SOUTH AFRICAN CIVIL AVIATION AUTHORITY

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

LIMITED ACCIDENT INVESTIGATION REPORT

Reference Number	CA18/3/2/10108								
Classification	Accident		**Date**	31 January 2022		**Time**	1144Z		
Type of Operation	Remotely Piloted Aircraft (Part 101)								
Location									
Place of Departure	Sun City Helipad, North West Province		Place of Intended Landing			Sun City Helipad, North West Province			
Place of Occurrence	Sun City, North West Province								
GPS Co-ordinates	Latitude	25˚20'43.65" S	Longitude	27˚05'16.40" E		Elevation	3 510 feet		
Aircraft Information									
Registration	ZT-UWB								
Model/Make	DJI Mavic 2 (Serial Number: MAV007)								
Damage to Aircraft	Unknown		Total Aircraft Hours	1 950					
Pilot-in-command									
Licence Type	Remote Pilot Licence (RPL)		Gender	Female		Age	36		
Licence Valid	Yes								
Total Hours on Type	35.10		Total Flying Hours	35.10					
People On-board	0	Injuries	0	Fatalities	0	Other (on ground)	0		

What Happened

On 31 January 2022 at about 1140Z, a remotely piloted DJI Mavic Enterprise drone with registration ZT-UWB took off from Sun City Helipad with the intention to land back at the same helipad. The purpose of the flight was to survey the mountainous area of Sun City. The flight was conducted under the provisions of Part 101 of the Civil Aviation Regulations (CAR) 2011 as amended. Clear weather conditions prevailed at the time of the flight.

According to the pilot, she launched the drone from the helipad and, as she waited for the drone to climb to its assigned height of 426.5 feet (ft) above ground level (AGL), she heard a message notification alert on her mobile device. As she was aware that checking the notification will divert her attention, she elected to pause the flight by selecting the 'pause button' on the unit controller before walking to the vehicle to check her message.

Once finished checking the message, she turned her attention back on the drone and un-paused the flight on the unit controller. She then checked the unit controller screen and confirmed the orientation in relation to the waypoints. However, a few moments after, she realised that the drone was no longer going in the direction of its assigned destination; this was followed by the drone disconnecting from the control and loss of (drone) visual.

Attempts by the pilot to search for a better signal (position) and selecting return-to-home (RTH) function were not successful. According to the pilot, the drone had been airborne for approximately 4 minutes and the battery was full and showing 18 satellite count (the minimum satellite count is 10). An intervention by colleagues who arrived at the site to assist in locating the drone was unsuccessful. The drone has not been recovered, and the operator was still continuing with the search in the area between surveillance operations at the time of completing this report.

What was found:

- The RTH is a built-in feature in a drone with three types of RTH options (smart RTH, battery low RTH and fail safe RTH). When selected on the unit controller, the drone returns to waypoint entered as home.

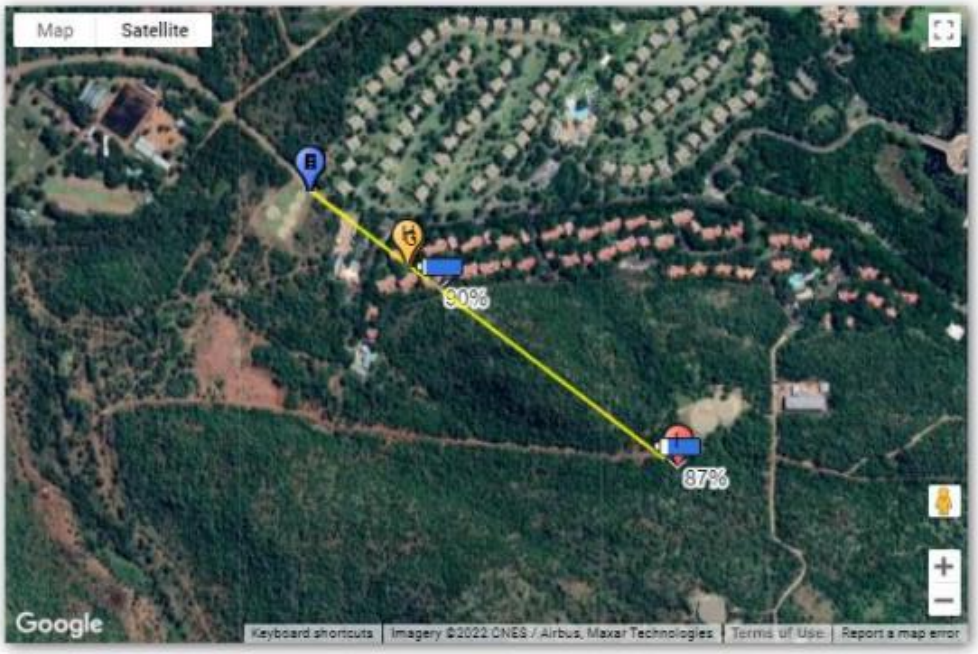
	GPS	Description
Home Point		If a strong GPS signal was acquired before takeoff, the Home Point is the location from which the aircraft launched. The GPS signal strength is indicated by the GPS icon ( ). The Aircraft Status Indicator will blink green quickly when the Home Point is recorded.

Table 1: Description of home point function. (Source: Mavic User manual)

- The pilot was licensed for the flight. Her Remote Pilot Licence (RPL) was issued on 5 September 2021 with an expiry date of 30 September 2023. Visual line of sight (VLOS) class was endorsed on her licence. The pilot also had a Commercial Pilot Licence issued on 24 February 2021 with an expiry date of 30 February 2022.
- The pilot was issued a Class 1 medical certificate on 5 March 2021 with an expiry date of 8 April 2022 with no medical waiver.
- At the time of the accident, the pilot was operating the drone using her RPL.
- Due to the nature of the work, the pilot receives notifications from the client and/or operator during operations regarding working conditions and intelligence around the area of operation.
- The last mandatory periodic inspection (MPI) of the drone was conducted on 16 January 2022 at 1 931 hours. The remotely piloted systems letter of approval (LOA) was issued on 16 October 2019 with an expiry date of 31 October 2022.

Figure 1: A drone type that is similar to the accident drone. (Source: Internet)

Figure 2: Flight path of the drone and the last known position: (Source: Google Earth)



HD Flight Player

Download notifications KML

	Flight time	Altitude	Home Dist	Type	Notification
A	00m 00s	0.0 m	0 m	Mode	Mode changed to Motors Started
B	00m 00s	0.0 m	0 m	Tip	✓ Setting new Return-To-Home altitude to 130m (427 ft). ✓ Data Recorder File Index is 12. ✓ Setting new Maximum Flight Altitude to 500m (1640 ft)
C	00m 00s	0.0 m	0 m	Warning	Mavic 2 Enterprise Advanced Camera SD card is full Solution: Change SD card or delete some files
D	00m 01s	0.0 m	0 m	Mode	Mode changed to AutoTakeoff
E	00m 04s	1.0 m	0 m	Mode	Mode changed to P-GPS
F	00m 04s	1.1 m	0 m	Mode	Mode changed to Waypoint
G	01m 14s	129.7 m	192 m	Warning	Mavic 2 Enterprise Advanced Camera SD card is full Solution: Change SD card or delete some files
H	02m 11s	129.7 m	187 m	Warning	Mavic 2 Enterprise Advanced Camera SD card is full Solution: Change SD card or delete some files
	02m 19s	129.7 m	249 m		90% Battery
I	03m 04s	129.7 m	703 m	Data Loss	⚠ Downlink data connection lost for 2.6 seconds
	03m 04s	129.7 m	704 m		87% Battery at maximum distance

Figure 3: The waypoints and Pixhawk T-log. (Source: Log Analysis Report)

- Post-accident, the operator's safety manager (Accident Investigation office) conducted an internal investigation into the occurrence. A flight log (Pixhawk T-Log) for the accident flight was retrieved from the unit controller. A Fly012.DAT was used to determine the cause of the accident.
- According to the flight log, at 00:04s, the drone was launched to the waypoint mission (assignment). At 02:19s, the drone flew past the first peak. At 03:04s, the drone lost connection for 2.6s before coming back online; thereafter, it lost connection again and is assumed to have crashed.

The following findings were made by the operator:

- *The collision avoidance system was deactivated.*
- *The drone was being operated at 130 metres (426 feet) and the mountain/peak is 150m (500ft) high.*
- *The pilot-in-command (PIC) was using the wrong waypoint file for the assigned mission.*
- *The operator was issued a Remotely Piloted Aircraft (RPA) Operating Certificate on 25 October 2021 with an expiry date of 31 October 2022.*

Probable cause

The drone followed an incorrect waypoint, resulting in an 'assumed' crash.

Safety Actions

The following safety actions were implemented by the operator to prevent similar occurrences:

- Fly with collision avoidance system active.
- Confirm the waypoint files before launch.
- Maintain visual confirmation during flight by examining what is showing on screen to observe (identify) obstacles.

Safety Message

Drone operators who operate similar systems are urged to always ensure that every operation is conducted with the following considerations:

1. Fly with collision avoidance system active.
2. Confirm the waypoint files before launch.
3. Maintain visual confirmation during flight by examining what is showing on screen to observe (identify) obstacles.

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
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