SOUTH AFRICAN CIVIL AVIATION AUTHORITY

Section/division **Accident and Incident Investigations Division** Form Number: CA 12-55

LIMITED ACCIDENT INVESTIGATION REPORT

Reference Number	CA18/2/3/10098					
Classification	Accident	**Date**	4 January 2022	**Time**	2305Z	
Type of Operation	Remotely Piloted Aircraft (Part 101)					
Location						
Place of Operation	2.2 nm from TFR station around Pullens Hope, near Hendrina Power Station in Mpumalanga Province					
GPS Co-ordinates	Latitude	S26°1'39.80"	Longitude	E028°36'10.77"	Elevation	5390 ft
Aircraft Information						
Registration	ZT-XEJ					
Model/Make	DJI Mavic Advanced (Serial number: Mav0036)					
Damage to Aircraft	Destroyed		Total Aircraft Hours	117		
Pilot-in-command						
Licence Type	Remote Pilot Licence		Gender	Male	Age	22
Licence Valid	Yes					
Total Hours on Type	128.4		Total Flying Hours	128.4		
What Happened						

On 4 January 2022, a pilot was conducting security surveillance work using a DJI Mavic Advanced drone with registration mark ZT-XEJ. The pilot was operating the drone 2.2 nautical miles (nm) from station, which is around Pullens Hope near Hendrina Power Station in Mpumalanga Province. The operation was conducted under visual flight rules (VFR) and under the provisions of Part 101 of the Civil Aviation Regulations (CAR) 2011 as amended. The drone was approved for night operations as per operations specifications.

The pilot stated that prior to the accident flight, he conducted a flight during which he spotted a cheetah that was reported to be on the loose about 2 kilometres (km) from the remotely piloted aircraft (RPA), north of Pullens Hope substation. The drone took off again at 2256Z (the drone had 97% battery life) in front of Pullens Hope Substation and the pilot proceeded to conduct the flight whilst standing on the back of a light delivery vehicle out of concern of the animal that was spotted during the previous flight. When the drone was 2.5km from take-off point, the pilot heard something rattling in the grass and lost focus. The drone then flew for another 1km. The drone vitals were good (controller and HD indications were at 4 bars). Afterwards, the pilot lost the first communication link. He then got off the light delivery vehicle and started running in the direction of the drone to try and re-establish connection. There was a brief reconnection which indicated that the drone was hovering in front of one of the water-cooling towers before the connection was lost again. The pilot climbed back onto the light delivery vehicle and drove towards the power station.

The drone is programmed to return to launch (RTL) point using the most direct route; the drone responded as programmed. However, because of the position at which the drone was launched, it routed directly overhead the power station; it is suspected to have collided with an Eskom water tower.

Figure 1: Photo of the drone. (Source: Operator)

Figure 2: Flight path of the drone. (Source: Pilot)

When the team went in search of the drone, only the battery cover was found (see Figure 3). The fuselage of the drone is suspected to have fallen into the water reservoir at the base of Eskom water tower as the drone was not recovered.

Figure 3: Battery cover that was recovered with scuff marks. (Source: Pilot)

What was found:

- The pilot was issued a Remote Pilot Licence (RPL) Aeroplane on 20 September 2020 with an expiry date of 30 September 2022. A Visual Line of Sight Operation (VLOS) rating was endorsed on his licence. His Class 3 medical certificate was issued on 18 August 2020 with an expiry date of 17 August 2024 with restrictions of correction for defective distant vision (VDL) and correction for defective near vision (VNL).
- The operator was issued a Remotely Piloted Aircraft (RPA) operator's certificate on 25 October 2021 with an expiry date of 31 October 2022.

The Unmanned Aerial Vehicle (UAV) & Drone Solutions USD regional manager investigated and found the following:

- *The pilot explained the following: the aircraft lost signal when it was behind Hendrina Power Station. The aircraft Returned to Launch (RTL) from its location directly to the home point (1609m elevation) and the cooling towers (1642m elevation) were in the direct flight path (Figure 2), he then further explained that the aircraft came to a stop prior to hitting the tower and that is where it stayed and lost signal again shortly after that.*

- *His assessment of what happened given all the fact of where they found the battery cover, the flight path, altitude, take-off elevation and tower elevation, the aircraft lost signal for 70.3 seconds and the self- return to launch engaged. The aircraft flew its path back to the home point, as it reached the cooling tower (which is semi-lit during the night) the aircraft*

vision sensors engaged and the aircraft stopped dead in its tracks (with the reduced ambient light it would probably have stopped about +-2 to 3 metres from the tower), with no further data coming from the aircraft we are not able to determine for how long it hovered there or at what stage it went into auto land.

- *Due to the way the cooling towers are built, they have a large base with a concave wall. From him standing next to the tower he would estimate it to be +-140m tall, add an additional +33m elevation difference from home point would put the aircraft hovering near the top of the tower. During the auto landing stage, the aircraft would not have fully landed as the ultrasonic sensor at the bottom of the aircraft will not recognise the shape for the wall. Eventually the aircraft would have remained in a hover until the battery depleted and would then fall along the wall and into the large water reservoir. Somewhere in the fall, the battery must have dislodged from the aircraft, tumbling down along the wall. At some stage, the battery cover came apart from the battery and that is why it was found with scuff marks.*

Additional information

According to the operator, the distance a drone loses connection depends on the geographical surroundings of the area (obstacles such as mountains, hills, trees, plantations, etc.) and also the likelihood of site specific magnetic or Radio Frequency interference.

- Although the user manual for the DJI Mavic states 5km, it may lose connection before that because of the site geography.
- In this instance, the drone lost connection around 3.5km, not due to obstacles, but due to massive magnetic interference from the power station. This happened the moment the power station lined up exactly between the controller and the drone.

The drone's operating height was 400 feet (ft) above ground level (AGL). The cooling tower height is approximately 460ft (140m) AGL (see Figure 4).

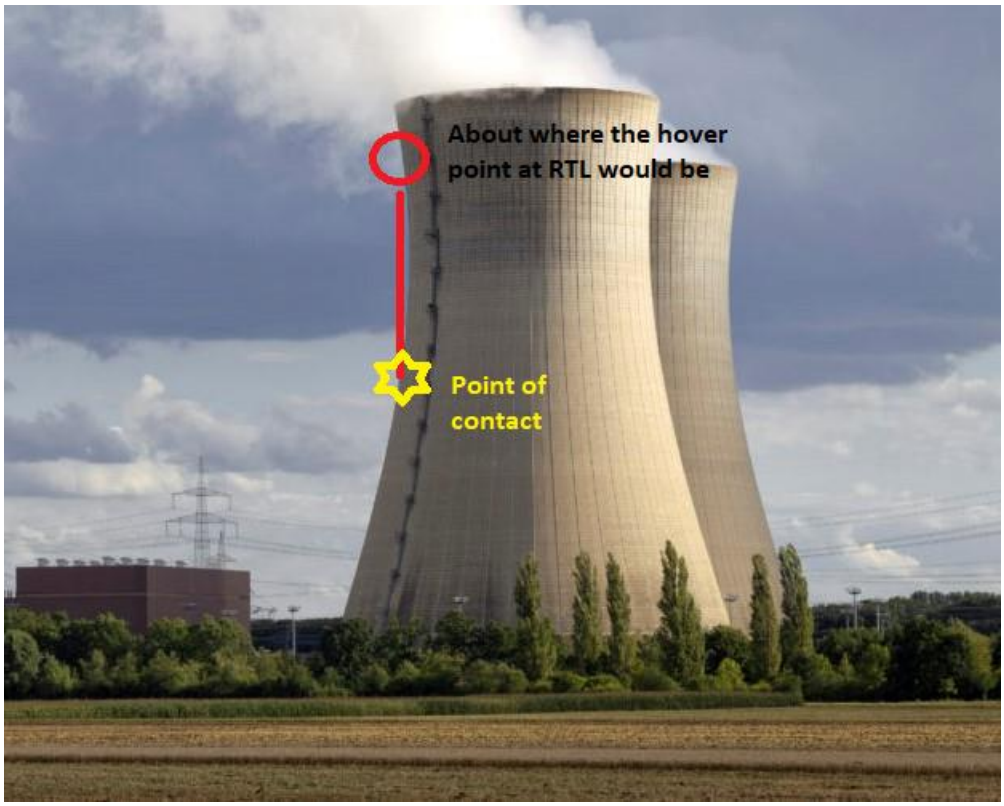

Figure 4: The cooling tower and the point of impact. (Source: Operator)

Probale cause:

The drone lost communication link with the pilot during flight and, whilst returning to base, it is suspected that it may have collided with the cooling station structure.

Safety Message and/or Safety Recommendation/s

None.

Purpose of the Investigation

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (CAR) 2011, 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****.*

About this Report

Decisions regarding whether to investigate, and the scope of an investigation are based on many factors, including the level of safety benefit likely to be obtained from an investigation. For this occurrence, no 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 brief report. The report has been compiled using information supplied in the initial notification, as well as follow-up information 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 accident.

This report provides an opportunity to share safety message/s in the absence of an investigation.

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.

Disclaimer

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