SOUTH AFRICAN CIVIL AVIATION AUTHORITY

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

LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/2/3/10264								
Classification	Accident			**Date**	8 January 2023			**Time**	2028Z
Type of Operation	Remotely Piloted Aircraft Systems – Surveillance (Part 101)								
Location									
Place of Departure	Anglo American Mine, Amandelbult, Limpopo Province			Place of Intended Landing			Anglo American Mine, Amandelbult, Limpopo Province		
Place of Occurrence	Anglo American Mine at Dishaba Mine, 61 Holding Section								
GPS Co-ordinates	Latitude	24°43'46.4" S		Longitude	027°23'55" E		Elevation	3145 ft	
Aircraft Information									
Registration	ZT-XFN								
Make; Model; S/N	UAV Drone Solutions; Condor (Serial Number: CON0001)								
Damage to Aircraft	Substantial			Total Aircraft Hours	37.40				
Pilot-in-command									
Licence Type	Remote Pilot Licence (RPL)			Gender	Male		Age	26	
Licence Valid	Yes	Total Hours		1578.19	Total Hours on Type		11.21		
Total Hours 30 Days	37.35			Total Flying on Type Past 90 Days	11.21				
People On-board	N/A	**Injuries**	0	**Fatalities**	0		**Other (on ground)**	0	

What Happened

On Sunday evening, 8 January 2023, a remotely piloted aircraft (RPA) with registration ZT-XFN was engaged in an aerial survey operation at Anglo American Mine Amandelbult in Limpopo 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 the pre-flight checks with no anomalies detected, he launched the RPA with 99% battery power with 2 hours endurance at 2000Z. After approximately 20 minutes into the flight, the RPA became erratic and lost data link from the ground station controller. The pilot engaged the return-to-launch (RTL) function, but the RPA did not return to the launch position.

An extensive search was conducted, and the RPA was located 10 days later, approximately 0.3 nautical miles south-west of the launch site with substantial damage to the wings, fuselage and operating equipment. There were no injuries reported.

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

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

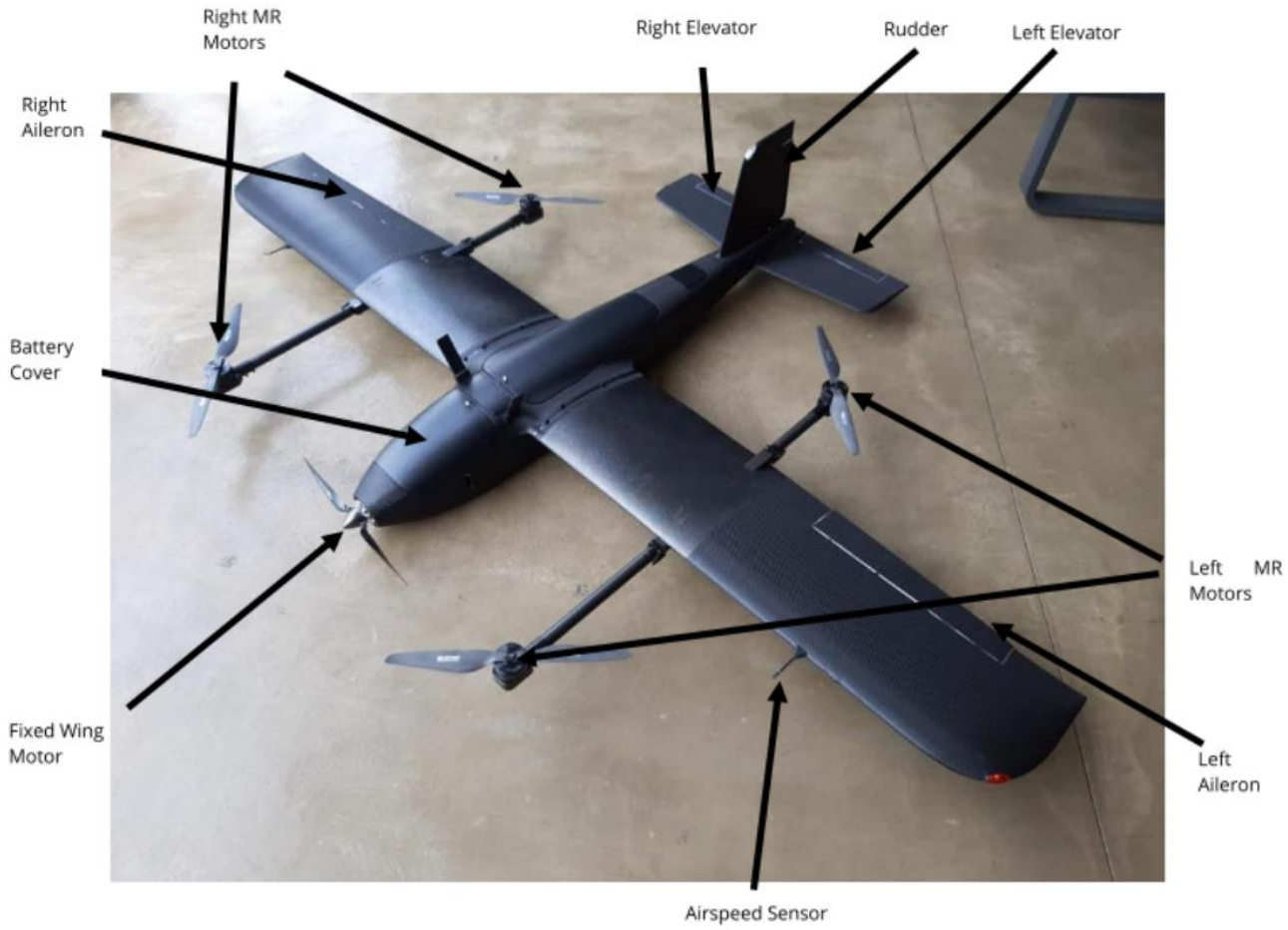
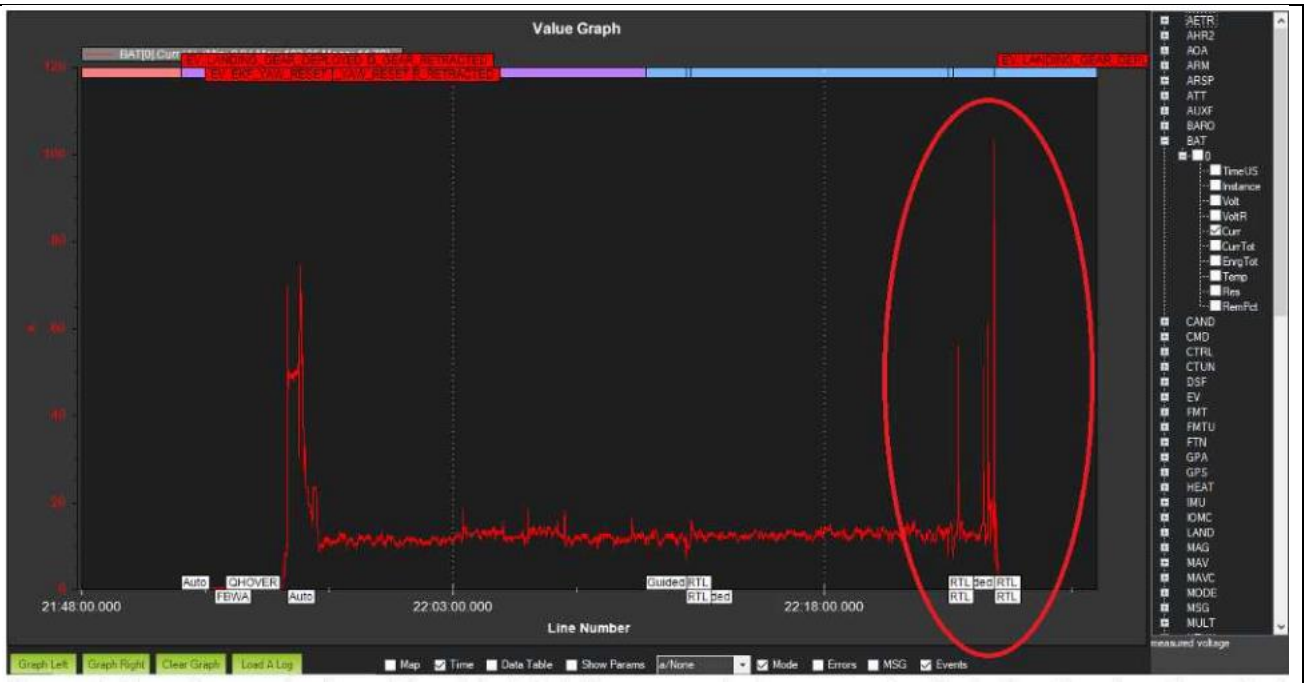


Figure 3: A model of the Condor RPA. (Source: Operator)

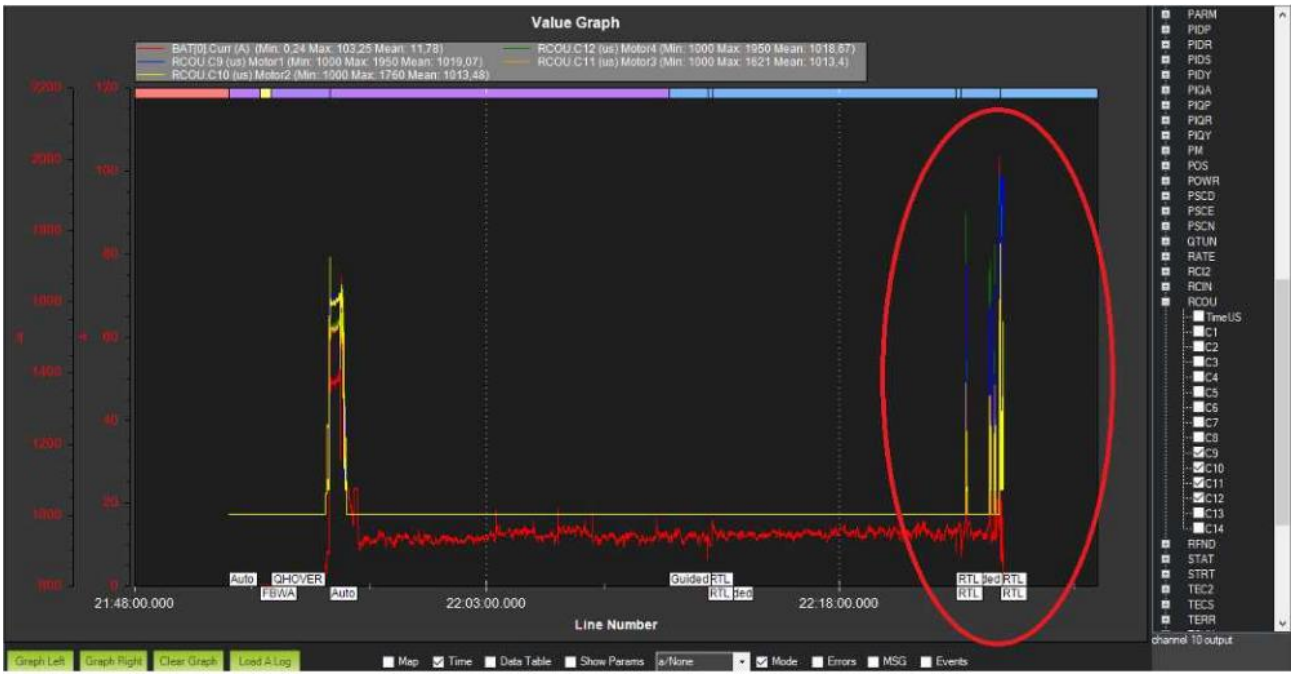
The following information was provided by the operator from the flight log:

Sequence of events:

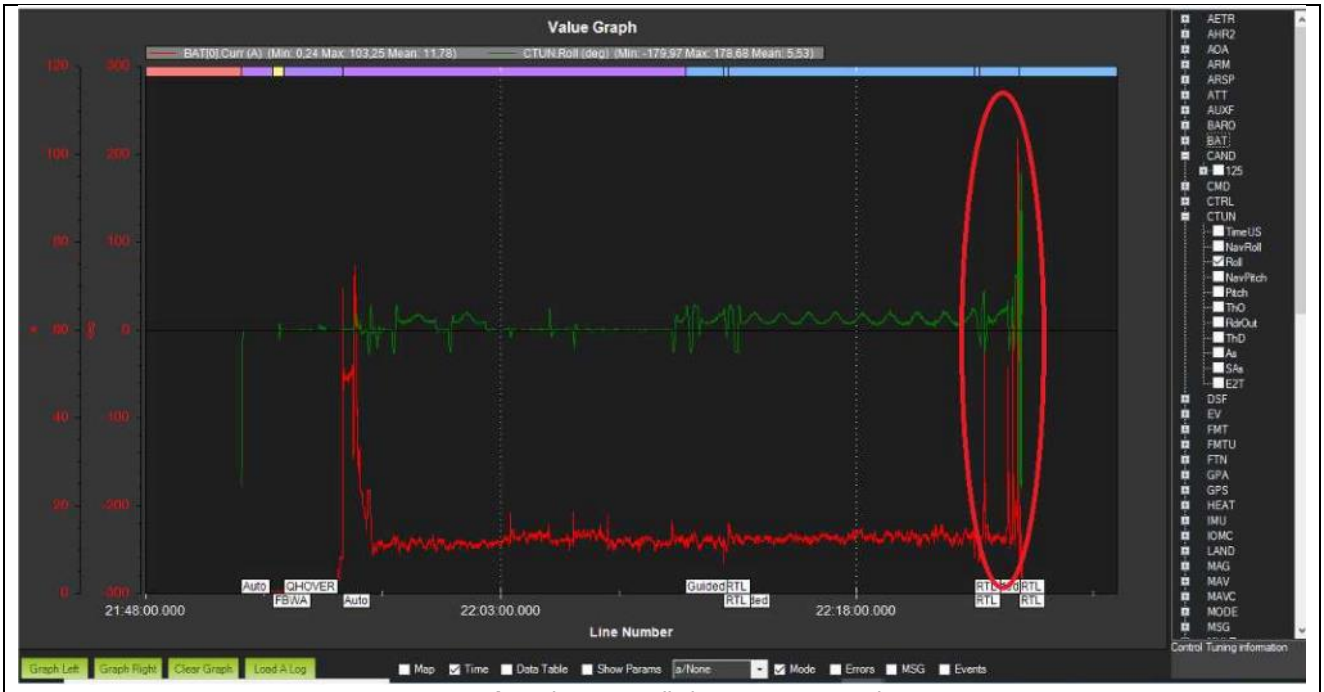
1. At 1959Z: The pilot armed the aircraft.
2. At 2000Z: The aircraft reached 56 metres and transitioned to fixed wing mode.
3. At 2014Z: The pilot switched to guide mode at a known hotspot.
4. At 2026Z: The aircraft RTL (failsafe: flight mode=11). The pilot cancelled the RTL and continued to loiter.
5. At 2027Z: The aircraft disconnected shortly after and did not RTL.



Graph 1: The battery current spikes. (Source: Operator)



Graph 2: Readings of motor 1 and 4 during the current spikes. (Source: Operator)



Graph 3:The RPA roll. (Source: Operator)

Findings

1. The pilot was initially issued a Remote Pilot Licence (RPL) by the Regulator (SACAA) on 25 November 2020. The RPL was reissued on 18 November 2022 with an expiry date of 30 November 2024. The pilot's Class 3 medical certificate was issued on 15 October 2018 with an expiry date of 31 October 2023. The pilot had a beyond visual line of sight (BVLOS) rating which was endorsed on his licence.

2. The RPA was issued a Remotely Piloted Aircraft System (RPAS) Letter of Approval (LOA) by the Regulator on 14 July 2022 with an expiry date of 13 July 2023. The RPA had not reached its mandatory periodic inspection date of six months or 200 operating hours at the time of the accident. The RPA's Certificate of Registration (C of R) was issued to the current owner on 7 October 2021.

3. The operator had a Remotely Piloted Aircraft Operating Certificate (ROC) No: CAA/G1291D that was issued by the Regulator on 31 October 2022 with an expiry date of 31 October 2023. The operational specification of the RPA type was endorsed on the ROC with an effective date of 10 November 2022.

4. The Condor is a vertical take-off and landing (VTOL) fixed wing that is constructed from composite material with an endurance of up to two hours. The four up-facing propellers are employed in multirotor (MR) mode. The loitering phase of the flight makes use of the front fixed wing electric motor.

5. The flight log graphs showed spikes in battery current which led to the increase in the revolutions per minute (RPM) on the number 1 and 4 motors (RPM). This caused the aircraft to roll about 180° following the failure of the Electronic Speed Controller (ESC). The RPA banked sharply and lost control and altitude before it crashed.

Probable Cause(s)

Loss of control following the failure of the ESC which caused the RPM to increase to 180° on the number 1 and 4 MR propellers before it rolled and crashed. The cause of battery spikes and ESC failure could not be determined.

Contributing Factor(s)

None.

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