

Unmanned Aircraft Systems

Rotary Wing Swarm Operations – Visual Line of Sight – Requirements, Guidance & Policy

CAP 722E

Published by the Civil Aviation Authority, 2020

Civil Aviation Authority
Aviation House
Beehive Ring Road
Crawley
West Sussex
RH6 0YR

All rights reserved. Copies of this publication may be reproduced for personal use, or for use within a company or organisation, but may not otherwise be reproduced for publication.

To use or reference CAA publications for any other purpose, for example within training material for students, please contact the CAA at the address above for formal agreement.

First edition of CAP 722E, 25 August 2020

The latest version of this document is available in electronic format at www.caa.co.uk

Contents

Contents	3
Revision history	4
Foreword	5
Point of contact	6
Abbreviations and glossary of terms	7
CHAPTER 1 General introduction	11
1.1 Policy	11
1.2 Scope	11
1.3 Editorial practices	11
CHAPTER 2 Basic requirements for all rotary wing VLOS swarms	13
2.1 OSC Volume 1 – Operations Manual	13
2.2 OSC Volume 2 – Systems	17
2.3 OSC Volume 3 – Safety Risk Assessment	21
2.4 Additional application requirements	21
CHAPTER 3 Additional information	23
3.1 Airspace	23
3.2 VLOS swarm for public display diagrams	25
3.3 Additional guidance for notifying swarm operations using form DAP 1918	26
Appendix A Summary of requirements	28
OSC Volume 1 – Operations Manual	28
OSC Volume 2 – Systems	30
OSC Volume 3 – Safety Risk Assessment	32
Additional application requirements	32

Revision history

First edition

July 2020

This is the first edition of this document.

Foreword

Aim

The aim of this document is to enable UAS operators to understand the requirements that must be met as part of an application for operational authorisations related to rotary wing UAS swarm operations in visual line of sight (VLOS).

It will indicate which volumes of the operating safety case (OSC) should address each requirement.

For more guidance on the OSC and the application process see [CAP 722A](#) and the UAS application process webpage [here](#).

In advance of further changes to this document, updated information is contained on the CAA website via [UAS Unit web pages](#).

Content

This CAP covers three areas. Chapter 2 describes the basic requirements for all rotary wing VLOS swarms. Chapter 3 provides additional information on airspace, public displays, and notification. Finally, Appendix A is a summary of the requirements listed in Chapter 2.

The content of CAP 722E does not replace the current civil regulations. Wherever possible, this guidance has been harmonised with any relevant emerging international UAS regulatory developments where available.

Availability

The latest version of CAP 722E can be located within the [publications](#) section of the CAA website.

Updated information can be found within the [latest updates](#) section of the CAA website's UAS webpages.

The CAA also provides a more general aviation update service via the [SkyWise system](#), which can be filtered by subject matter for relevant UAS related information.

Structure

CAP 722E, sits within the CAP 722 suite of UAS guidance and policy, which can be found [here](#).

This document is structured as follows:

CAP 722E

Chapter 1	General introduction
Chapter 2	Basic requirements for all rotary wing VLOS swarms
Chapter 3	Additional information
Appendix A	Summary of requirements

Point of contact

Unless otherwise stated, all enquiries relating to CAP 722E must be made to:

For queries relating to the content of CAP 722E:

UAS Unit
CAA
Safety and Airspace Regulation Group
Aviation House
Beehive Ring Road
Crawley
West Sussex
RH6 0YR

E-mail: uavenquiries@caa.co.uk

For matters concerning operations or approvals:

Shared Service Centre (UAS)
CAA
Aviation House
Beehive Ring Road
Crawley
West Sussex
RH6 0YR

Telephone: 0330 022 1908

E-mail: uavenquiries@caa.co.uk

Abbreviations and glossary of terms

The terminology relating to UAS operations continues to evolve and therefore the abbreviations and glossary of terms sections are not exhaustive. The terms listed below are a combination of the emerging ICAO definitions and other 'common use' terms which are considered to be acceptable alternatives.

Abbreviations

A

ADS-B	Automatic dependent surveillance broadcast
AGL	Above ground level
ALARP	As low as reasonably practicable
ANO	Air Navigation Order
AR Ops	Airspace Regulation Operations (Civil Aviation Authority)

B

BVLOS	Beyond visual line of sight
-------	-----------------------------

C

CAA	Civil Aviation Authority
C2	Command and control

F

FRZ	Flight restriction zone
-----	-------------------------

N

NOTAM	Notice to airmen
-------	------------------

O

OSC	Operating safety case
-----	-----------------------

R

RF	Radio frequency
RPA	Remotely piloted aircraft

U

UA	Unmanned aircraft
UAS	Unmanned aircraft system(s)

V

VLOS Visual line of sight

Glossary of terms

A

Aircraft – Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the Earth's surface.

Air Navigation Order (ANO) – The legal document, established as a UK Statutory Instrument (SI) that is made for the purposes of regulating air navigation within the United Kingdom.

B

Beyond visual line of sight (BVLOS) – An operation in which the remote pilot or RPA observer does not use visual reference to the unmanned aircraft in the conduct of flight.

C

Command and control (C2) link – The data link between the remotely piloted aircraft and the Command Unit for the purposes of managing the flight.

Concept of operations – Describes the characteristics of the organisation, system, operations, and the objectives of the user.

Command unit – The equipment or system of equipment to control unmanned aircraft remotely as defined in point 32 of Article 3 of Regulation (EU) 2018/1139 which supports the control or the monitoring of the unmanned aircraft during any phase of flight, with the exception of any infrastructure supporting the command and control (C2) link service.

Note: In other UAS documents, Remote Pilot Station or Ground Control Station is listed as the preferred term. However, Command Unit is now the accepted term and other documents will be updated in due course.

Contingency volume – Zone between the boundary of the flight volume and the emergency buffer.

E

Emergency buffer – Zone outside the operational volume. If UA enters the emergency buffer, the emergency response plan must be carried out.

F

Flight restriction zone (FRZ) – Airspace of defined dimensions around a protected aerodrome (as defined in the Air Navigation Order, Article 94) within which the permission of the relevant ATS unit or aerodrome operator, as appropriate, is required before a small unmanned aircraft flight can take place.

Flight volume – The zone containing the planned operation, within which the UA must remain for continued safe operation.

L

Latency – This is defined by the time it takes for a request to travel from the transmitter (Command Unit) to the receiver (UA) and for the receiver to process that request. This is the total round-trip time from the Command Unit to the UA and back again. In reliable two-way communication systems, latency limits the maximum rate that information can be transmitted.

Lost C2 link – The loss of command and control link with the remotely piloted aircraft such that the remote pilot can no longer manage the aircraft's flight.

O

Operator – See UAS operator.

Note: In the context of remotely piloted aircraft, an aircraft operation includes the remotely piloted aircraft system.

Operating safety case (OSC) – Methodology used to apply to the CAA for a permission or exemption to operate a UAS within the UK.

Operational authorisation – A document issued by the CAA that authorises the operation of an unmanned aircraft system, subject to the conditions outlined within the authorisation, having taken into account the operational risks involved.

Operational volume – The zone containing the flight volume and the contingency volume.

R

Recovery area – An alternative area identified for the purpose of landing the swarm in the event of an emergency.

Remote pilot – A natural person responsible for safely conducting the flight of an unmanned aircraft by operating its flight controls, either manually or, when the unmanned aircraft flies automatically, by monitoring its course and remaining able to intervene and change the course at any time. Regulation (EU) 2018/1139.

Note: Within ANO 2016, article 94G the “remote pilot”, in relation to a small unmanned aircraft, is an individual who:

- (i) operates the flight controls of the small unmanned aircraft by manual use of remote controls, or
- (ii) when the small unmanned aircraft is flying automatically, monitors its course and is able to intervene and change its course by operating its flight controls

In this document, the term ‘remote pilot’ is used for all sizes of unmanned aircraft, hence the first definition is applicable.

Remotely piloted aircraft (RPA) – An unmanned aircraft which is piloted from a remote pilot station.

Remote pilot station (RPS) – See command unit.

S

Sterile ground area – An area on the ground or water within which only people that are involved in the operation are permitted.

Swarming – Operation of more than one UA which are controlled collectively rather than individually.

U

Unmanned aircraft (UA) – Any aircraft operating or designed to operate autonomously or to be piloted remotely without a pilot on board.

Note: RPA is considered a subset of UA.

Unmanned aircraft system (UAS) – An unmanned aircraft and the equipment to control it remotely.

Note: The UAS comprises individual 'System Elements' consisting of the Unmanned Aircraft (UA) and any other System Elements necessary to enable flight, such as a Command Unit, Communication Link and Launch and Recovery Element. There could be multiple UA, Command Units or Launch and Recovery Elements within a UAS.

Unmanned aircraft system operator (UAS operator) – Any legal or natural person operating or intending to operate one or more UAS.

V

Visual line of sight (VLOS) operation – Means a type of UAS operation in which, the remote pilot is able to maintain continuous unaided visual contact with the unmanned aircraft, allowing the remote pilot to control the flight path of the unmanned aircraft in relation to other aircraft, people and obstacles for the purpose of avoiding collisions.