UAS DJI Matrice M210 Version 1	**Poole, Dorset**	**19 November 2020**	**Accident**

Investigation Synopsis

The quadcopter unmanned aircraft (UA) was being flown over the city of Poole during a police operation when the wind at 400 ft exceeded the forecast wind, the manufacturer's wind limit and the maximum restricted speed of the UA. The UA drifted beyond visual line of sight and then communication with it was lost. When the battery level was low it entered an auto-land mode but collided with the wall of a house, damaging its propeller blades before coming to rest on a balcony. The investigation revealed that shortly after takeoff one of the UA's two batteries had disconnected which resulted in its maximum speed being restricted, but this restriction is not referenced in the user manual and neither the remote pilot nor operator were aware of it. When the UA detected that the manufacturer's wind limit had been exceeded, the message triggered on the pilot's controller display was 'Fly with caution, strong wind'instead of advising the pilot that the limit had been exceeded and that the UA should be landed as soon as possible.Three Safety Recommendations are made to the UAS manufacturer and one to the CAA on Visual Line of Sight guidance.

Safety Recommendation 2022-001

Justification

The manufacturer appears to have used the same message for both a level 1 and a level 2 wind warning, causing confusion to the remote pilot on the action to take. The manufacturer had set a wind limit of 27 mph, and therefore the level 2 wind warning should have advised the pilot to land as soon as possible.

Therefore, the following safety recommendation was made:

> **Safety Recommendation 2022-001**
>
> It is recommended that DJI amend the DJI Pilot and DJI GO4 apps to warn the remote pilot when the wind limit has been exceeded and that the UA should be landed as soon as possible.

Date Safety Recommendation made: 05 April 2022

LATEST RESPONSE

Response received: Awaiting Response

Safety Recommendation Status **Open**

AAIB Assessment **Awaiting Response**

Action Status

Feedback rationale

(EU Regulation 996/2010 article 18 refers).

RESPONSE HISTORY

N/A

(SRIS Reference:)

Safety Recommendation 2022-002

Justification

The pilot is required to maintain visual line of sight with the UA and therefore could miss an alert message on the controller screen if they are concentrating on manoeuvring the UA visually. If messages related to safety of flight had an associated aural warning the pilot's attention could be drawn to them.

Therefore, the following safety recommendation was made:

> **Safety Recommendation 2022-002**
>
> It is recommended that DJI amend the DJI Pilot and DJI GO4 apps so that an aural alert is triggered when alert messages relating to safety of flight appear.

Date Safety Recommendation made: 05 April 2022

LATEST RESPONSE

Response received: Awaiting Response

Safety Recommendation Status **Open**

AAIB Assessment **Awaiting Response**

Action Status

Feedback rationale

(EU Regulation 996/2010 article 18 refers).

RESPONSE HISTORY

N/A

(SRIS Reference:)

Safety Recommendation 2022-003

Justification

At low battery voltages the DJI Matrice 200 series activates a pitch limiting system which reduces the maximum speed of the UA and the wind limits it can operate in. The manufacturer's user manual for the Matrice 200 series does not provide details of the operation of the pitch limiting system.

Therefore, the following safety recommendation was made:

> **Safety Recommendation 2022-003**
>
> It is recommended that DJI amend the Matrice 200 series user manual to provide information on the pitch attitude limiting system, including the new maximum speed which results from the limit, and the battery level at which it triggers; and communicate this change widely to pilots and operators.

Date Safety Recommendation made: 05 April 2022

LATEST RESPONSE

Response received: Awaiting Response

Safety Recommendation Status **Open**

AAIB Assessment **Awaiting Response**

Action Status

Feedback rationale

(EU Regulation 996/2010 article 18 refers).

RESPONSE HISTORY

N/A

(SRIS Reference:)

Safety Recommendation 2022-004

Justification

The operator had adopted a distance of 500 m for their VLOS operations in part because of the CAA's guidance in CAP 722 at this distance the Matrice has an apparent size of just 0.4 by 0.3 mm on a piece of paper held at normal reading distance and its orientation cannot be determined. It is not clear from the regulation or CAP 722 whether this is acceptable.

Therefore, the following safety recommendation was made:

> **Safety Recommendation 2022-004**
>
> It is recommended that the Civil Aviation Authority review the Visual Line of Sight distance figures in CAP 722 and amend the guidance to make it clear that just being able to see an unmanned aircraft is not sufficient for Visual Line of Sight operations and that pilots need to be able to demonstrate that at the distance they are flying, they can manoeuvre it rapidly to avoid a collision and can also land the unmanned aircraft safely following a loss of position-holding without reference to video or telemetry.

Date Safety Recommendation made: 05 April 2022

LATEST RESPONSE

Response received: 05 January 2023

Thank you for the recommendation, which we have reviewed, and concluded that we should add some further GM to the Acceptable Means of Compliance and Guidance Material (AMC and GM) document. There are two aspects to this recommendation:
a) The manoeuvring of a UA, at distances they are operating at following a failure; and
b) The landing of a UA, at distances they are operating at following a failure

On the first part (a) of the recommendation, we believe that the current guidance contained, in relation to being able to safely manoeuvre the aircraft at any distance within Visual Line of Sight (VLOS), is sufficient.

On the second part (b) of this recommendation, we have now added guidance that will focus on the importance of maintaining situational awareness, in regard to potential landing sites, should one be required following an emergency or other such event. We now advise Remote Pilots to make use of available sensors to scan the immediate ground below the aircraft to check for uninvolved persons and potential landing sites, so that a suitable site may be quickly located should it be needed.

The finalised text has now been published as GM in the Annex of UK Regulation (EU) 2019/947, under 'Emergency Landing' and can be found at GM1 UAS.OPEN.060(2)(b) Responsibilities of the Remote Pilot (caa.co.uk). It is also included below for ease of reference:
Planning is a crucial stage of a mission's success and Remote Pilots (RPs) must consider all 'in-flight' emergency scenarios, particularly when operating at a range where a systems failure or external influence may remove the RTH option and potentially result in an unplanned landing outside of the VLOS criteria. RPs should continually identify and update suitable Emergency Landing Sites (ELS) as part of their desk top analysis, when conducting on-site reconnaissance and throughout the flight phase.

If an UA Observer is not employed and an aircraft experiences a critical system failure, or is subject to unexpected external influences, precluding the aircraft from safely returning to the home point it may be necessary to conduct an unassisted emergency landing away from the RP. RPs are required to maintain

good situational awareness throughout all flights and must therefore adequately divide their attention between scanning the airspace for conflicting aircraft and achieving the mission. This should also involve exploiting the aircraft's sensor to scan the ground below for uninvolved persons infringing the safety minima and to identify suitable emergency landing sites (ELSs) should an emergency landing be required. RPs should proactively scan and plan for new ELSs as the aircraft tracks away from the previous one. In such circumstances, whilst it is accepted that an RP may have little or no control over the aircraft's safe descent, they must make every effort to mitigate the risk to uninvolved persons.

We believe this satisfies the intent of SR 2022-004.

Safety Recommendation Status **Open**

AAIB Assessment **Partially Adequate**

Action Status **Planned Action Ongoing Update Due** 01 June 2023

Feedback rationale

The AAIB recognises the changes to the guidance material and CAP 722 however the current revision of CAP 722 does not make it clear that Remote Pilots that remote pilots must maintain sufficient visual line of sight of the UA to manoeuvre the UA without the use of video or telemetry. An update is requested before 05 July 2023.

RESPONSE HISTORY

Response received: 08 June 2022

The CAA accepts this recommendation. We have reviewed the content contained within CAP 722, and will amend the text accordingly. The draft wording is included below for information. This new wording will, initially, be contained within the Acceptable Means of Compliance (AMC) and Guidance Material (GM) to UK Regulation (EU) 2019/947 (the UAS Implementing Regulation) and is contained within the AMC/GM to the definition of VLOS, and the AMC/GM to the responsibilities of the Open Category remote pilot.

Due to the legal responsibilities that the CAA is subject to, in regard to the publication of Acceptable Means of Compliance and Guidance Material, under UK Regulation (EU) 2018/1139 (the Basic Regulation), this new draft text along with extensive other new guidance text is currently within the Rulemaking Process and will be published for consultation in June/July 2022, and adopted soon after. CAP 722 will then be withdrawn and re-published in a new format, in due course.

AAIB Assessment – Partially Adequate Open

(SRIS Reference:)