SOUTH AFRICAN CIVIL AVIATION AUTHORITY

Section/division **Accident and Incident Investigations Division** Form Number: CA 12-57

LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/2/3/10261								
Classification	Accident			**Date**	12 January 2023			**Time**	1820Z
Type of Operation	Aerial Surveillance (Part 101)								
Location									
Place of Departure	AMSA Mine, Orkney, North West Province			Place of Intended Landing	AMSA Mine, Orkney, North West Province				
Place of Occurrence	At Orkney Mine approximately 500 metres from launch position								
GPS Co-ordinates	Latitude	26° 35' 31.21" S		Longitude	025° 53' 19.59" E		Elevation	5024ft	
Aircraft Information									
Registration	ZT-XOB								
Make; Model; S/N	ARACE; Sirin (Serial Number: SIR0022)								
Damage to Aircraft	Destroyed			Total Aircraft Hours	591.23				
Pilot-in-command									
Licence Type	Remote Pilot Licence			Gender	Male		Age	34	
Licence Valid	Yes	Total Hours		693.24	Total Hours on Type			693.24	
Total Hours 30 Days	16.04			Total Flying on Type Past 90 Days	159.03				
People Controlling	1	**Injuries**	0	**Fatalities**	0	**Other (on ground)**	0		

What Happened

On Thursday evening, 12 January 2023, a remotely piloted aircraft (RPA) with registration ZT-XOB was engaged in an aerial survey at AMSA Mine in Orkney, North West Province. Visual meteorological conditions (VMC) by night prevailed at the time of the flight. 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 pre-flight checks with no anomalies found, he launched the RPA at 1800Z with 99% battery power. After approximately 20 minutes into the flight, the RPA disconnected from the control unit. The pilot activated the return-to-launch (RTL) function. However, the RPA did not return to launch position. The pilot made his way to the last known location captured on the control unit. He found the RPA on fire on the ground. The RPA was destroyed by the post-impact fire that erupted during the accident sequence. There were no injuries reported during this accident.

The RPA specifications in the Industrial UAV Solution (Operator/Manufacturer)
(Source: www.araceuas.com/sirin/)

The Sirin can be airborne up to 85 minutes without payload and it covers more than 40 kilometres (km) in a single flight. If it is operated at the maximum allowable payload, it can operate for approximately 65 minutes. Its design operating altitude range is 16 000ft above sea level (ASL). Field development takes less than 1 minute and requires no assembly. The RPAS is equipped with a multi redundancy for safe operation such as:

- *Triple IMUs*
- *Dual Compass*
- *Dual GNSS/GPS (multi constellation)*
- *No pre-flight calibration is required.*
- *Numerous built-in failsafe features.*

The RPAS can be operated up to a radius of 20km and can act as a relay with ARACE point to multi-point Mobile Remote Terminal (MRVT).

Figure 1: The aircraft at the accident site. (Source: Operator)

Its battery which can be recharged 3-4x (3-4 times) as much as a traditional LiPo batteries which is what is used on most commercially available RPA (drones). The type used on the RPA is a custom-made battery provided by a local supplier which are of a high-grade Panasonic Li-Lon cells. The batteries can handle a current of up to 35 Amperes (Amps) during flight, which is very high, however its limitations allow for operations well within the parameter.

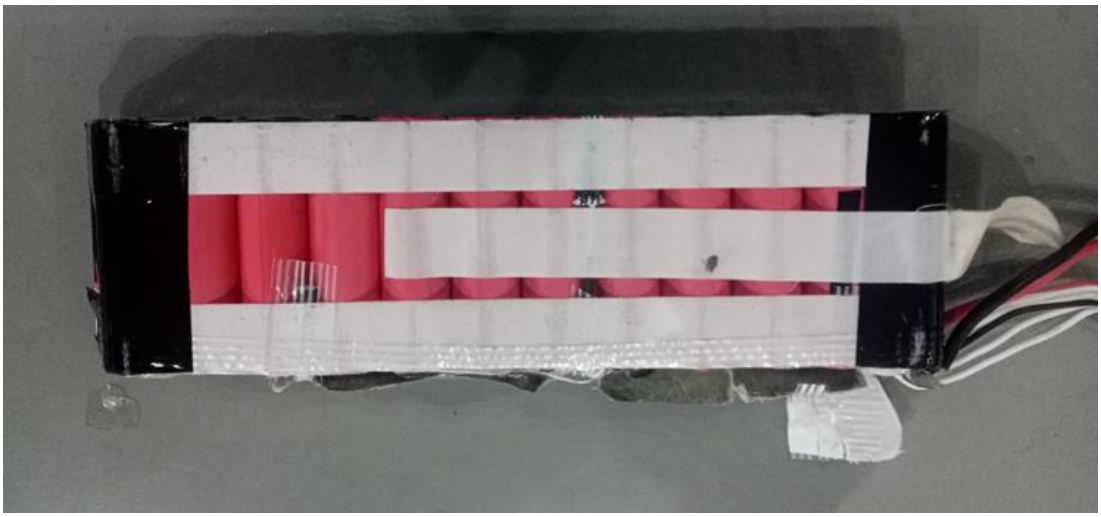

Figure 2: The RPA battery pack. (Source: Operator)

Post-accident Investigation:

According to the operator, the RPA was completely burnt, limiting the investigation of components. At the time of the accident flight, the meteorological information indicated strong wind conditions of approximately 26 knots (kts) which likely played a role in this accident.

The following weather report was provided by the operator, which had the following caution: "*Not Good to Fly*". Wind speed: 18 knots gusting 26 knots at 120m; Wind direction: north-easterly; Air Temperature: 26ºC.

Upon impact with the ground, the RPA caught fire which originated from the battery. It is likely that the battery pack casing was torn during impact with the ground, and the soldering between the cells came apart/loosened. As a result, the cells came into contact with each other, overheated and subsequently caught alight.

Findings

1. The pilot was issued a Remote Pilot Licence by the Regulator (SACAA) on 21 March 2021 with an expiry date of 31 March 2023. The pilot's Class 3 medical certificate was issued on 23 October 2020 with an expiry date of 31 October 2023. The pilot was rated on visual line of sight (VLOS) and beyond visual line of sight (BVLOS) and multirotor (MR), which were endorsed on his licence.

2. The RPA was issued a Remotely Piloted Aircraft System (RPAS) Letter of Approval (LOA) by the Regulator on 21 September 2022 with an expiry date of 14 October 2023. The last maintenance periodic inspection conducted on the RPA was carried out on 20 December 2022 at 546.61 hours. The RPA was issued a Certificate of Registration by the Regulator on 2 August 2021.

3. The maintenance of the RPA was carried out by the approved person with a Remote Maintenance Technician (RMT) certificate that was issued by the Regulator on 4 April 2022 with an expiry date of 3 April 2024.

4. The operator had the RPAS Operating Certificate (ROC) that was issued by the Regulator on 31 October 2022 with an expiry date of 31 October 2023. The operation specifications of the RPA type were endorsed on the ROC, issued on 10 November 2022 with an expiry date of 30 November 2023.

5. The pilot stated that he launched the RPA at 99% battery power to conduct aerial surveillance. According to the RPA specifications, the battery at full capacity could last approximately 65 minutes when operated at maximum payload. According to the pilot's report, about 20 minutes into the flight, the RPA disconnected from the control unit. The pilot engaged the RTL function for it to return to the launch position.

6. Following the disconnection, the pilot dispatched to the last location captured on the control unit, however, he found it on fire. According to the RPA's design specifications, it is equipped with a multi-redundancy function for safe operations if all functions are engaged. According to the pilot, all system functions for safe operation were checked and activated.

7. The control signal disconnection was due to the battery depleting too fast as there were strong wind conditions at the time. The wind was blowing against the direction of the flight path of the RPA during the RTL command. The RPA crashed to the ground and the battery casing was torn. Damage was caused to the cells soldering. As a result, the batteries (cells) overheated, and this led to the fire erupting and destroying the critical components.

Probable Cause

The RPA crashed following a control signal disconnection due to low battery. The battery depleted fast after the RTL function was activated as there were strong wind conditions at the time of the flight.

Contributing Factor

Strong wind conditions prevailed at the time of the flight.

Safety Action(s)
None.
Safety Message and/or Safety Recommendation/s
Pilots are encouraged to heed weather conditions and to discontinue operation if the weather does not permit.
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.
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This report is issued by:

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