SOUTH AFRICAN CIVIL AVIATION AUTHORITY

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

LIMITED ACCIDENT INVESTIGATION REPORT

Reference Number	CA18/2/3/10081										
Classification	Accident	**Date**	2 November 2021	**Time**	1130Z						
Type of Operation	Remotely Piloted Aircraft (Part 101)										
Location											
Place of Departure	Thungela Shared Services in Witbank, Mpumalanga Province	Place of Intended Landing	Thungela Shared Services in Witbank, Mpumalanga Province								
Place of Accident	Water Treatment Plant at Thungela Shared Services										
GPS Co-ordinates	Latitude	S25° 56' 37.9"	Longitude	E029°11' 20.9"	Elevation	5066 feet					
Aircraft Information											
Registration	ZT-UWG										
Model/Make	DJI Matrice M210 V2 (Serial Number: M200-01)										
Damage to Aircraft	Destroyed	Total Aircraft Hours	1065.45 hours								
Pilot-in-command											
Licence Type	Remote Pilot Licence (RPL)	Gender	Male	Age: 25							
Licence Valid	Yes										
Total Hours on Type	624.42	Total Flying Hours	624.42								
People On-board	N/A	Injuries	0	Fatalities	0	Other (on ground)	0				

What Happened

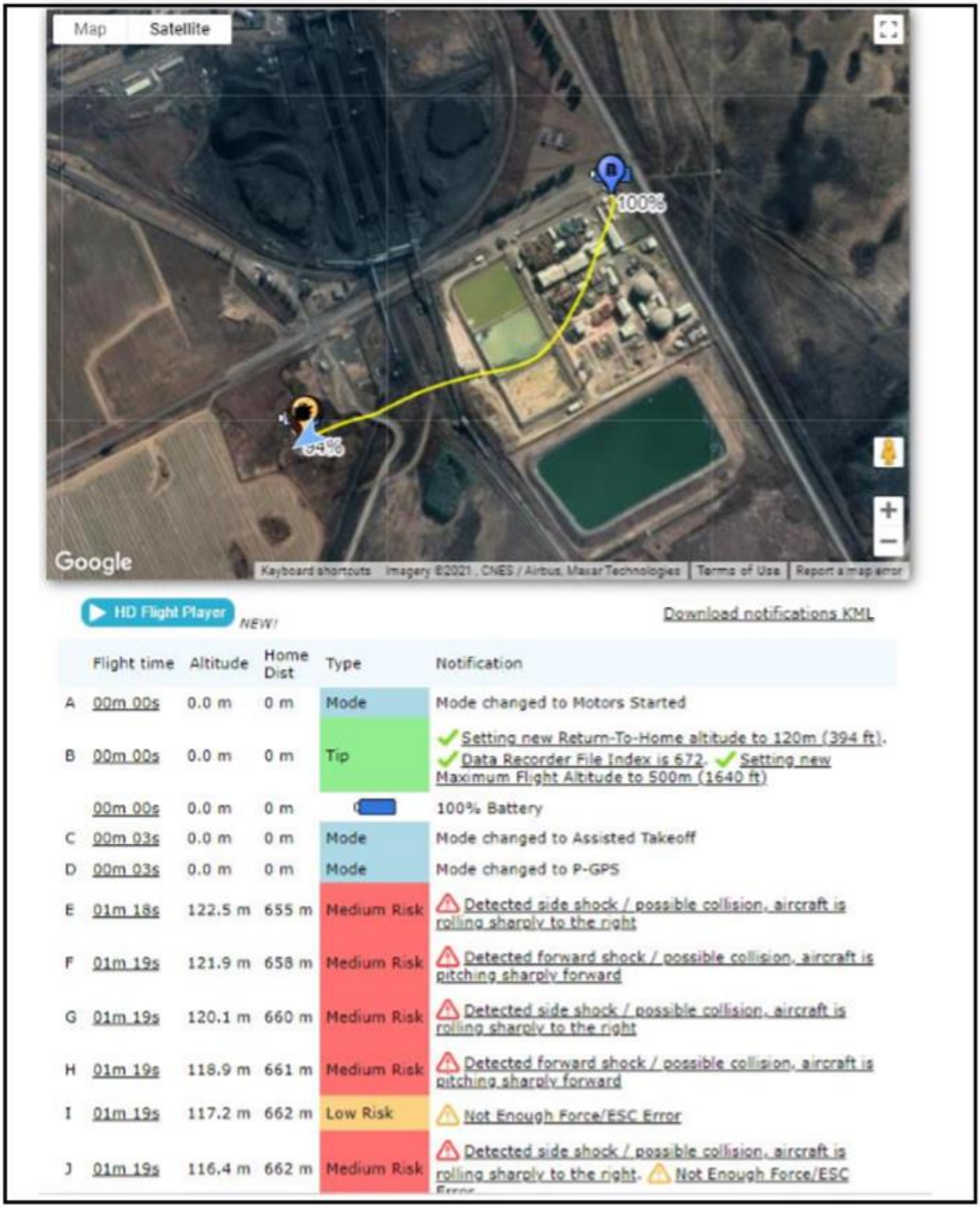
On 2 November 2021, the remotely piloted DJI Matrice drone/unmanned aircraft with registration marking ZT-UWG took off from Thungela Shared Services facility in Witbank, Mpumalanga province, for aerial inspection with the intention to return to launch facility. The flight was conducted under visual flight rules (VFR) by day and under the provisions of Part 101 of the Civil Aviation Regulations (CAR) 2011 as amended.

The pilot reported that the first flight was completed without incident. During the last flight at approximately 400 feet (ft) above ground level (AGL) and 700m from the landing zone at the facility whilst monitoring the transmitter screen, the pilot saw the drone malfunctioning and, thereafter, entered a rapid uncontrolled descent with no warnings or high wind speeds observed. The pilot then lost the drone's line of sight. According to the pilot, prior to the first flight, the drone battery was fully charged at 100%. At the time of accident, the drone had 85% battery power remaining. The drone was recovered in a nearby field, approximately 700m from the landing zone.

The drone was destroyed on impact with the ground during the accident sequence. The body was shattered, and its internal hardware and electronic systems were destroyed. Other damage was

limited to the gear skids, antenna, battery bay, propellers, arms and the four electric motors. One of the batteries (M200-246) had split upon impact.

Figure 1: The damaged RPA. (Source: Operator)



HD Flight Player *NEW!*

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 120m (394 ft). ✓ Data Recorder File Index is 672. ✓ Setting new Maximum Flight Altitude to 500m (1640 ft)
	00m 00s	0.0 m	0 m		100% Battery
C	00m 03s	0.0 m	0 m	Mode	Mode changed to Assisted Takeoff
D	00m 03s	0.0 m	0 m	Mode	Mode changed to P-GPS
E	01m 18s	122.5 m	655 m	Medium Risk	⚠ Detected side shock / possible collision, aircraft is rolling sharply to the right
F	01m 19s	121.9 m	658 m	Medium Risk	⚠ Detected forward shock / possible collision, aircraft is pitching sharply forward
G	01m 19s	120.1 m	660 m	Medium Risk	⚠ Detected side shock / possible collision, aircraft is rolling sharply to the right
H	01m 19s	118.9 m	661 m	Medium Risk	⚠ Detected forward shock / possible collision, aircraft is pitching sharply forward
I	01m 19s	117.2 m	662 m	Low Risk	⚠ Not Enough Force/ESC Error
J	01m 19s	116.4 m	662 m	Medium Risk	⚠ Detected side shock / possible collision, aircraft is rolling sharply to the right. ⚠ Not Enough Force/ESC Error

Figure 2: Airdata –The RPA experienced a problem with thrust (see number “E”). The smart motors recorded collision and electronic speed control (ESC) error (see number “I”). (Source: Operator)

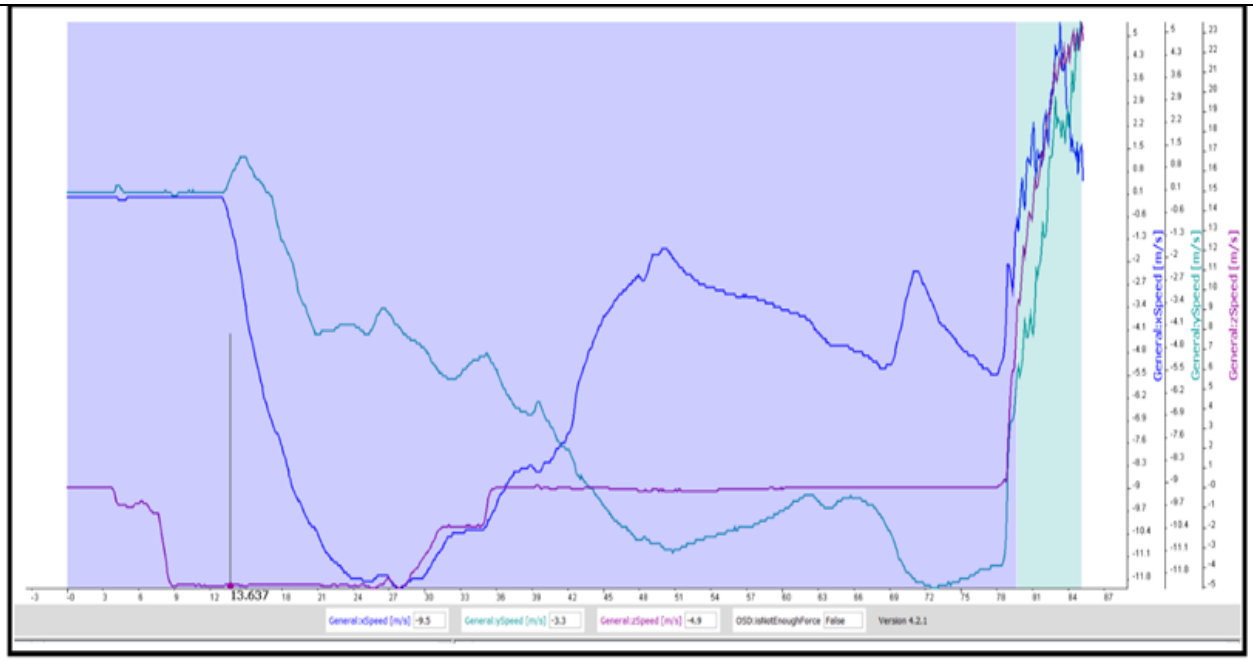


Figure 3 – CSV (comma-separated values) View –The IMU (inertial measurement unit) log shows that no impact was recorded in-flight. The RPA started falling faster than normal. The log retrieved does not show which motor caused the whole system to go out of sync. Only .DAT files show information relating to the motor. (Source: Operator)

The aqua hue as the background is the internal flight command or IMU confirming that there is a thrust lost being recorded as the RPA is flying beyond the manufacturing specifications or beyond the programmed parameters, thus, confirming an ESC failure.

Note: *X – Blue – Speed going forward.*
Y – Turquoise or green – Yaw speed.
Z – Purple – Ascend/Descend speed of the aircraft.
The black line below is only showing the time in milliseconds, as these events happen quick.

Note: *A CSV (comma-separated values) file is a text file that has a specific format which allows data to be saved in a table structured format.*

Note: *An inertial measurement unit (IMU) is an electronic device that measures and reports a body's specific force, angular rate, and sometimes the orientation of the body, using a combination of accelerometers, gyroscopes, and sometimes magnetometers.*

The pilot had a Remote Pilot Licence (RPL) issued by the Regulator (SACAA) on 20 June 2020 with an expiry date of 30 June 2022. His Class 3 medical certificate was issued by the Regulator on 24 December 2019 with an expiry date of 31 December 2023. The pilot was qualified for the flight operation and his licence was endorsed as a multirotor drone operator. The pilot had a total of 624.42 drone operating hours and had a drone type endorsement on his pilot licence.

The operator had a remote piloted aircraft system letter of approval (LOA) issued by the Regulator on 22 October 2021 with an expiry date of 31 October 2022. During the investigation, records of the operator's maintenance and pre-flight checks (including flight and function tests) were reviewed. The investigation did not find any indication of malfunction of the power systems and

sensors that would have affected the drone in the context of the accident.
The drone was registered under the Regulator's registry on 1 February 2019. The drone had operated approximately 1065.45 flight hours since new. The operator had an operating certificate issued by the Regulator on 25 October 2021 with an expiry date of 31 October 2022.

Probable cause(s)

ESC or motor failed during flight, thus, rendering the RPA out of sync and causing the RPA to fall and crash.

Contributing factor(s)
Component or hardware failure.

Safety Action/s

None.

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

This report is issued by:

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