied with during the MPI that was conducted on 25 November 2021 at 2 895.70 engine total time. The SB was last complied with on 18 June 2018 at 2 243.4 engine total time. The engine had operated 652.3 hours since the last SB was conducted. The SB on the engine had been exceeded by 252.3 hours in operation at the time of this inspection.

### 3.3. Probable Cause/s

3.3.1. The engine lost power during the climb as a result of a loss of compression on cylinder number 4 (four) which was caused by the exhaust valve that was stuck in open position. A forced landing was initiated, which was unsuccessful.

### 3.4. Contributory Factor/s

3.4.1. The pilot's decision to depart FABL with a known engine defect.

## 4. SAFETY RECOMMENDATIONS

### 4.1. General

The safety recommendations listed in this report are proposed according to paragraph 6.8 of Annex 13 to the Convention on International Civil Aviation and are based on the conclusions listed in heading 3 of this report. The AIID expects that all safety issues identified by the investigation are addressed by the receiving States and organisations.

### 4.2. Safety Recommendation/s

4.2.1. The AMO responsible for the maintenance had released the aircraft with an unhonoured Service Bulletin (SB) 388C. Moreover, the SACAA renewed the Certificate of Airworthiness (C of A) as prescribed by the CAR and the South Africa Civil Aviation Technical Standards (SA-CATS) 21.08.12A. It is recommended to the Director of Civil Aviation to review its internal processes of verifying and validating aircraft's airworthiness prior to the issuance of renewed C of As.

## 5. APPENDICES

5.1 Appendix A – Service Bulletin 388C.

**This report is issued by:**
**Accident and Incident Investigations Division**
**South African Civil Aviation Authority**
**Republic of South Africa**

## Appendix A

DATE: November 22, 2004

Service Bulletin No. 388C
(Supersedes Service Bulletin No. 388B
and Supplement No. 1 to Service Bulletin No. 388B)

SUBJECT: Procedure to Determine Exhaust Valve and Guide Condition

PART 1 – Use of P/N ST-71 and P/N ST-310 Fixtures

PART 2 – A. Modification to P/N ST-71 and P/N ST-310 Fixtures to Allow Use of a Dial Indicator
B. Optional Inspection Procedure Using a "Go/No-Go" Gage.

PART 3 – Example of Alternate Tools That Can Be Locally Manufactured

TIME OF COMPLIANCE: Helicopter Engines – 300 hour intervals or earlier if valve sticking suspected. All Other Engines – 400 hour intervals or earlier if valve sticking suspected until exhaust valve guides are replaced with guides made of improved material. (Refer to latest revision of Service Instruction No. 1485.)

To insure positive and trouble free valve train operation, the inspection procedure described in this publication should be accomplished as recommended in the Time of Compliance section of this publication. Failure to comply with the provisions of this publication could result in engine failure due to excessive carbon build up between the valve guide and valve stem resulting in sticking valves or; broken exhaust valves which result from excessive wear (bell-mouthing) of the exhaust valve guide.

This publication describes the approved procedures for checking exhaust valve guide condition.

### PART 1 – USE OF P/N ST-71 AND P/N ST-310 FIXTURES TO DETERMINE VALVE GUIDE WEAR OR CARBON BUILD UP

The illustrations used in PART 1 are primarily of a parallel valve cylinder and the P/N ST-71 fixture which uses one adjustable self-locking screw to measure valve stem movement on all parallel valve cylinders. The procedure for inspecting angle valve cylinders with the P/N ST-310 fixture is basically the same. Refer to Figure 2 for fixture installation. Valve guide wear (bell-mouthing) occurs on the inside diameter of the valve guide in a straight line with the center line of the rocker arm. Valve stem movement must be measured by moving the valve stem along this line. The P/N ST-310 fixture incorporates two adjustable self-locking screws located at different angles to accomplish this on two differently designed angle valve cylinder head configurations. Refer to Figure 2.