

UAS LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/2/3/10338						
Classification	Accident	Date	21 June 2023		Time	2325Z	
Type of Operation	Unmanned Aircraft Systems (Surveillance) – Part 101						
Location							
Place of Departure	Piet Retief, Mpumalanga Province		Place of Intended Landing	Piet Retief, Mpumalanga Province			
Place of Occurrence	Piet Retief, Mpumalanga Province						
GPS Co-ordinates	Latitude	27°05'47" S	Longitude	030°49'10" E	Elevation	3900 ft	
Aircraft Information							
Registration	ZT-XNK		Class	3A			
Make; Model; S/N	Arace Sirin (Serial Number: SIR0014)						
Damage to Aircraft	Destroyed		Total UAS Hours	1 393.50			
Pilot-in-command							
Licence Type	Remote Pilot Licence (RPL)		Gender	Male	Age	32	
Licence Valid	Yes	Total Hours	670.6	Total Hours on Type	445.42		
Total Hours 30 Days	46.1		Total Flying on Type Past 90 Days	134.3			
People operating	1	Injuries (On ground)	0	Fatalities	0	Fatalities (on ground)	0
What Happened							
<p>On Wednesday, 21 June 2023 at 2310Z, an unmanned aircraft system (UAS) with registration ZT-XNK was launched from a launch pad for surveillance of the electrical overhead lines at Piet Retief in Mpumalanga province, with the intention to return to the take-off launch pad. The flight was conducted beyond visual line of sight (BVLOS) by night and under the provisions of Part 101 of the Civil Aviation Regulations (CAR) 2011 as amended. Clear weather conditions prevailed at the time of the flight.</p> <p>The pilot reported that he arrived on site and conducted the necessary checks. Thereafter, he launched the UAS for the mission in stealth mode (external lights off). The pilot completed five missions which were uneventful. After landing the UAS after the fifth mission, the pilot replaced the battery in preparation for the sixth mission. When the pilot powered on the UAS at the start of the mission, it indicated 96% battery power. The mission was to fly above the rail overhead lines at a height of 50 feet (ft) above ground. Fifteen (15) minutes into the flight, the remote pilot station became blank and connection with the UAS was lost. As the UAS's external lights were switched off prior to launch, the pilot was unable to locate the UAS's position. The remote pilot station regained signal approximately 10 minutes later. The pilot switched on the UAS lights and was able to identify the position of the UAS. He then drove to the location of the UAS and found it suspended on the electrical overhead lines between two masts. The rotors appeared to be still turning. To free the UAS, the pilot elected to initiate a flight from that position as he was concerned that a train might appear. However, there was an electric spark whilst the pilot was manipulating the controls and the UAS caught fire and fell on the railway tracks. The pilot retrieved the fire extinguisher (BCF type) from his vehicle and doused the fire. The UAS was destroyed as a result of the electric shock and the resultant fire. No people were injured during the accident, and there was no damage to the power lines.</p>							



Figure 1: Overlay of the accident site. (Source: Google Earth)



Figure 2: The UAS after it was recovered. (Source: Pilot)

UAS Description (Source: AraceUAS.com)

Arace Sirin is a versatile, next generation, autonomous aerial platform. It boasts a compact size, very easy deployment (no assembly required) and exceptionally long flight time. The Sirin can be airborne up to 85 minutes without payload and cover more than 40 kilometres in a single flight. Field deployment takes less than 1 minute and requires no assembly. Li-ion battery, which can be recharged 3-4x as much as traditional LiPo battery, is used on most commercially available drones.



Figure 3: A picture of a similar UAS type. (Source: [SIRIN – ARACE \[araceuas.com\]](https://araceuas.com))

Failsafe (Source: SIRIN – ARACE [araceuas.com])

The SIRIN is programmed with a set of failsafe behaviours to prevent a crash in the event of a loss of communication channels required for autonomous flight. Although certain failsafe have assigned tones, it is unlikely that you will be able to hear these at a distance. Monitor the Flight Data screen for failsafe indications. If a failsafe is triggered, the assigned behaviour will activate.

Radio/Ground Control Station (RC) Signal Failsafe (Source: [SIRIN – ARACE \[araceuas.com\]](https://araceuas.com))

Physical obstructions and interference from nearby wireless signals can affect the SIRIN's connection with the Ground station unit. If the SIRIN loses contact with the Ground station unit, it will return to the launch point at the same altitude as it was when it lost the link. Unless it was lower than 65m in which case it will climb to 65m before starting the return flight. Only it arrives to the HOME position, it will hover for 5 seconds before it will commence its descent and land on the spot where it took-off from.

Electrical Overhead Lines (Source: [Overhead line - Wikipedia](https://en.wikipedia.org/wiki/Overhead_line))

An overhead line consists of one or more wires (or rails, particularly in tunnels) situated over rail tracks, raised to a high electrical potential by connection to feeder stations at regular intervals. The feeder stations are usually fed from a high-voltage electrical grid.



Figure 3: A similar rail track showing an approximate position where the UAS was suspended.
(Source: MeghaSyam)

Findings

1. The pilot was issued a Remote Pilot Licence (RPL) on 8 July 2022 with an expiry date of 30 April 2024. The pilot was issued a Class 3 aviation medical certificate on 19 February 2023 with an expiry date of 28 February 2027 with no medical restrictions. The pilot was issued a BVLOS and multirotor ratings which were endorsed on his licence.
2. The UAS was registered to the owner on 3 August 2021.
3. The UAS was authorised to operate at night and in BVLOS conditions, according to the operations specification approval, dated 5 April 2023.
4. The UAS's major inspection was conducted on 9 April 2023 at 1 345.44 hours. The next inspection due was a mandatory periodic inspection (MPI) on 23 November 2023 or at 1 420.44 hours, whichever comes first. At the time of the accident, the UAS had 1 393.50 total hours since new. The UAS was flown for 48.06 hours since the major inspection. During the sixth flight, the UAS was flown a total of 15 minutes. The battery voltage at lift-off was 96%, according to the pilot.
5. The UAS Letter of Approval (UASLA) was initially issued on 12 October 2021; it was renewed following the MPI and was re-issued on 19 September 2022 with an expiry date of 11 October 2023.
6. The remote maintenance technician (RMT) who certified the last inspection was issued a RMT certificate on 20 March 2022 with an expiry date of 19 March 2024; a multirotor rating was endorsed on his licence on 20 March 2023.
7. The operator was issued an Unmanned Aircraft Systems Remote Operator Certificate (UASROC) on 31 October 2022 with an expiry date of 31 October 2023. The UAS was included in the operations specifications, dated 5 April 2023.

8. The operator had an approved landowner's form dated 12 December 2022 with an expiry date of 31 December 2023. The form authorised the operator to conduct surveys on the land stipulated under the agreement.
9. According to the operator, the UAS was substantially damaged, and no data could be retrieved.
10. The UAS impacted the railway overhead lines and lost signal due to an electric shock. The operator's manual states that "*during loss of connection with the ground station, the UAS will return to the launch point at the same height it was when the connection was lost*". The UAS was suspended on the electrical overhead lines, thus, could not automatically return to the take-off launch pad. During an attempt to retrieve the UAS, a spark ignited the UAS before it fell on the railway tracks.

Probable Cause

Impact with railway overhead lines resulted in temporary loss of connection with the remote pilot station during a stealth operation. It is likely that the temporary loss of connection was due to an electric shock. Whilst attempting to retrieve the UAS, a spark ignited it before it fell on the train tracks.

Contributing Factor

Poor decision making to operate the UAS which was suspended on electrical overhead lines whilst the propellers were turning.

Safety Action(s)

None.

Safety Message and/or Safety Recommendation/s

None.

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 desk top enquiries 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.

Disclaimer

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