SOUTH AFRICAN CIVIL AVIATION AUTHORITY

Section/division **Accident and Incident Investigations Division** Form Number: CA 12-58

RPAS/UAS LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/2/3/10296										
Classification	Accident		**Date**	26 April 2023			**Time**	2050Z			
Type of Operation	Remotely Piloted Aircraft System – Surveillance (Part 101)										
Location											
Place of Departure	Sibanye Stillwater Mines, Rustenburg, North West, Province			Place of Intended Landing			Sibanye Stillwater Mines, Rustenburg, North West, Province				
Place of Occurrence	Sibanye Stillwater Mines in Hexriver dumping area, Rustenburg, North West Province										
GPS Co-ordinates	Latitude	25°40'31.78"S		Longitude	27°17'20.87"E		Elevation	3738ft ft			
Aircraft Information											
Registration	ZT-YJG			Class	Class 3A						
Make; Model; S/N	Arace; Sirin (Serial Number: SIR117)										
Damage to Aircraft	Destroyed			Total UAS Hours	420.11						
Pilot-in-command											
Licence Type	Remote Pilot Licence (RPL)			Gender	Female			Age	34		
Licence Valid	Yes	Total Hours		974.49	Total Hours on Type			175.5			
Total Hours 30 Days	0			Total Flying on Type Past 90 Days	77.46						
Number Controlling	1	**Injuries**	0	**Fatalities**	0	**People (on ground)**	0				

What Happened

On Wednesday evening, 26 April 2023, an unmanned aircraft system (UAS) with registration ZT-YJG was engaged in a surveillance flight at Sibanye Stillwater dumping ground in Rustenburg, North West province, when the accident occurred. The flight was conducted under beyond visual line of sight (BVLOS) rules and under the provisions of Part 101 of the Civil Aviation Regulations (CAR) 2011 as amended.

The pilot stated that after conducting the pre-flight checks with no anomalies detected, she launched the UAS at 2032Z with 99% battery power and 2 hours endurance. Approximately 18 minutes into the flight, the pilot received a message on her cellular phone from a team member seeking urgent assistance. Whilst reading the message, the pilot inadvertently pressed the acrobatic (ACRO) button (which requires manual control by the pilot) on the pilot remote station, which was on her left hand, and the UAS engaged ACRO flying mode (the UAS's remote control was equipped with an ACRO mode button). At the time of the accident, the UAS, which was being flown in Global Positioning System (GPS) mode, was approximately 300 feet (ft) above ground level (AGL) and 1.78 kilometres (km) south-east from the launch site. In GPS mode/autonomous, the UAS is able to fly under automatic systems, that is, without the intervention of the pilot.

The pilot reported that whilst attempting to engage the UAS back to GPS mode, the UAS entered a dive and the airspeed drastically increased before it disconnected from the remote pilot station. A post-impact fire ensued which destroyed the UAS. It is likely that the fire was caused by an explosion from the UAS's battery after impact. No damage to property or injury to personnel on the ground was reported. The pilot and her team tracked the UAS from the last recorded location; they found it crashed on the ground and destroyed by fire. During the investigation, it was discovered that the flight log burnt in the fire.

Figure 1: A view of the UAS flight path and the accident site. (Source: Google Earth).

Figure 2: The burnt UAS at the accident site. (Source: Operator)

Figure 3: An Arace Sirin similar to the accident UAS. (Source: Operator)

The description and operation of the Arace Sirin

Source: UDS, Annexure A1, Technical Descriptions of RPA (UDS Operations Manual)

The Arace Sirin is manufactured by Arace Sirin, approved for day and night operations. It can be conducted under Visual line of sight (VLOS) and beyond visual line of sight (BLOVS). The

RPA can be flown at 15 kilometres (km), if the wind is less than 15 knots (kts), range is restricted to 10km. The RPA is a quad rotor, electric propulsion type and powered by four motors producing 320 kilovolts (Kv). It has an un-laden weight of 1.5 kilogram (kg) and the maximum take-off mass of 2.98kg. The maximum permissible airspeed is 37kts and the maximum operating altitude is 16404 feet (ft) with flight of endurance of 65 minutes (min) with payload and 85 min without payload.

Acro Mode

Acro mode uses the remote control (RC) sticks to control the angular velocity of the copter in each axis. Release the sticks and the vehicle will maintain its current attitude and will not return to level (attitude hold). Acro mode is useful for aerobatics such as flips or rolls or FPV when smooth and fast control is desired. Raising the INS_GYRO_FILTER cut-off frequency and returning may allow better responsiveness, but appropriate harmonic notch filtering to prevent noise impacts must be setup prior to returning.

Manual

Manual mode

Manual mode is the least preferable and should only be used if RTL or FBW-A/ATTI Mode is not successful.

Findings

1. The pilot was initially issued a Remote Pilot Licence (RPL) by the Regulator (SACAA) on 16 July 2019. The RPL was reissued on 5 August 2021 with an expiry date of 31 August 2023. The pilot had a visual line of sight (VLO) and a beyond visual line of sight (BVLOS) ratings which were endorsed on the pilot's licence. The pilot conducted a skills test for BLOVS rating on 15 March 2023.

2. The pilot's Class 3 medical certificate was issued on 15 November 2021 with an expiry date of 30 November 2025.

3. The UAS's mandatory periodic inspection (MPI) was certified on 26 April 2023 at 419.19 total airframe hours, with an expiry date of 26 October 2023 or at 619.19 airframe hours, whichever occurs first. At the time of the accident, the UAS had accumulated 420.11 airframe hours. The UAS was flown a further 0.92 hours since the last MPI. The MPI is conducted every six months or at 200 operating hours.

4. The UAS's Certificate of Registration (C or R) was issued to the current owner on 24 June 2022.

5. The UAS was issued a Remotely Piloted Aircraft Systems Letter of Approval (RLA) by the Regulator on 6 September 2022 with an expiry date of 5 September 2023.

6. The operator had an RPAS Operating Certificate (ROC) that was issued by the Regulator on 31 October 2022 with an expiry date of 31 October 2023.

7. According to the operator, ZT-YJG was a class 3A RPAS.

8. The pilot inadvertently engaged the ACRO button on the remote pilot station and, in an attempt to engaged it back to GPS mode, the RPA entered a dive and the airspeed drastically increased. The UAS disconnected from the remote pilot station and impacted the ground. A post-impact fire ensued which destroyed the UAS.

Probable Cause(s)

The pilot inadvertently engaged the ACRO button on the UAS's remote pilot station which led to the UAS entering a dive and subsequently impacted the ground.

Contributing Factor(s)

Distraction by incoming mobile phone message.

Safety Action(s)

Following the accident, the operator restricted the pilot from using cellular phones on the job from 23 May 2023 to 1 June 2023 whilst receiving training.

The manufacturer reported that this is the first occurrence of this type, and that they are researching ways of repositioning the ACRO button more effectively as it is not an official operating function of the Arace Sirin.

Safety Message and/or Safety Recommendation/s

None.

About this Report

Decisions to conduct a limited investigate 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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Accident and Incident Investigations Division
South African Civil Aviation Authority
Republic of South Africa