



UAS LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number		CA18/2/3/10325													
Classification		Accident		Date	9 June 2023		Time	2334Z							
Type of Operation		Remotely Piloted Aircraft Systems – Surveillance (Part 101)													
Location															
Place of Departure		Transnet Watloo DSV near Mamelodi, Gauteng Province			Place of Intended Landing			Transnet Watloo DSV near Mamelodi, Gauteng Province							
Place of Occurrence		Transnet pipelines at Watloo DSV near Mamelodi, Gauteng Province													
GPS Co-ordinates		Latitude		25° 43'55.0" S		Longitude		028° 20'15.3" E		Elevation		6502.6 ft			
UAS Information															
Registration		ZT-XWG			Class		3A								
Make; Model; S/N		Arace Sirin (Serial Number: SIR0067)													
Damage to UAS		Substantial			Total UAS Hours		1045.13								
Pilot-in-command															
Licence Type		RPL Multirotor			Gender		Male		Age		26				
Licence Valid		Yes		Total Hours		656.0		Total Hours on Type		222.4					
Total Hours 30 Days		63.9			Total Flying on Type Past 90 Days			222.4							
Injuries		None		Injuries (On ground)		0		Fatalities		0		Fatalities (on ground)		0	
What Happened															
<p>On 9 June 2023, an unmanned aircraft system (UAS) Arace Sirin with registration ZT-XWG was launched for surveillance purposes over Transnet pipelines at Watloo DSV near Mamelodi in Gauteng province. The operation was conducted under beyond visual line of sight (BVLOS) rules by night and under the provisions of Part 101 of the Civil Aviation Regulations (CAR) 2011 as amended.</p> <p>The pilot stated that he conducted a pre-flight inspection, and no anomalies were found on the UAS. Thereafter, the UAS was launched and it climbed to 347.6 feet (ft) above ground level. Approximately 14 minutes into the flight at 3.6 kilometres (km) from the take-off position, the remote pilot station indicated 17.3 volts battery availability. The pilot noticed that the battery percentage status was not aligning with the remaining volts. He then scanned the area to land the UAS; meanwhile he received a potential thrust loss warning for all motors. As a result, the UAS descended rapidly towards the ground. The pilot set out to look for it at its last recorded location; he found it crashed on the ground.</p> <p>The UAS sustained damage to the camera and the legs.</p>															



Figure 1: The ZT-XWG at the crash site. (Source: Operator)



Figure 2: Damaged camera and skid. (Source: Operator)

Post-accident:

- According to the post-accident log analysis report (LAR), the pilot took off and climbed to 347.6 feet above ground level; about 14 minutes into the flight, the UAS switched to land mode and had a critical battery failsafe warning, and thereafter, a potential thrust loss warning before it descended rapidly towards the ground and crashed about 3.6 kilometres (km) from the take-off position.
- The pilot took off with an almost depleted battery.
- According to the pilot, the remote pilot station indicated 68% moderate battery availability, but the flight log indicated critical battery.
- On 14 January 2023, all four motors were replaced at 659.38 hours during a mandatory periodic inspection (MPI). The UAS had accumulated a total of 1 045.13 at the time of the accident. The UAS was flown a further 385.75 hours after the replacement of the motors.

The Original Equipment Manufacturer (OEM) (Source: www.araceaus.com)

- 1 The OEM facility is located in the town of Páty, Hungary, where the elevation is approximately 656 feet (200m).
- 2 According to the manufacturer's website (www.araceaus.com), the maximum take-off weight (MTOW) for the Arace Sirin is 2.98kg (EU RPAS Class 2) with a maximum payload of 500 grams (g).
- 3 Engagement with the OEM regarding the incidents related to "Potential Thrust Loss" revealed the following factors:
 - (i) The atmospheric conditions in which the UASs are flown in South Africa differ from the conditions in Hungary. The density altitude conditions in South Africa and especially in the highveld areas are approximately eight times higher than in Hungary.
 - (ii) The OEM fly UASs fitted with new batteries and new motors. Battery power (voltage) is of paramount importance to ensure optimal effectiveness of the four motors at all times. The OEM recommended that the operator limit their flight time to levels of not below 50% battery power.
 - (iii) Pilots must avoid flying in strong wind conditions.
 - (iv) The OEM is continuously monitoring the data provided to them by operators around the world and is constantly striving to improve reliability. Several of the components (i.e., the motors) are obtained from various vendors and the reliability of these components is only tested during operational flying. One of the critical parts of a motor is the bearing,

which is also sourced from different vendors, although the OEM strives to use only one supplier which it has found (since they have been in production) to be producing competent bearings.

- (v) The four motors fitted to the UAS have a service life of 500 hours and should be replaced thereafter.

Findings

1. The pilot was initially issued a Remote Pilot Licence (RPL) on 18 May 2022 with an expiry date of 31 May 2024. A visual line of sight (VLOS) and beyond visual line of sight (BVLOS) ratings are endorsed on his licence. His Class 3 medical certificate was issued on 19 March 2022 with an expiry date of 31 March 2026 with the restriction to wear corrective lenses.
2. The last inspection that was carried out on the UAS prior to the accident flight was on 29 May 2023 at 1 016.38 hours. The UAS had accumulated a total of 1 045.13 hours at the time of the accident. The UAS was flown a further 28.75 hours after the said inspection.
3. On 14 January 2023, a MPI was conducted which included the replacement of all four motors at 659.38 hours.
4. The operator was issued a Remotely Piloted Aircraft Systems Letter of Approval (LOA) on 30 March 2022, which was renewed on 18 March 2023 with an expiry date of 28 March 2024. The operator was issued a Remotely Piloted Aircraft Systems Operating Certificate (ROC) on 31 October 2022 with an expiry date of 31 October 2023.
5. Fine weather conditions prevailed at the time of the flight. The weather did not have a bearing to this accident.
6. The UAS had a potential thrust loss warning before it descended rapidly and crashed approximately 3.6 km from the take-off position.
7. According to the LAR, the UAS took off with a low battery (it had 22.2 volts on take-off).
8. After the accident, the UAS was repaired and the battery was replaced.

Probable Cause

The UAS was launched with a critical battery voltage and had a potential thrust loss warning before it crashed.

Contributing Factor
The pilot took off with a low battery voltage.
Safety Actions
After the accident, the operator implemented the following safety actions: <ul style="list-style-type: none"> ➤ Pilots must make sure that the battery is fully charged before take-off. ➤ The operator's workshop must make sure that all Arace Sirin are configured for a minimum arming voltage of above 24 volts.
Safety Message and/or Safety Recommendation/s
None.
About this Report
<p><i>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.</i></p> <p><i>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.</i></p>
Purpose
<i>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.</i>
Disclaimer
<i>This report is produced without prejudice to the rights of the AIID, which are reserved.</i>

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