SOUTH AFRICAN CIVIL AVIATION AUTHORITY

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

LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/2/3/10274						
Classification	Accident		**Date**	22 February 2023		**Time**	0637Z
Type of Operation	Aerial Photography (Part 101)						
Location							
Place of Departure	ArcelloMittal South Africa, Vanderbijlpark, Gauteng Province		Place of Intended Landing		ArcelloMittal South Africa, Vanderbijlpark, Gauteng Province		
Place of Occurrence	Area near ArcelloMittal steel factory in Vanderbijlpark, Gauteng Province						
GPS Co-ordinates	Latitude	26° 39’ 31. 36” S	Longitude	27° 48’.32 75” E	Elevation	4 911 ft	
Aircraft Information							
Registration	ZT-XEA						
Make; Model; S/N	DJI Mavic 2 Enterprise Advanced (Serial Number: MAV0037)						
Damage to Aircraft	Substantial		Total Aircraft Hours	428. 31 minutes			
Pilot-in-command							
Licence Type	Remote Pilot Licence (RPL)		Gender	Male	Age	51	
Licence Valid	Yes	Total Hours	1 939.11	Total Hours on Type	14.09		
Total Hours Past 90 Days	14.09		Total Flying Hours on Type Past 90 Days	14.09			
People Controlling	1	**Injuries** 0	**Fatalities**	0	**Other (on ground)**	0	

What Happened

On Wednesday morning, 22 February 2023, a pilot reported at ArcelloMittal South Africa steel factory facility in Vanderbijlpark, Gauteng province to prepare for an aerial photography flight around the factory using a DJI Mavic 2 Enterprise Advanced remotely piloted aircraft (RPA) with registration ZT-XEA. The flight was conducted in visual line of sight (VLOS) by day and under the provisions of Part 101 of the Civil Aviation Regulations (CAR) 2011 as amended.

The pilot reported that upon arrival at the steel factory, he performed a pre-flight inspection on the RPA and no anomalies were noted. The pre-flight inspection included checking for software updates, ensuring that the co-ordinates were identified by the Global Positioning System (GPS) satellite, the home point was set to the take-off location and the 16.2 voltage battery was fully charged and correctly installed. The RPA was launched at 0631Z and it climbed to 387 feet (ft) above ground level (AGL). However, approximately 5 minutes into the flight, numerous electronic speed control (ESC) related errors appeared on the DJI controller unit screen. The RPA did not respond to the pilot’s inputs, but it started an uncontrolled descent until it impacted the ground at 0637Z. The RPA sustained substantial damage. No damage to property was caused and no people on the ground were injured.

Figure 1: An aerial view showing the launch area and the accident site. (Source: Pilot).

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

The Pilot

The pilot was initially issued a Remote Pilot Licence (RPL) by the South African Civil Aviation Authority (SACAA) on 12 April 2019 with an expiry date of 28 February 2023. The pilot had a valid Class 3 aviation medical certificate which was issued on 6 February 2023 with an expiry date of 28 February 2024. At the time of the accident, the pilot had flown a total of 1 939.11 hours, of which 14.09 hours were during the past 90 days.

The Remotely Piloted Aircraft (Source: Mavic 2 Enterprise Series Manual, page 6)

The DJI Mavic 2 Enterprise advanced drone is the latest commercial RPA with an advanced flight control system, six directional sensing and positioning system. It is equipped with a more powerful thermal imaging camera with a 640 x 512 pixels thermal resolution with an accuracy of + - 2 degrees. It comprises of several advanced flight functions including return-to-home and obstacle sensing. It is constructed with a magnesium aluminium composite shell and carbon fibre arms that hold the motors and landing struts. During the flight, these arms are raised to allow unobstructed view from the camera that is suspended by the gimbal below the RPA.

The accident RPA, with serial number MAV0037, had a maximum take-off weight (MTOW) of 1 100 grams (g). It also had a maximum flight time of 31 minutes with batteries fully charged. The RPA can be operated at a distance of 18 kilometres (km) radius from the launch position.

Figure 3: An illustration of the DJI Mavic 2 RPA in landing configuration. (Source: DJI)

The last maintenance inspection conducted on the RPA prior to the accident flight was certified on 25 September 2022 at 396 hours. The RPA had logged 428 hours and 31 minutes (428hrs:31min) at the time of the accident, meaning that it was flown for 32 minutes and 31 seconds (32min:31sec) since the last inspection. The operator was issued a Remotely Piloted Aircraft Systems (RPAS) Letter of Approval (LOA) by the SACAA on 30 August 2022 with an expiry date of 28 September 2023. The RPA's Certificate of Registration (C of R) was issued to the present owner on 11 May 2021. The aircraft's technical records indicated that the aircraft was properly certificated and maintained in accordance with (IAW) the SACAA regulations. There were no open or differed maintenance items listed on the aircraft flight folio before the accident flight.

Weather Information

The weather conditions estimated by the pilot at take-off were as follows:

Wind Direction	40°	Wind Speed	9 knots	Visibility	> 10km
Temperature	18°C	Cloud Cover	Nil	Cloud Base	Nil
Dew Point	15°C	QNH	1028 hPa		

Follow-up investigation

The operator provided a technical report of their post-accident findings. It was concluded that the pilot flew the RPA in sport mode for more than 5 minutes, which depleted the battery power. This caused the motors to stop operating, as well as interrupted the pilot's inputs from reaching the RPA.

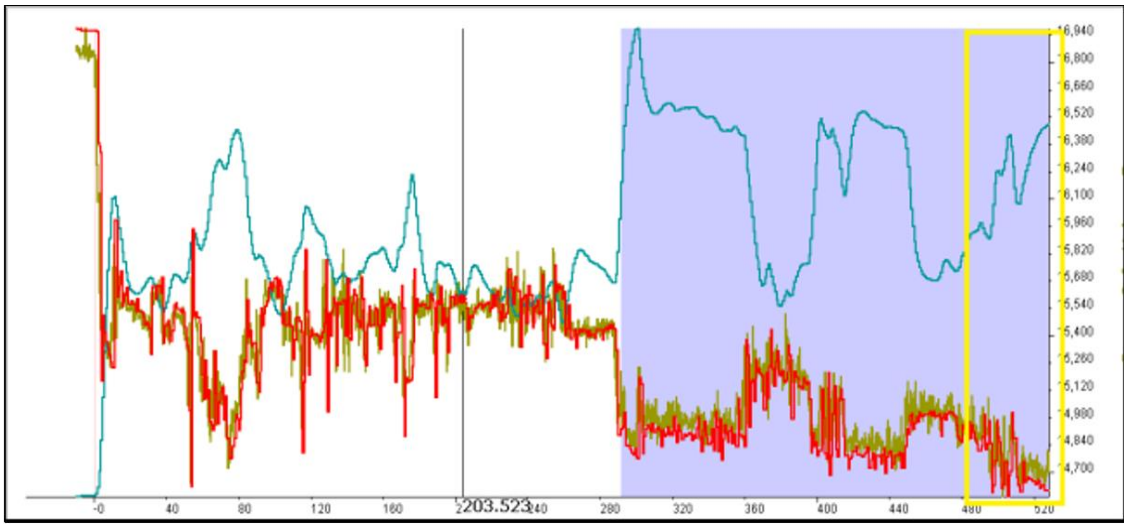

Figure 4: The downloaded data showing the battery voltage (red line) depleting faster after it was switched to "sport" mode. (Source: Operator)

Findings

i. The pilot was initially issued a Remote Pilot Licence (RPL) by the SACAA on 12 April 2019 with an expiry date of 28 February 2023.

ii. The pilot had a valid Class 3 aviation medical certificate which was issued on 6 February 2023 with an expiry date of 28 February 2024.

iii. The pilot had flown 1 939.11 hours, of which 14.09 hours were during the past 90 days.

iv. Fine weather conditions prevailed at the time of the flight.

v. The last maintenance inspection on the RPA prior to the accident flight was certified on 25 September 2022 at 396 hours. The RPA was flown a further 32 minutes and 31 seconds (32min:31sec) since the last inspection.

vi. The aircraft's technical records indicated that the aircraft was properly certificated and maintained IAW the SACAA regulations.

vii. The operator was issued a Remotely Piloted Aircraft Systems (RPAS) Letter of Approval (LOA) by the SACAA on 30 August 2022 with an expiry date of 28 September 2023.

viii. The RPA's Certificate of Registration (C of R) was issued to the present owner on 11 May 2021.

ix. The operator concluded that the pilot flew the RPA in sport mode for more than 5 minutes, which depleted the battery power; this caused the motors to stop operating, as well as interrupted the pilot's inputs from reaching the RPA.

x. The RPA sustained substantial damage during the accident sequence.

xi. No person was injured on the ground during the accident.

Probable Cause

The pilot flew the RPA in sport mode for more than 5 minutes, which depleted the battery power; this caused the motors to stop operating, as well as interrupted the pilot's inputs from reaching the RPA.

Contributing Factor

Lack of awareness of the screen vitals and active flight modes.

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