SOUTH AFRICAN CIVIL AVIATION AUTHORITY

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

UAS LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/3/2/1417								
Classification	Serious Incident		**Date**	15 June 2023		**Time**	1754Z		
Type of Operation	Remotely Piloted Aircraft System – Surveillance (Part 101)								
Location									
Place of Departure	Bokgoni Colliery Mine, Mpumalanga Province		Place of Intended Landing			Bokgoni Colliery Mine, Mpumalanga Province			
Place of Occurrence	Bokgoni Colliery Mine in Mpumalanga Province								
GPS Co-ordinates	Latitude	26° 00' 40.00" S	Longitude	29° 13' 23.54" E		Elevation	5051 ft		
Aircraft Information									
Registration	ZT-XSG			Class		3A			
Make; Model; S/N	DJI; Mavic 2 Enterprise Advanced (Serial Number: MAV0069)								
Damage to Aircraft	Minor			Total UAS Hours		975.3			
Pilot-in-command									
Licence Type	Remote Pilot Licence (RPL)		Gender	Male		Age	26		
Licence Valid	Yes	Total Hours	628.9	Total Hours on Type		628.9			
Total Hours Past 90 Days	234.0		Total Flying Past 90 Days on Type	234.0					
People Controlling	1	**Injuries (On Ground)**	0	**Fatalities**	0	**Fatalities (On Ground)**	0		

What Happened

On 15 June 2023, an Unmanned Aircraft System (UAS) with registration ZT-XSG was engaged in a surveillance flight at Bokgoni Colliery Mine in Witbank, Mpumalanga province, when the accident occurred. The flight was conducted under visual line of sight (VLOS) rules by night and under the provisions of Part 101 of the Civil Aviation Regulations (CAR) 2011 as amended.

The pilot reported that whilst the UAS was 1.5 kilometres (km) from the take-off point, it lost signal. The pilot then engaged the return-to-home (RTH) button on the remote pilot station and the UAS flew homewards. As the UAS was commencing to land, the pilot deduced that it was going to impact the perimeter fence in the parking lot where he was stationed. The pilot engaged the RTH button again to stop it from landing, thereafter, switched to manual control and increased throttle to effect climb. However, the pilot responded too late as the UAS impacted the perimeter fence and damaged two of its propeller blades and one of the landing gears.

The UAS sustained minor damage; there was no injury to persons or damage to property.

Figure 1: The UAS at the incident site. (Source: Operator)

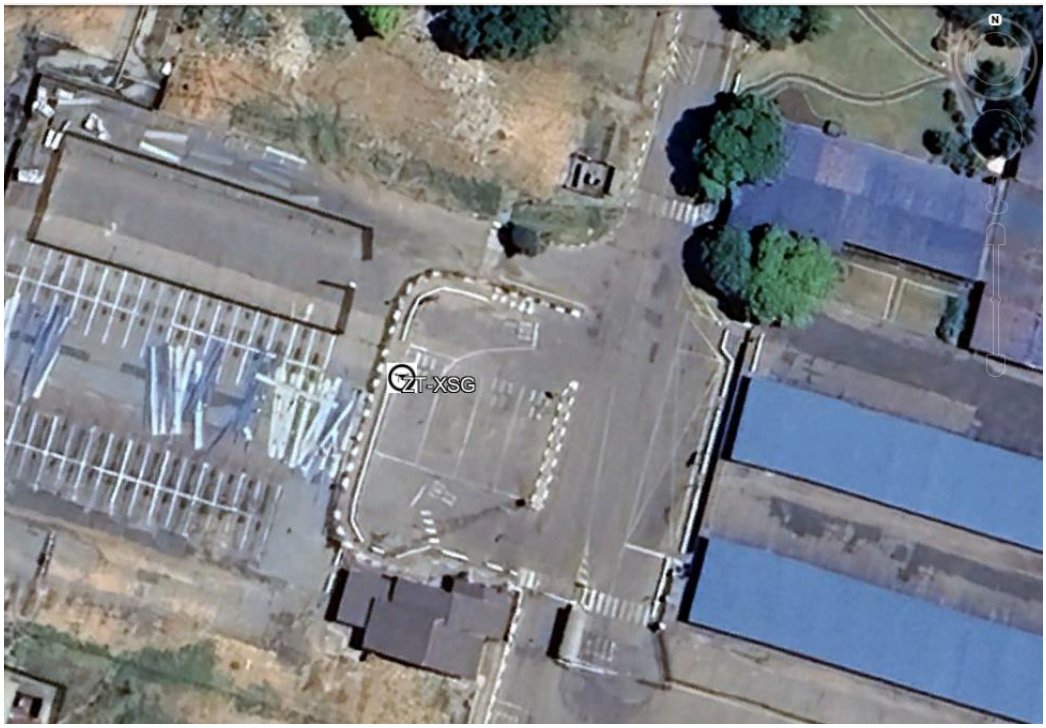

Figure 2: Aerial view of the incident site. (Source: Google Earth)

- The weather information below was obtained from the Meteorological Aerodrome Report (METAR) that was issued by the South African Weather Service (SAWS) on 15 June 2023 at 1800Z, recorded in Witbank Airport (FAWI), Mpumalanga province, which is 10 nautical miles (nm) north of the incident site.
  FAWI 151800Z AUTO 22005KT //// // ////// 12/M01 Q1024=

Wind Direction	220°	Wind Speed	5kts	Visibility	9999m
Temperature	12°C	Cloud Cover	CAVOK	Cloud Base	CAVOK
Dew Point	-1°C	QNH	1024hPa		

- Failsafe RTH (Source: Mavic 2 Enterprise Advanced User Manual)

  The forward Vision System allows the aircraft to create a real-time map of its route as it flies. If the Home Point was successfully recorded and the compass is functioning normally. Failsafe RTH automatically activates after the remote controller signal is lost for more than two seconds. When Failsafe RTH is activated, the aircraft starts to retrace its original flight route home. If the remote control signal is re-established within 60 seconds of Failsafe RTH being activated, the aircraft hovers at its present location for 10 seconds and waits for pilot commands. Press the RTH button on the remote controller to cancel failsafe RTH and retake control. If no pilot command is given, the aircraft flies to the home point in a straight line. If the remote control signal is still lost 60 seconds after activating failsafe RTH, the aircraft stops retracting its original flight route and flies to the Home Point in a straight line.

Findings

1. The pilot was issued a Remote Pilot Licence (RPL) with visual line of sight (VLOS) and beyond visual line of sight (BVLOS) ratings on 25 July 2022 with an expiry date of 30 June 2024. His Class 3 medical certificate was issued on 14 May 2022 with an expiry date of 31 May 2026 with no medical restrictions.

2. The operator had a Remotely Piloted Aircraft Systems Operating Certificate (ROC) that was issued on 31 October 2022 with an expiry date of 31 October 2023. The operator's operation specifications included aerial patrol and survey (G3), and was approved for night operations.

3. The UAS was issued a Remotely Piloted Aircraft Systems Letter of Approval (RLA) on 21 February 2023 with an expiry date of 14 February 2024.

4. The mandatory periodic inspection (MPI) on the UAS prior to the serious incident was conducted on 8 June 2023 and was certified at 944.5 airframe hours. The UAS was operated a further 30.8 airframe hours since the said MPI.

5. The Remote Maintenance Technician (RMT) who performed the last MPI was issued an RMT Licence on 30 September 2022 with an expiry date on 20 September 2024.

6. Post-accident Log Analysis Report (Source: Manufacturer)
   17:39 UTC: The pilot armed the aircraft and ascended to 400 ft AGL.
   17:52 UTC: 13 minutes into the flight, the aircraft disconnected from the C2 link and switched to "RTL".
   17:53 UTC: 14 min into the flight the aircraft reached the home location and switched to auto landing.
   17:54 UTC: The aircraft landed on a fence and flipped upside down, and hit the ground.

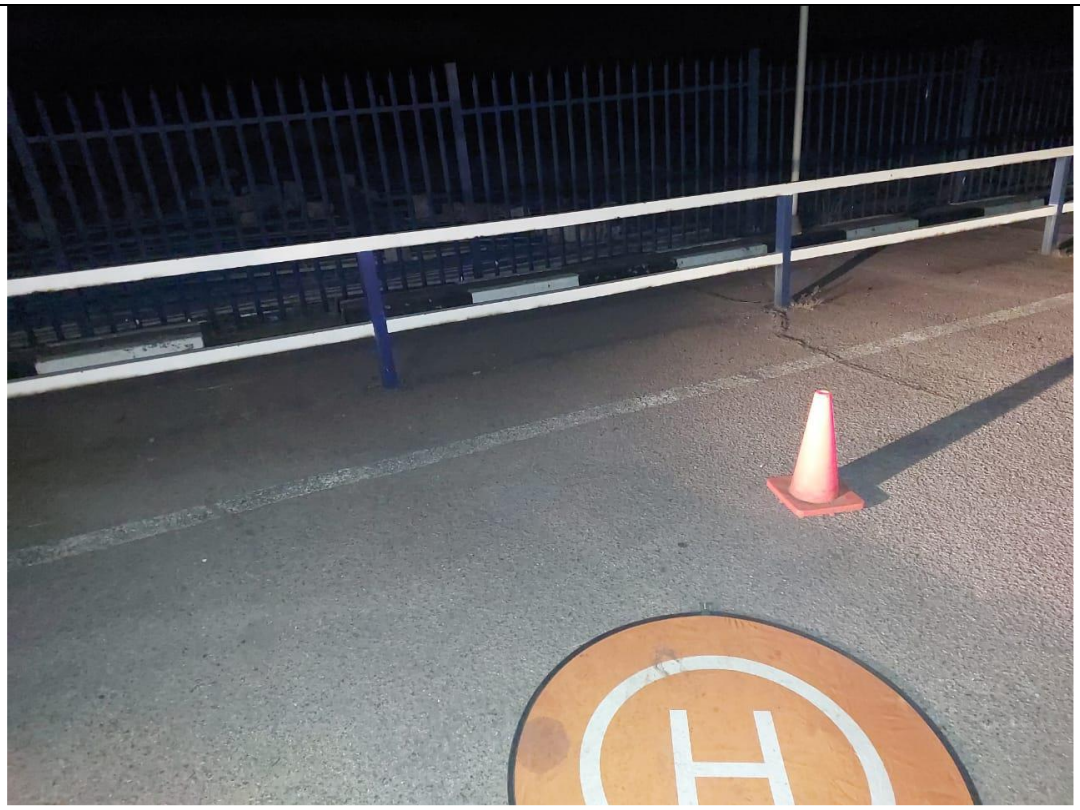

Figure 3: The incident site indicating the proximity of the landing zone to the perimeter fence. (Source: Operator)

Findings:

1. The aircraft disconnected from the C2 link and switched to RTL.

2. The pilot did not take back control, leaving the aircraft to auto land.

3. The aircraft hit a fence next to the LZ and flipped upside down.

Probable Causes:

1. Upon further investigation it was found that the pilot did not maintain situational awareness regarding the landing phase of the flight.

2. The pilot filled out his flight folio while the aircraft landed.

Conclusion:

1. The aircraft landed on a fence which caused it to flip upside down and crash on the ground.

2. The pilot did not maintain situational awareness regarding the landing phase.

7. The pilot stated via the pilot questionnaire that he attempted to stop the UAS from crashing on the perimeter fence. However, the post-accident log analysis report states that the pilot was filling out the flight folio whilst the UAS was landing, and thus, would not have observed that the landing path was towards the perimeter fence.

Probable Cause

Disconnection of the UAS from the C2 link and, whilst the UAS was returning to the landing zone, it impacted a perimeter fence. The cause of the link disconnection could not be determined.

Contributing Factors

1. The home base was too close to the perimeter fence.
2. Situational awareness.

Safety Actions
The pilot was reminded of operational requirements: *1. The pilot must manually land the aircraft and must not leave his aircraft to auto land.* *2. The pilot should only fill out the flight folio after the aircraft has been disarmed.*
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
This report is produced without prejudice to the rights of the AIID, which are reserved.

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