

LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/2/3/10532						
Classification	Accident	Date	29 November 2024		Time	0828Z	
Type of Operation	Private (Part 94)						
Location							
Place of Departure	Willow Valley Farm Airstrip, Lephalale, Limpopo Province			Place of Intended Landing	Willow Valley Farm Airstrip, Lephalale, Limpopo Province		
Place of Occurrence	Bushy terrain in Weltevreden Game Farm, Lephalale, Limpopo Province						
GPS Co-ordinates	Latitude	23°54'.12" S	Longitude	27°56'.50" E	Elevation	4 831 feet	
Aircraft Information							
Registration	ZU-COC						
Make; Model; S/N	Micro Aviation SA; Bat Hawk R (Serial Number: 0104)						
Damage to Aircraft	Substantial			Total Aircraft Hours	192.8		
Pilot-in-command							
Licence Type	Private Pilot Licence		Gender	Male		Age	23
Licence Valid	Yes	Total Hours	180.7		Total Hours on Type	73.5	
Total Hours 30 Days	27.5		Total Hours on Type Past 90 Days	27.5			
People On-board	1 + 1	Injuries	0	Fatalities	0	Other (on ground)	0
What Happened							
<p>On Friday morning, 29 November 2024, a pilot and a passenger on-board a Bat Hawk R aircraft with registration ZU-COC were on a game-capture flight from Willow Valley Farm Airstrip in Lephalale, Limpopo province, with the intention to land at the same airstrip when the accident occurred. The flight was conducted under visual meteorological conditions (VMC) by day and under the provisions of Part 94 of the Civil Aviation Regulations (CAR) 2011 as amended.</p> <p>The pilot stated that he conducted a pre-flight inspection of the aircraft, and no anomalies were found. The pilot informed the investigation team that on the morning before the flight, he uplifted 50 litres (L) of Octane 95 Unleaded fuel, which brought the total to 80L. However, the recorded data on page serial number 255818 in the flight folio revealed that the aircraft was last refuelled at Willow Valley Farm on Friday, 1 November 2024, during which 50L of fuel was uplifted. The pilot was not sure of the total fuel in the tank after refuelling the aircraft on 1 November 2024; he estimated it to be between 90 and 93L. On 29 November 2024 at around 0800Z, the pilot started the engine and allowed it to warm up. When the engine parameters were within the acceptable operating limits, he taxied the aircraft to the gravel runway. Around 0810Z, he opened the throttle to 5 500 revolutions per minute (RPM) and commenced with the take-off run. The aircraft rotated and climbed to 300 feet (ft) above ground level (AGL).</p>							

Later, he retarded the throttle to 5 000 RPM and scanned the forest for the wild dogs. The farm management had intended to tag the wild dogs, a technique which would allow them to routinely track them. A standby crew in motor vehicles was on the ground to assist the pilot once the wild dogs have been spotted and sedated. A few minutes after take-off, the pilot spotted the wild dogs. He executed a right turn towards them (wild dogs) at a speed of 65 knots (kts), which positioned the aircraft in tail wind.

He then reduced the airspeed to 55 kts; however, the right-side wing dropped suddenly and he lost control of the aircraft. It consequently crashed on a bushy terrain on the grounds of the neighbouring Weltevreden Game Farm. The aircraft sustained substantial damage. The pilot vacated the aircraft unharmed. He immediately notified the farm owner who then called the Aeronautical Rescue Coordination Centre (ARCC) in Johannesburg. The Emergency Medical Services (EMS) and officials from the local South African Police Service (SAPS) in Lephalale swiftly responded to the accident site. The passenger sustained serious injuries. First aid was administered to him by the EMS personnel before he was airlifted to a private hospital in Polokwane where he was admitted for medical examination.

The accident occurred during daylight at Global Positioning System (GPS) co-ordinates determined to be 23°54'.12" South 27°56'.50" E East, at an elevation of 4 831ft.



Figure 1: Aerial view of Weltevreden Game Farm and the approximate location of the accident site.
(Source: Google Earth)



Figure 2: The aircraft at the accident site.

Aircraft Description (Source: Bat Hawk R Pilot's Operating Handbook [POH])

The Bat Hawk R features a strut-braced high-wing two seats in side-by-side configuration open cockpit, fixed tricycle landing gear and a single engine in tractor configuration. As a conventional 3-axis light sport aircraft LSA, the Bat Hawk R does not rely on pilot weight shift to affect control. Twin seats are positioned side by side for full dual control and both crew members are well protected from the weather by an aerodynamic fibreglass pod and large wrap-around windshield. The cockpit is very similar to that of a helicopter with excellent forward visibility, as well as on both sides. Several important designs are incorporated into the Bat Hawk R, which include a four-cylinder, four stroke, Rotax 912 ULS engine rated at 100 horsepower (hp). The engine has a mechanical fuel pump and fuel air mixture is fed from the manifold to the twin carburetors. The aircraft's maximum take-off weight (MTOW) is 540 kilograms (kg). It is equipped with a 100l fuel tank capacity, of which 1 litre is unusable.

Meteorological Information:

The weather information entered in the table below was obtained from the pilot questionnaire.

Wind Direction	340°	Wind Speed	10 knots	Visibility	9999 m
Temperature	24°C	Cloud Cover	None	Cloud Base	None
Dew Point	12°C	QNH	Unknown		

Post-accident Examination of the Aircraft

The aircraft's impact heading was approximately 265°magnetic in a westerly direction. On-site examination of the wreckage indicated that the aircraft sustained substantial damage during the accident sequence. The severed tree-tops showed that the aircraft struck the ground in a nose-down attitude and swerved to face the direction of approach. The ignition and the fuel pump switches were found in OFF position, they were switched off by the pilot after the accident. The continuity of the control system was confirmed from the flight control surfaces to the vicinity of the impact-damaged cockpit. There was no pre- or post-impact fuel-fed fire. One of the propeller blades had broken at the tip; the other two had broken near the root after impacting the rocks. Damage on the blades indicated that the propeller was not rotating at the time of impact. The spinner also did not exhibit any rotational signatures, which was consistent with the engines not producing power at the time of impact. The reduction gearbox was examined externally, and the propeller shaft was rotated by hand to check for anomalies; none was found. No anomalies were found with the gearbox after hand rotation was completed. Compression and suction were confirmed on all four cylinders.

The coolant water pump was examined for condition, and no anomalies were observed. The coolant lines were examined for condition; they were found serviceable. The oil system was examined for condition and no anomalies were noted. The oil tank was examined and found to be in good condition. The oil tank cap was in place and the tank had adequate oil. The oil pump was examined for condition, and no anomalies were noted. The oil lines were examined and were in good condition. No leaks were found on the oil supply lines. The induction system was examined and nothing abnormal was noted. The ignition system was also examined and nothing abnormal was found. All eight spark plugs remained intact in their cylinders and were undamaged.



Figure 3: The view of the spinner and broken propeller blades.



Figure 4: The damaged fuel tank (yellow window highlights a hole in the fuel tank).

The fuel system was examined and no evidence of disconnection on the fuel lines was found. The 100L capacity fuel tank, which is located behind the seats, had a rupture underneath after it hit the rocks during the accident sequence; however, there was no evidence of fuel spillage or smell of fuel around the aircraft and on the fabric underneath the fuel tank.

The gascolator was examined, and it contained no fuel. The plastic screen type fuel filter also contained no fuel. The two carburetors were correctly synchronised, and the throttle levers and springs were in place and intact. The engine-related control linkages were continuous and operational. The retention clips were intact, unbroken, and secured to the carburetors. The empty fuel filter and the carburettor bowls indicated that the aircraft did not have sufficient fuel for the planned flight, which was in contravention of Part 91.07.12 of the CAR 2011 as amended.



Figure 5: A picture of the fuel filter assembly showing the absence of fuel.



Figures 6 and 7: The right and the left carburettor bowls contained no fuel.

The investigation team interviewed the Search and Rescue team leader to determine if the fuel system was tampered with during the rescue operation. His response was that none of the systems was tampered with.

Examination of the flight folio showed that the pilot was the regular flyer of the accident aircraft. The entries in the flight folio showed that the pilot was consistent in logging the flights, hours, landings, replenishment of lubricants/oil and fuel. According to the pilot's questionnaire (CAA form number CA12-03), the pilot estimated the fuel consumption for Rotax 912 ULS engine to be 20L per hour. The maximum 90L total fuel estimated by the pilot after refuelling the aircraft on Friday, 1 November 2024, was the basis of the investigation. The first flight recorded in the flight folio after the aircraft was refuelled lasted 3.0 hours during which three touch-and-go landings were conducted and recorded with an estimated fuel burn of approximately 60L; about 33L remained in the tank. The second flight recorded occurred on Friday, 22 November 2024, with a duration of 0.4 hours (24 minutes) during which one landing was performed with an estimated fuel burn of about 9L; about 24L of fuel remained in the tank. The accident flight occurred on Friday morning, 29 November 2024. It lasted 0.3 hours (18 minutes) with an estimated fuel burn of about 8L. Approximately 16L of fuel could not be reconciled as it was absent (unaccounted for).

Date	From	To	Flight-duration	Fuel-on board	Fuel-consumed
1 November 2024	Willow Valley Farm	Willow Valley Farm	3.0	93L	60L
22 November 2024	Willow Valley Farm	Willow Valley Farm	0.4	33L	9L
29 November 2024	Willow Valley Farm	Willow Valley Farm	0.3	24L	8L
No record found for fuel				16L	

The wreckage was recovered to the aircraft maintenance organisation (AMO) in Mbombela, Mpumalanga province, for further investigation. The aircraft had the MGL Avionics Extreme Electronic Flight Instrument System (EFIS) that mainly serves as the engine monitoring system (EMS). According to MGL Avionics, the EFIS model does not have an internal data recording and has an external Secure Digital (SD) card. The approved person (AP) rated on the aircraft type examined the EFIS and informed the investigation team that it was on manual, meaning that no engine parameters were recorded in the SD card as it was not set to automatic during the accident flight. The EFIS model is designed in such a way that it would display the actual amount of fuel being burnt and the remaining fuel relative to tank capacity; however, in the absence of the recorded parameters, the actual amount of fuel that remained in the tank could not be determined. Also, the fact that the pilot could not remember the total amount of fuel in the tank after refuelling the aircraft on Friday, 1 November 2024, was a concern.



Figure 8: The EFIS with the SD card still in place (yellow arrow).

Fuel Supply: Part 91.07.12

- (1) The pilot shall not commence a flight unless he or she is satisfied that the aircraft carries at least the planned amount of fuel to complete the flight safely, taking into account operating and meteorological conditions and the expected delays.*
- (2) The PIC shall ensure that the amount of usable fuel remaining in flight is not less than the fuel required to proceed to an aerodrome or, in the case of a helicopter, a suitable landing place, where a safe landing can be made.*
- (3) If the usable fuel on board the aircraft is less than the final reserve fuel, the PIC of such aircraft, shall –*
 - (a) in the case of an aeroplane, declare an emergency; or*
 - (b) in the case of a helicopter, land as soon as possible.*
- (4) The method of calculating the amount of fuel to be carried for each flight shall be as prescribed in Document SA-CATS 91.*

Findings

1. Personnel Information

1.1 The pilot had a Private Pilot Licence (NPL) that was initially issued by the Regulator (SACAA) on 11 September 2023. The licence was reissued on 29 August 2024 with an expiry date of

30 September 2026. The pilot had flown a total of 180.7 hours of which 73.5 hours were on the aircraft type.

1.2 The pilot was issued a Class 2 aviation medical certificate on 14 February 2022 with an expiry date of 28 February 2027.

2. Aircraft Information

2.1 The aircraft was maintained by an approved person (AP) under Aero Club of South Africa. The last 100-hour annual inspection of the aircraft was conducted and certified on 22 October 2024 at 189.4 Hobbs hours. The aircraft had accrued 3.4 hours after the annual inspection.

2.2 The aircraft had a valid Authority-to-fly (ATF) Certificate that was initially issued on 3 November 2022. The latest ATF was issued on 20 November 2024 with an expiry date of 2 November 2025.

2.3 The aircraft's Certificate of Registration (C of R) was issued to the present owner on 29 September 2022.

2.4 The aircraft was issued a Certificate of Release to Service (CRS) on 22 October 2024 with an expiry date of 22 October 2025 or at 285.8 Hobbs hours, whichever occurs first.

2.5 The fuel filter, gascolator and the carburettor bowls were empty, an indication that the aircraft did not have sufficient fuel for the planned flight, which was in contravention of Part 91.07.12 of the CAR 2011 as amended.

2.6 Based on the available evidence, it is likely that the pilot did not verify the fuel quantity prior to departure; thus, he took off with less fuel than he had planned for, which resulted in the engine stoppage due to fuel exhaustion.

Probable Cause(s)

Based on the available evidence, it is likely that the aircraft's engine stopped in-flight due to fuel exhaustion which led to an unsuccessful forced landing on a bushy terrain at Weltevreden Game Farm in Lephalale.

Contributing Factor(s)

1. Based on the available evidence, it is likely that the pilot did not verify the fuel quantity before departure; therefore, he took off with less fuel than he had planned for, which resulted in the engine stoppage due to fuel exhaustion.

2. Poor airmanship.

3. Disregard for the SACAA regulations and safe standard operating procedures (SOP).

Safety Action(s)

None.

Safety Message

Accurate fuel management is a critical aspect of flight operations, and it is important to utilise all available means to gain the highest assurance that fuel quantity measurement is accurate. It is essential that a reliable quantity cross-check is adopted, utilising at least two independent methods and a conservative approach. Pilots should also understand the functionality of the low fuel warning system on their aircraft and treat any warning annunciations as being accurate unless there is overwhelming evidence otherwise.

About this Report

The decision to conduct a limited investigation is based on factors including whether the cause is known and the evidence supporting the cause is clear, the level of safety benefit likely to be obtained from an investigation, and that will determine the scope of an investigation. For this occurrence, a limited investigation has been conducted, and the Accident and Incident Investigations Division (AIID) has relied on the information submitted by the affected person/s and organisation/s to compile this limited report. The report has been compiled using information supplied in the initial notification, as well as from follow-up desktop inquiries to bring awareness of potential safety issues to the industry in respect of this occurrence, as well as possible safety action/s that the industry might want to consider in preventing a recurrence of a similar occurrence.

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.

Purpose

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (CAR) 2011 and ICAO Annex 13, 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.

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This report is issued by:

**Accident and Incident Investigations Division
South African Civil Aviation Authority
Republic of South Africa**