

Unmanned Aircraft System Operations in UK Airspace – Guidance

CAP 722



Published by the Civil Aviation Authority, 2020

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Previously published as DAP Unmanned Aerial Vehicle Operations in UK Airspace – Guidance, June 2001

First edition of CAP 722, 29 May 2002

Second edition, 12 November 2004

Third edition, 28 April 2008

Third Edition incorporating amendment 2009/01, 14 April 2009

Fourth Edition, 6 April 2010

Fifth Edition, 10 August 2012

Sixth Edition, 31 March 2015

Seventh Edition, July 2019

Seventh Edition, amendment 2019/01, 23 July 2019

Seventh Edition, amendment 2019/02, 30 July 2019

Seventh Edition, amendment 2019/03, 6 September 2019

Eighth Edition, 5 November 2020

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Revision History

Eighth Edition

November 2020

This revision implements the new UAS Regulatory Package, which becomes applicable in its entirety in the UK from 31 December 2020. The document has been completely restructured in order to accommodate the necessary changes and present them in a clearer and more comprehensible manner.

Seventh Edition

September 2019

A number of small amendments have been made to CAP 722 Seventh edition since it was published in July.

Seventh Edition

July 2019

This amendment updates references and text in accordance with ANO 2016 and its subsequent amendments, changes to European regulations brought about by the publication of the New Basic Regulation in Autumn 2018, incorporates Guidance material that has been published in the interim, and brings terms, definitions and procedures/processes up to date as they have evolved, and a change to the structure of the document.

In addition, the opportunity has been taken to transfer the Appendices into two separate, but related, documents with CAP 722A covering the development of Operating Safety Cases, and CAP 722B covering the requirements for National Qualified Entities.

Some minor editorial amendments have been made to this edition, since original publication in July. A list of these changes can be found on the CAP 722 publication web page.

Sixth Edition

March 2015

CAP 722 has been completely refreshed and restructured under this revision. Key changes to the document are:

- Complete restructure of the document.
- Updates to all Chapters (including Abbreviations and Glossary of Terms).
- Introduction of a Concept of Operations Approach (ConOps)

- Introduction of the UAS OSC - Unmanned Aircraft System Operating Safety Case (formerly titled Congested Areas Operating Safety Case).
- Introduction of an Approval Requirements Map.
- Removal of Military Operations Chapters.
- Addition of Alternative Means of Compliance to demonstrate Operator Competency.
- Introduction of Restricted Category Qualified Entities.

Fifth Edition

10 August 2012

The changes at this edition primarily concentrate on updating areas where terms, definitions or procedures have evolved significantly and where details of chapter sponsors have also been changed. The specific areas to note are:

- Revised Abbreviations and Glossary (also reflected throughout the document), which reflect worldwide developments in UAS terminology.
- Introduction of a Human Factors chapter.
- A complete rewrite of the 'Civil Operations, Approval to Operate' chapter.
- Amendments to civilian Incident/Accident Procedures.
- A complete revision to Section 4 (Military Operations), which reflects the formation of the Military Aviation Authority (MAA) and the revised Military Aviation Regulatory Publications.

Fourth Edition

6 April 2010

This edition incorporates the changes to legislation introduced in Air Navigation Order 2009 (ANO 2009) regarding the requirement for operators of small unmanned aircraft to obtain a CAA permission when their aircraft are being used for aerial work, and also in some cases for surveillance or data acquisition purposes (now termed small unmanned surveillance aircraft).

Unmanned aircraft having a mass of less than 7 kg are now covered by this new legislation, which is intended to ensure public safety by applying appropriate operational constraints, dependent on the flying operation being conducted and the potential risks to third parties. In line with this change, some guidance on the additional details to be provided within an application for permission to operate small unmanned aircraft have also been included (Annex 1 to Section 3, Chapter 1).

Expanded guidance regarding the reporting of incidents/occurrences involving the operation of unmanned aircraft has also been included; such reporting is viewed as being a vital element in the successful development of the 'fledgling' civilian UAS industry.

Finally, in line with continued developments in UAS terminology, and the principle that unmanned aircraft are still to be treated as aircraft rather than as a separate entity. In line with this, the term 'pilot' (i.e. the person who operates the controls for the aircraft) is used more frequently. The term 'Remotely Piloted Aircraft' (RPA) is also emerging in some areas, although it has not yet been wholeheartedly accepted for use in the UK.

Third Edition

28 April 2008

Introduction

Following discussions at the CAA Unmanned Aircraft Systems (UAS) Working Group, held on 12 October 2006, it was considered that sufficient progress had been made in many areas of UAS work to warrant a substantial review of CAP 722. In particular, as an upsurge in UAS activity is envisaged over the coming years it is essential that both industry and the CAA, as the regulatory body, clearly recognize the way ahead in terms of policy and regulations and, more importantly, in safety standards.

With an ever-increasing number of manufacturers and operators, it is vital that the regulations keep pace with UAS developments, without losing sight of the safety issues involved in the simultaneous operation of manned and unmanned aircraft. As a living document, it is intended that CAP 722 will be under constant review and that it will be revised, where necessary, to take account of advances in technology, feedback from industry, recognised best practice and changes in regulations, which are developed to meet these demands. However, it is recognised that with continual rapid developments there will inevitably be times when Chapter sponsors will have to be approached directly for further guidance.

Revisions in this Edition

The layout of the document has been amended to more clearly separate Civil and Military guidance and as such the Chapters have changed in many areas. In addition, while there are many minor textual changes to the document, a significant revision has been made in many areas and as such it is recommended that those involved in UAS operations review the entire content of the document to ensure that they are fully cognisant with the update.

Impending Changes to Regulation

The CAA is in the process of a consultation with industry over a proposal to amend the Air Navigation Order which will require operators of UAS with a UAV component of less than 7 kg mass to obtain a CAA permission, as is currently the case for UAVs with a mass of 7-20 kg. This proposal intends to ensure public safety by applying operational constraints to

UAVs of less than 7 kg mass, as deemed appropriate to the type of operation envisaged and the potential risk to members of the public.

If the consultation exercise approves the proposal, it is likely that the ANO Amendment will pass into law in December 2008. Potential operators of UAS with a UAV component of less than 7 kg must ascertain, before commencing operations, whether or not they are required to obtain a CAA permission.

Third Edition incorporating amendment 2009/01 14 April 2009

This amendment is published in order to update contact details and references throughout the document and make some editorial corrections.

Second Edition

12 November 2004

The major changes in this document are on legal, certification, spectrum and security issues.

Details of the CAA Policy on Model Aircraft/Light UAV have also been included.

Foreword

Aim

CAP 722, Unmanned Aircraft System Operations in UK Airspace – Guidance and Policy, is compiled by the Civil Aviation Authority's Unmanned Aircraft Systems Unit (UAS Unit). CAP 722 is intended to assist those who are involved with the development, manufacture or operation of UAS to identify the route to follow in order that the appropriate operational authorisation(s) may be obtained and to ensure that the required standards and practices are met. Its content is primarily intended for non-recreational UAS operators, but it is clearly recognised that there is a great deal of overlap with recreational use, particularly when the smaller (lower mass) unmanned aircraft are concerned; as a result, much of this guidance is also directly relevant to recreational uses.

Furthermore, CAP 722 highlights the safety requirements that must be met, in terms of airworthiness and/or operational standards, before a UAS is allowed to operate in the UK.

In advance of further changes to this document, updated information can be found on the CAA website¹.

How to use this document

This document is divided into 5 Chapters which provide generalised information which is relevant to all forms of UAS operation (recreational and non-recreational or employing simple or complex technologies) and 4 Annexes which provide more detailed information for operators.

Its content is directly related to the new package of UAS Regulations, which apply within the UK from 31 December 2020.

Page and section headers are also colour coded in order to assist the location of text associated with particular topics as follows:

- | | |
|-------------------------------|---|
| Black section headers | - refer to administration and document layout aspects |
| Purple section headers | - refer to General information |
| Blue section headers | - refer to Operational matters |
| Green section headers | - refer to Engineering and technical matters |

¹ www.caa.co.uk/uas

Orange section headers - refer to **Personnel** matters

Dark red section headers - refer to **Human factors and safety management** matters

The terms below are to be interpreted as follows:

- **‘Must’** / ‘must not’ indicates a mandatory requirement.
- **‘Should’** indicates a strong obligation (I.e. a person would need to provide clear justification for not complying with the obligation).
- **‘May’** indicates discretion.
- **‘Describe’** / **‘explain’** indicates the provision of logical argument and any available evidence that justifies a situation, choice or action.

Units of measurement

The units of measurement used within this document are expressed in accordance with those used in normal aviation practise within the UK:

- Vertical distances of aircraft (heights, altitudes) are expressed in **feet (ft)**
- Heights of obstructions are expressed in **metres (m)**
- Distances for navigation, airspace reservation plotting, and ATC separation are expressed in **nautical miles (nm)**
- Shorter distances are expressed in **metres (m)** and **kilometres (km)** when at or over 5000 metres
- Mass is expressed in **kilogrammes (kg)** and **grammes (g)** when less than 1kg
- Speed is expressed in **knots (kt)**

Note: *Speeds below 50kt may also be expressed in metres per second (m/s)*

Where appropriate, conversions will be provided within the text with the alternative value shown in brackets e.g. 400 feet (120 metres).

Other typical conversions that are used are:

- Distance
 - 10 feet = 3 metres
 - 50 feet = 15 metres
 - 500 feet = 150 metres
- Mass
 - 250g = 0.55 lb (pounds)
 - 25 kg = 55 lb

Content

CAP 722 does not replace civil regulations but provides guidance as to how civil UAS operations may be conducted in accordance with those regulations, along with any associated policy requirements. Wherever possible the guidance has been harmonised with any relevant emerging international UAS regulatory developments.

It is acknowledged that not all areas of UAS operations have been addressed fully. It is therefore important that operators, industry and government sectors remain engaged with the CAA and continue to provide comment on this document.

Availability

The primary method of obtaining a copy of the latest version of CAP 722 is via the CAA website² under the '[Publications](#)' section.

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](#).

Structure

The CAP 722 is structured as follows:

CAP 722

Chapter 1 General

Chapter 2 Operational Guidance

Chapter 3 Engineering and Technical Guidance

Chapter 4 Personnel

Chapter 5 Human Factors and Safety Management

Annexes:

Annex A The Open Category

Annex B The Specific Category

Annex C The Certified Category

Annex D Acceptable Means of Compliance and Guidance Material

² www.caa.co.uk/CAP722

CAP 722 is the lead document of the 'CAP 722 series' of UAS Guidance documentation, which includes:

CAP 722A – ConOPS and Risk Assessment Methodology

CAP 722B - The Recognised Assessment Entity

CAP 722C – UAS Airspace Restrictions Guidance and Policy

CAP 722D – UAS Master Glossary and Abbreviations

CAP 722E – UAS Rotary Wing Swarm Operations - Visual Line of Sight – Requirements, Guidance and Policy

Point of Contact

Enquiries relating to CAP 722 should be made as follows:

For queries relating to the content of CAP 722:

UAS Unit
CAA
Safety and Airspace Regulation Group
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Crawley
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RH6 0YR

E-mail: uavenquiries@caa.co.uk

For matters concerning operations, authorisations or approvals:

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

Telephone: 03300 221908

E-mail: uavenquiries@caa.co.uk

Abbreviations and Glossary of Terms

The definitive list of abbreviations and terms/definitions that are relevant to UAS operations within the UK and for the whole CAP 722 'series' of documents are centralised within CAP 722D UAS Definitions and Glossary (www.caa.co.uk/cap722d)

CHAPTER 1 | General

1 General

1.1 Introduction

1.1.1. Policy

UAS operating in the UK must meet at least the same safety and operational standards as manned aircraft when conducting the same type of operation in the same airspace.

As a result, when compared to the operations of manned aircraft of an equivalent class or category, UAS operations must not present or create a greater hazard to persons, property, vehicles or vessels, either in the air or on the ground.

However, with unmanned aviation, the primary consideration is the type of operation being conducted, rather than who or what is conducting it, or why it is being done. Because there is 'no one on board' the aircraft, the consequences of an incident or accident are purely dependent on where that incident/accident takes place. The CAA's focus is therefore on the risk that the UAS operation presents to third parties, which means that more effort or proof is required where the risk is greater.

The CAA will supplement CAP 722 with further written guidance when required. For the purpose of UAS operations, the 'See and Avoid' principle employed in manned aircraft is referred to as 'Detect and Avoid'.

1.1.2. Unmanned aircraft – clarification of terms

Although all definitions are contained within CAP 722D, the following are reproduced here:

'unmanned aircraft' means any aircraft operating or designed to operate autonomously or to be piloted remotely without a pilot on board;

'aircraft' means any machine that can derive support in the atmosphere from the reactions of the air other than reactions of the air against the earth's surface;

For clarification, the CAA considers the following as flying 'objects' rather than flying 'machines', and so are not considered to be unmanned aircraft:

- Paper aeroplane.
- Hand launched glider, but only those with no moveable control surfaces or remote-control link.

- Frisbees, darts and other thrown toys.

For the purposes of electrically powered unmanned aircraft, the batteries are considered as part of the aircraft, and the 'charge' is considered as the fuel.

1.1.3. Scope

The guidance within CAP 722 concerns civilian UAS as they are defined in CAP 722D (UAS Definitions and Glossary of Terms). It primarily focuses on the aspects connected with unmanned aircraft that are piloted remotely, whilst acknowledging the potential for autonomous operations in the future.

Military Systems are regulated by the Military Aviation Authority (MAA).

1.2 Legal considerations

1.2.2 The Chicago Convention

As a signatory to the Chicago Convention of 7 December 1944 and a member of ICAO, the United Kingdom undertakes to comply with the provisions of the Convention and Standards contained in Annexes to the Convention, except where it has filed a Difference to any of those standards.

Article 3 of the Convention provides that the Convention applies only to civil aircraft and not to State aircraft. State aircraft are defined as being aircraft used in military, customs and police services. No State aircraft may fly over the territory of another State without authorisation. Contracting States undertake when issuing Regulations for their State aircraft that they will have “due regard for the safety of navigation of civil aircraft”.

Article 8 of the Convention provides that no aircraft capable of being flown without a pilot shall be flown without a pilot over the territory of a Contracting State without special authorisation by that State. Under this Article, ICAO has determined that the term “*without a pilot*” should be taken to mean without a pilot *on-board the aircraft* and hence this has specific relevance to unmanned aircraft operations.

Article 8 of the Convention also requires that “each contracting State undertake to insure *sic* that the flight of such aircraft without a pilot in regions open to civil aircraft shall be so controlled as to obviate danger to civil aircraft”.

1.2.2.1 ICAO Annexes

The 19 Annexes to the Chicago convention contain the International Standards and Recommended Practices (SARPS), upon which every ICAO member State then uses to create its own national regulations, or in some cases a set of ‘regionalised’ regulations (such as within the European Union).

ICAO is currently in the process of developing international SARPS covering Remotely Piloted Aircraft Systems which are conducting international Instrument Flight Rules (IFR) operations within controlled airspace and from aerodromes. These SARPS fit into the Certified category of UAS operations (see 2.2.3 below) and the appropriate UK regulations will be adapted in accordance with these SARPS when they are completed.

ICAO is not currently developing SARPS for any other types of UAS operations.

1.2.3 UAS Regulation within the UK

This section sets out the basis for UAS regulation within the UK. It directly reflects the corresponding EU regulations and represents the regulatory situation that will be in place for UAS within the UK after the EU exit transition period ends on 31 December 2020.

In very simple terms, the relevant EU regulations (the Basic Regulation plus the UAS Implementing Regulation and the UAS Delegated Regulation – described below) will be transferred across into UK domestic law, as UK regulations, once the transition period ends. These regulations are referred to as ‘retained EU law’.

The text, layout and intent of the EU regulations will remain as currently written except that any European references (such as Member States, the Commission, competent authorities etc) have been changed to UK references (such as United Kingdom, Secretary of State, CAA etc).

It should be noted that the names of the ‘retained’ regulations (E.g. *COMMISSION IMPLEMENTING REGULATION [EU] 2019/947*) will not be changed. Therefore, extreme care must be taken when any reference is made to a regulation in order to ensure that the regulation made in UK domestic law is being referenced.

Note: *The presumption to be followed is that any reference made in domestic law to EU legislation should be interpreted as a reference to the ‘retained EU law’ version of the EU legislation that applies in UK domestic law (as opposed to the EU law version).*

1.2.3.1 The Role of the CAA

The CAA is the designated competent authority for all civil aviation matters within the UK. The duties of the CAA are set out in the Civil Aviation Act 1982, as amended. The CAA regulates aviation within the legislative framework as set by the government and overseen by the Department for Transport. This remit of the CAA therefore includes the registration of aircraft, the safety of air navigation and aircraft (including airworthiness), the health of persons on board aircraft, the control of air traffic, the certification of operators of aircraft and the licensing of air crews and aerodromes.

Included within the role of the CAA, and the tasks of the UAS unit, is:

- Carrying out the tasks of the competent authority as defined in Article 18 of the UAS Implementing regulation (UAS IR – see 1.2.3.4).
- The production of policy and guidance
- Issuing operational authorisations for operations
- Issuing safety notices and directives

- Issuing general permissions and exemptions
- Oversight activities for organisations and persons holding authorisations and approvals
- Carrying out enforcement activity in cooperation with the Investigation and Enforcement Team.

It is not the role of the CAA to carry out Research and Development activities; these must be performed by the UAS industry. The research and development process could include consultation with the CAA at appropriate stages so that the CAA can provide guidance on the interpretation of the applicable rules and regulations.

It is strongly recommended that developers of new or novel technology for UAS or support systems set up a programme of discussion and review of their research and development activity with the CAA through the innovation team; early engagement is vital in the process. This will ensure that UAS and system developers will have access to the best advice on the applicable regulations, thereby increasing the likelihood of the ultimate acceptance of any UAS or supporting system by the civil authorities.

UAS and support system designers will need to demonstrate equivalence to the regulatory requirements and standards that are set for manned aircraft.

1.2.3.2 The Basic Regulation

The Basic Regulation (BR), which has the designation '[REGULATION \(EU\) 2018/1139 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL](#)' sets out the common rules for civil aviation within the UK. It makes provision for Implementing Regulations or Delegated Regulations (sometimes referred to as Implementing Acts or Delegated Acts) dealing with subjects such as airworthiness certification, continuing airworthiness, operations, pilot licensing, air traffic management and aerodromes.

Note: *A 'retained version' of the BR has also been made and is applicable from 1 January 2021.*

Neither the BR nor its Implementing Regulations apply to aircraft carrying out military, customs, police, search and rescue, firefighting, coastguard or similar activities or services (which are known as 'State aircraft'). The State of the UK must, however, ensure that such services have due regard as far as practicable to the objectives of the Regulation.

The essential requirements for unmanned aircraft are contained within Annex IX of the BR.

Certain categories of civil aircraft are also exempt from the need to comply with the BR and its Implementing Regulations. These exempt categories are listed in Annex I to the

BR (normally referred to as 'Annex I aircraft') and primarily consist of manned aircraft categories. The exempt categories which are of relevance for UAS are detailed in paragraph 2 of Annex I, and copied below:

- tethered aircraft with no propulsion system, where the maximum length of the tether is 50 m, and where:
 - the MTOM of the aircraft, including its payload, is less than 25 kg, or
 - in the case of a lighter-than-air aircraft, the maximum design volume of the aircraft is less than 40 m³;
- tethered aircraft with a MTOM of no more than 1 kg.

All other UAS are subject to the Basic Regulation and its implementing and delegated regulations as discussed in 1.2.3.3 below.

An aircraft which is not required to comply with the Basic Regulation, either because it is a State aircraft or because it falls within one of the exempt categories, remains subject to separate national regulation, to be found within the Air Navigation Order (ANO).

1.2.3.3 Implementing and Delegated Regulations

Implementing Regulations are regulations that, in effect, put the requirements of the Basic Regulation into practice. The conditions within EU Implementing Regulations are set by the European Commission, but only when agreed (under a vote if necessary) by a committee consisting of representatives from all of the EU countries (for aviation matters, this is called the 'EASA Committee').

- Implementing Regulations for airworthiness certification and continuing airworthiness were the first 'common EU regulations' to be introduced.
- Implementing Regulations for pilot licensing, operations, aerodromes, air traffic management and common rules of the air have more recently become applicable.

Delegated Regulations also put the requirements of the basic regulation into practice, but for non-essential parts of legislation. The key difference is that these regulations can be adopted by the European Commission without the need to first obtain the explicit approval of the representatives of the European countries, (i.e. the EU Member States have *delegated* this task to the EC) although in practice the EC will still seek consensus if at all possible. Delegated Regulations are used in aviation for:

- Regulations that contain technical requirements or standards.
- Regulations relating to Third-countries.

1.2.3.4 The UAS Regulation Package

Specific EU regulations covering UAS operations were published on 11 June 2019 and, like the BR, will be transferred into UK law at the end of the Brexit EU exit transition period. This 'UAS Regulation Package' consists of two separate, but interlinked regulations as follows:

- "Commission Implementing Regulation (EU) 2019/947 on the procedures and rules for the operation of unmanned aircraft".

Note 1: *For simplicity, this is referred to as the 'UAS Implementing Regulation' (UAS IR) within this document*

- "Commission Delegated Regulation (EU) 2019/945 on unmanned aircraft and on third country operators of unmanned aircraft systems".

Note 2: *This is referred to as the 'UAS Delegated Regulation' (UAS DR) within this document*

Both regulations have been amended by the EU since their first publication.

Additionally, as a result of the UK's exit from the European Union, both regulations have been further amended in accordance with the principles described in 1.2.3 above by the "Unmanned aircraft (Amendment) (EU Exit) Regulations 2020"

Consolidated versions of each are published by the CAA as [CAP 1789A](#) (UAS IR) and [CAP 1789B](#) (UAS DR).

1.2.3.4.1 Applicability

The UAS DR became applicable on 1 July 2019.

The UAS IR is applicable throughout the EU and the UK from 31 December 2020.

These regulations do not apply to operations that are conducted indoors.

1.2.4 The Air Navigation Order 2016

The main civil requirements for UK aviation are set out in the ANO.

The provisions in the ANO concerning equipment requirements, operational rules, personnel licensing, aerodrome regulation and regulation of air traffic services apply to all non-military aircraft, organisations, individuals and facilities.

With regard to UAS operations, the ANO provides additional regulatory content that is

either:

- not covered by the IR and DR – for example, endangerment regulations and legal penalties for breaches of these regulations; or
- in support of a more general requirement stated within the IR or DR – for example, airspace restrictions around aerodromes and other ‘protected’ locations.

ANO 2016 article 240 applies to all persons and stipulates that a person must not recklessly or negligently act in a manner likely to endanger an aircraft or a person within an aircraft.

ANO 2016 article 241 applies to all operating categories and stipulates that a person must not recklessly or negligently cause or permit an aircraft (manned or unmanned) to endanger any person or property (which includes other aircraft and their occupants).

If the CAA believes that danger may be caused by the flight of any aircraft (including unmanned aircraft), then the CAA may direct that the aircraft must not be flown (ANO 2016 article 257 - CAA’s power to prevent aircraft flying).

1.2.4.1 UAS related articles within the ANO

The Department for Transport intends to amend the ANO so that it reflects the applicability of the new UAS regulations.

Guidance on the amendment will be published in a separate CAP and will be subsequently incorporated into this document.

Note: *If the ANO and the new UAS regulations overlap, the ‘supremacy principle’ will apply. This means that the new UAS regulations or the Basic Regulation will always take precedence over the ANO.*

1.2.5 Civil and Military regulations

In the United Kingdom, there are two regulatory regimes: civil and military. Military requirements are a matter for the Ministry of Defence. A military aircraft for this purpose includes any aircraft which the Secretary of State for Defence has issued a certificate stating that it must be treated as a military aircraft.

Any aircraft that is not a military aircraft must, under United Kingdom aviation safety legislation, comply with civil requirements. There is no special provision for other types of non-military State aircraft such as those carrying out police, search and rescue, firefighting, coastguard or similar activities or services.

1.3 Privacy and Security - Images and other Data Collection Requirements

The provision of images or other data solely for the use of controlling or monitoring the aircraft is not considered to be applicable to the meaning of ‘a *sensor able to capture personal data*’ in relation to the registration of UAS operators within Article 14 (5)(a) ii of the IR.

UAS operators and remote pilots should be aware that the collection of images of identifiable individuals, even inadvertently, when using surveillance cameras mounted on an unmanned aircraft, may be subject to the General Data Protection Regulation and the Data Protection Act 2018. Further information about these regulations and the circumstances in which they apply can be obtained from the Information Commissioner’s Office and website: <https://ico.org.uk/for-the-public/drones/>.

UAS operators must be aware of their responsibilities regarding operations from private land and any requirements to obtain the appropriate permission before operating from a particular site. They must ensure that they observe the relevant trespass laws and do not unwittingly commit a trespass whilst conducting a flight.

1.4 Insurance

It is the responsibility of every UAS operator to ensure they have appropriate insurance coverage. This is a condition of each operational authorisation that is issued by the CAA.

[Regulation \(EC\) 785/2004](#), which came into force on 30 April 2005, requires most operators of aircraft, irrespective of the purposes for which they fly, to hold adequate levels of insurance in order to meet their liabilities in the event of an accident. This EC Regulation specifies, amongst other things, the minimum levels of third-party accident and war risk insurance for aircraft operating into, over or within the EU (including UAS) depending on their Maximum Take-Off Mass (MTOM). Details of the insurance requirements can be found on the CAA website³ under “Mandatory Insurance Requirements”.

UK legislation which details insurance requirements is set out in Civil Aviation (Insurance) Regulations 2005⁴.

Article 2(b) of EC 785/2004 states that the regulation does not apply to ‘model aircraft with an MTOM of less than 20kg’, but the term ‘model aircraft’ is not defined within the regulation itself. Therefore, for the purposes of interpretation within the insurance regulation only, its use of the term ‘model aircraft’ should be taken to mean:

“Any unmanned aircraft which is being used for sport or recreational purposes only”.

Note: For all other purposes, the definition of model aircraft is as set out within CAP 722D.

For all other types of unmanned aircraft operation, whether commercial or non-commercial, appropriate cover that meets the requirements of EC 785/2004 is required.

³ <http://www.caa.co.uk/default.aspx?catid=122&pagetype=90&pageid=4510>

⁴ <http://www.opsi.gov.uk/si/si2005/20051089.htm>

1.5 Registration

The registration requirements for civil UAS are contained within Regulation (EU) 2018/1139 (the EASA Basic Regulation) and in the UAS IR; they are in line with the requirements of ICAO Annex 7.

The registration requirements for unmanned aircraft differ from those required for other aircraft in that they are dependent on the category of UAS operation (see 2.2 below).

The following basic principles apply:

- UAS operated within the Certified category (i.e. the design is subject to certification) – each individual UA must be registered. Further details are provided in Annex C.
- UAS operated within the Open or Specific categories – the UAS operator must be registered. Further details, including the specific circumstances where registration is required, are provided in Annexes A and B.

1.6 Enforcement

The CAA takes breaches of aviation legislation seriously and will seek to prosecute in cases where dangerous and illegal flying has taken place.

The CAA's enforcement strategy is designed to reflect the balance of capabilities between the CAA and local Police services.

The Police often have greater resources, response times and powers of investigation than the CAA. To support this, the CAA has agreed with the Police, in a signed Memorandum of Understanding that the Police will take the lead in dealing with UAS misuse incidents, particularly at public events, that may contravene aviation safety legislation or other relevant criminal legislation. Please report any misuse of UAS to your local Police force.

The CAA's remit is limited to safety and also to investigate where someone is operating, or has operated, in a manner that is not in accordance with their operational authorisation. This does not include concerns over privacy or broadcast rights.

Breaches of Aviation Regulation legislation must be reported directly to:

Investigation and Enforcement Team
Civil Aviation Authority
Aviation House
Beehive Ring Road
Crawley
West Sussex
RH6 0YR

E-mail: jetmailbox@caa.co.uk

Privacy issues are covered by the Information Commissioners Office (ICO) and will not be dealt with by the CAA.

If you have any concerns about UAS being used in your area, either from a safety or privacy perspective, contact your local police on 101.

CAA Enforcement guidance can be found here [Enforcement-and-prosecutions](#).

CHAPTER 2 | Operational Guidance

2 Operational Guidance

2.1 Operating Principles

2.1.1 Visual line of sight operations (VLOS)

Operating within Visual Line of Sight (VLOS) means that the remote pilot must be able to clearly see the unmanned aircraft and the surrounding airspace at all times while it is airborne. The key requirement of any flight is to avoid collisions and a VLOS operation ensures that the remote pilot is able to monitor the aircraft's flight path and so manoeuvre it clear of anything that it might collide with. While corrective lenses may be used, the use of binoculars, telescopes, or any other forms of image enhancing devices are not permitted. Putting things in very simple terms, when operating VLOS, the aircraft must not be flown out of sight of the remote pilot's eyes.

The CAA will normally accept that the VLOS requirement is met when the UA is flown out to a distance of 500 metres horizontally from the remote pilot, but only if the aircraft can still be seen at this distance.

The 'operating height' is limited to a maximum distance of 400 feet (120 metres) from the closest point of the earth's surface (see para 2.1.1.1 below). Operations at a greater distance from the remote pilot may be permitted if an acceptable safety case is submitted. For example, if the aircraft is large it may be justifiable that its flight path can be monitored visually at a greater distance than 500 metres. Conversely, for some small aircraft, operations out to a distance of 500 metres may mean it is not possible to assure or maintain adequate visual contact, and so the aircraft must obviously be kept closer to the remote pilot.

2.1.1.1 VLOS Operating Heights

Visual Line of Sight operations are normally limited to a maximum distance of 400 feet (120 metres) from the closest point of the surface of the earth, unless when overflying certain obstacles (see Annex A paragraph A1.1.3). However, there is scope for the CAA to authorise flight at greater heights, via an operational authorisation (see Annex B), if the CAA is satisfied that this can be achieved safely. Operations above 400 feet may also be permitted within a protected aerodrome's flight restriction zone (FRZ – see 2.5.1), under the procedures detailed in 2.5.1, without the need to seek prior authorisation from the CAA.

This height limitation is intended to contribute to the safety of manned aircraft from the risk of collision with an unmanned aircraft. With the obvious exception of take-off and landing, the majority of manned aircraft fly at heights greater than 500 ft (150 m) from the surface. While there are some other exceptions where manned aircraft fly at 'low level' (such as Police, Air Ambulance and Search and Rescue helicopters, as well as military aircraft), flying an unmanned aircraft below 400 ft (120 m) significantly reduces the likelihood of an encounter with a manned aircraft.

In aviation terms, 'height' means the vertical distance of an object (in this case the unmanned aircraft) from a specified point or datum (in this case above the surface of the earth). To cater for the few occasions where an unmanned aircraft is being flown over hilly/undulating terrain or close to a cliff edge, the regulations specify a requirement to remain within a 400 feet (120 m) distance from the surface of the earth, as shown in Figure 1 below.

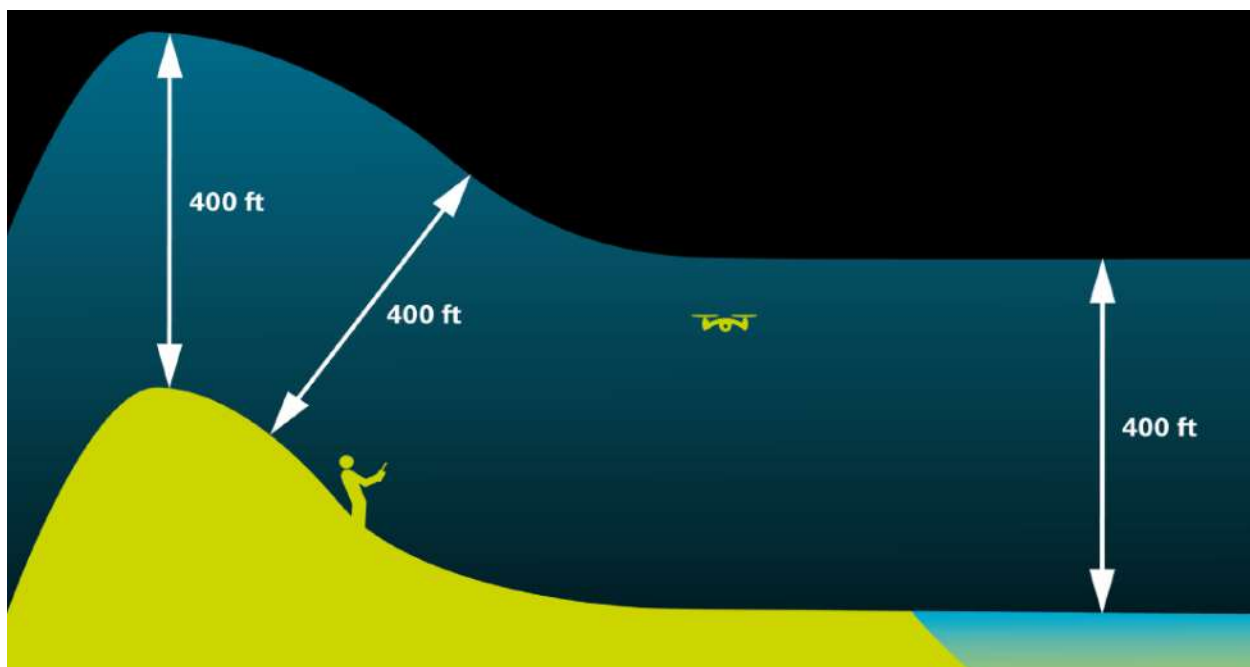


Figure 1 – 400ft (120m) separation from surface of the earth

It must be noted that the 400 ft (120 m) limitation applies to 'heights above/distances from' the surface of the earth. It does not automatically apply to heights/distances from tall buildings or other structures unless covered by Annex A paragraph A1.1.3.

2.1.1.2 VLOS operations at night

There are no specific prohibitions to VLOS operations during night time. The basic VLOS principles still apply (i.e. you must be able to see the aircraft and the surrounding airspace).

Any applications for operational authorisations which include VLOS flight at night will be

expected to include a 'night operations' section within the operations manual which details the operating procedures to be followed and should include items such as:

- daylight reconnaissance and site safety assessment of the surrounding area;
- identification and recording of any hazards, restrictions and obstacles;
- illumination of the launch site;
- aircraft lighting/illumination requirements;
- weather limitations for operation.

2.1.1.3 Avoidance of other aircraft

Remote pilots flying under VLOS should always approach their task with the mindset that they will be the ones that will need to 'make the first move' when avoiding other airspace users; invariably, they will be the first to recognise (i.e. 'see' or more likely 'hear') the potential conflict.

The small size and structure of most 'VLOS operated' UA, particularly the multi-rotor models, means that they are unlikely to be clearly visible to pilots of manned aircraft until at a much closer distance than would normally be the case when looking at another manned aircraft. This is particularly the case when the UA is hovering or moving slowly. Visually observing a small unmanned aircraft from another aircraft is likely to be a 'late sighting' with reduced time to alter course and avoid collision.

This is particularly relevant when operating near areas such as the London helicopter routes, due to the higher density of low-level traffic; remote pilots should fly their aircraft no higher than strictly necessary for the operation. Due to their small size and ability to operate out of small sites in towns and cities, the smaller types of unmanned aircraft are particularly difficult to see against an urban backdrop when compared to the relatively much larger size of a manned aircraft.

Many unlicensed helicopter landing sites also exist, including hospital helipads, as well as numerous Police helicopter and air ambulance flights. Such aircraft may loiter at low-level or land and take off unexpectedly. All of these types of helicopter operations may therefore be affected by VLOS operations particularly when approaching to land or departing from a site; UAS operators and remote pilots must take active precautionary measures to avoid affecting the safety of other airspace users. Such measures should involve keeping sufficiently clear to avoid any avoiding action being necessary by either party, or any distraction or change in mission to the other party (e.g. aborting an air ambulance landing due to a UAS sighting).

It should also be noted that the UAS IR specifically requires remote pilots operating in the Open and Specific categories to "avoid any risk of collision with any manned aircraft

and discontinue a flight when continuing it may pose a risk to other aircraft, people, animals, environment or property” [UAS.OPEN.060(2)(b) and UAS.SPEC.060(3)(b)]. In practical terms, unmanned aircraft operated under VLOS could present a particular hazard when operating near any aerodrome or other landing site due to the presence of manned aircraft taking off and landing.

A NOTAM is generally not required to be issued for VLOS operations due to the typically small scale, duration and operating limitations of VLOS flights. The potential need for NOTAM action must, however, form part of the operator’s risk assessment process, particularly above 400ft (120m), outside of controlled airspace or when several unmanned aircraft will be operating together.

2.1.2 Beyond visual line of sight operations (BVLOS)

Operation of an unmanned aircraft beyond a distance where the remote pilot is able to respond to or avoid other airspace users by direct visual means (i.e. the remote pilot’s observation of the unmanned aircraft) is considered to be a BVLOS operation.

Unmanned aircraft intended for BVLOS operations will require either:

- A technical capability which has been accepted as being at least equivalent to the ability of a pilot of a manned aircraft to ‘see and avoid’ potential conflicts. This is referred to as a Detect and Avoid (DAA) capability. Further details regarding DAA can be found at 3.6;

Note: Any DAA capability would be expected to ensure compliance with Regulation (EU) 923/2012 the Standardised European Rules of the Air (SERA) chapter 2 (avoidance of collisions), as adjusted by Rule 8 of the Rules of the Air Regulations 2015 (Rules for avoiding aerial collisions);

- A block of airspace to operate in which the unmanned aircraft is ‘segregated’ from other aircraft - because other aircraft are not permitted to enter this airspace block, the unmanned aircraft can operate without the risk of collision, or the need for other collision avoidance capabilities; or
- Clear evidence that the intended operation will pose ‘no aviation threat’ and that the safety of persons and objects on the ground has been properly addressed.

Note: The ultimate responsibility for avoiding collisions lies with the remote pilot, irrespective of the flight rules that the flight is being conducted under, or any ATC clearances that may have been issued.

2.1.2.1 BVLOS operations utilising visual observation (Extended Visual Line of Sight - EVLOS)

In some cases, the requirement for the remote pilot to maintain direct visual contact with the unmanned aircraft can be addressed via other non-technical 'visual observation' methods or procedures while still achieving the key responsibilities of avoiding collisions.

Although technically these are BVLOS operations (because the remote pilot cannot actually see the unmanned aircraft), they are more often referred to as 'Extended Visual Line of Sight' or EVLOS. It is important to note, however, that collision avoidance is still achieved through the 'unaided visual observation' of a human, either through the use of additional observers and/or visually 'scanning' a block of airspace for conflicts.

With the exception of one particular case in the Open category (see Annex A, A1.1.1), EVLOS operations may only be conducted within the Specific category (see 2.2 below) under the terms of an operational authorisation issued by the CAA and based on a risk assessment. Factors taken into consideration must include:

- the procedures for avoiding collisions;
- the size of the unmanned aircraft being used;
- the colour of and markings on the unmanned aircraft;
- any additional aids to observation;
- meteorological conditions and visibility, including background conditions (cloud / blue sky);
- the use of deployed observers, including suitable communication methods within the team; and
- operating range limits - suitable radio equipment must be fitted in order to be able to effect positive control over the UA at all times.

2.1.3 Protection of Third Parties

While the primary focus of the UAS Regulations is on the protection of persons, UAS operators and remote pilots must also bear in mind their responsibilities towards vehicles, vessels and structures while flying, even if they are unoccupied.

Under ANO 2016 article 241, '*no person may recklessly or negligently cause or permit an aircraft to endanger any person or property*'. This article does, of course, also apply to the endangerment of manned aircraft with an unmanned aircraft (because manned aircraft are 'property') and the occupants of manned aircraft (because they are still 'persons').

Similarly, ANO 2016 article 240 requires that '*a person must not recklessly or negligently act in a manner likely to endanger an aircraft, or any person in an aircraft*'. Although this

article does not apply to ‘small unmanned aircraft’ (see the exception in article 23 – ie. a small unmanned aircraft cannot be ‘endangered’), its requirements still apply to UAS operators and remote pilots.

Key points to note when considering the safety of third parties:

- Fly defensively and with the expectation that control of the UA could be lost without notice
- Reduce the harmful characteristics of the small unmanned aircraft to people
 - Minimise the UA’s mass wherever possible or use a smaller/lighter UA
 - Use a UA with design features that reduce harm
 - Do not fly at excessive speeds when close to people
- Check that the UA is in a safe condition to fly
- Consider the environmental factors that may aggravate the potential for loss of control or loss of propulsion
- Consider the use of additional operating personnel to warn uninvolved people immediately following any loss of control or propulsion
- Make use of any available technology or safety features which may reduce the risk of harm if control is lost

2.1.3.1 Uninvolved Persons

The primary focus for UAS operations is the protection of people that are not a part of the flying operation (i.e. third parties). Within the UAS regulations, they are referred to as ‘uninvolved persons’.

An uninvolved person is a person that does not take part in the UAS operation, either directly or indirectly, such as:

- Spectators or any other people gathered for sport activities or other mass public events for which the UAS operation is not the primary focus;
- People sitting at a beach or in a park or walking on a street or on a road.

A person may be considered to be ‘involved’ in a UAS operation if they:

- are solely present for the purpose of participating in the flight operation; or
- have given explicit consent to the UAS operator or to the remote pilot to be part of the UAS operation (even indirectly as a spectator or just accepting to be overflown by the UAS); and

- have received from the UAS operator or from the remote pilot clear instructions and safety precautions to follow in case the UAS exhibits any unplanned behaviour. Such persons could include building-site or other industrial workers, film and TV production staff and any other pre-briefed, nominated individuals with an essential task to perform in relation to the event.

In principle, this means that an involved person must:

- be able to decide whether or not to participate in the UAS operation;
- broadly understand the risks involved;
- have reasonable safeguards introduced for them, introduced by the site manager, the UAS operator or the remote pilot during any UAS operation; and
- be expected to follow the directions and safety precautions provided.

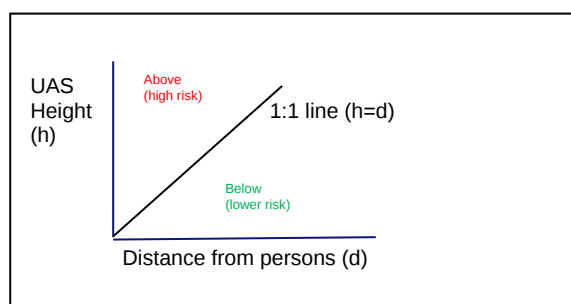
The UAS operator or remote pilot should check by asking simple questions to make sure that the directions and safety precautions have been properly understood.

Persons should not be restricted from taking part in the event or activity if they decide not to participate in the UAS operation.

Note: When filming with a UAS at a large music festival or public event, it is not sufficient to inform the audience, or anyone present via a public address system, or via a statement on the ticket, or in advance by email or text message. Those types of communication channels do not satisfy the points above. In order to be considered an 'involved person', each person should be asked for their permission and be made aware of the possible risk(s).

2.1.3.1.1 The 1:1 rule

The '1:1 rule' is a simple principle (as opposed to an exact rule in law) which can be used to quickly work out what separation from uninvolved persons is safe enough in the short term. It is based on the relationship between the unmanned aircraft's height and its distance from the uninvolved person (the 1:1 line) and works as follows:



- A2 subcategory – (for C2 aircraft only)

When operating in 'low-speed' mode within 30m of uninvolved persons, remote pilots should aim to maintain a horizontal separation distance that is greater than, or equal to, the aircraft's height, using the same units of measurement. (i.e. if the aircraft is at 10m height, it should be kept at least 10m horizontally away from uninvolved people.

Operations where the aircraft's height is greater than the separation distance (i.e. above the 1:1 line) should be avoided or kept to the absolute minimum time necessary, due to the increased risk.

- A3 subcategory

The 1:1 rule is a short-term separation measure aimed at dealing with unexpected issues, such as a person that is approaching or has entered the area of flight.

If the UA is above the 1:1 line (i.e. closer to the person than its height), then it must be moved further away quickly, or its height reduced, until below the 1:1 line.

If/when the UA is below the 1:1 line, then the remote pilot can continue to monitor the situation until the person has vacated the operating area.

Note: *the separation from any uninvolved person must not be reduced below 50m horizontally at any time.*

2.1.3.2 Vehicles, vessels and structures

The regulations are focussed on the safety of uninvolved persons and so there are no specific minimum distances set down for separation from 'vehicles, vessels and structures'.

However, this does not imply that there are no limits to consider at all. In many cases, vehicles, vessels and structures will still have persons inside them who need to be protected. There are two important points to consider:

- The current 'endangerment' regulation in the Air Navigation Order (article 241), still applies, and so it is an offence to 'endanger' such property with an unmanned aircraft;
- The prescribed separation distances from uninvolved persons still apply to persons that are occupants of any vehicle, vessel or structure. Therefore, the relevant limitations for separating from persons must still be applied, unless the remote pilot can be certain that they are either:
 - unoccupied, or;

- in the case of structures, the remote pilot can be certain that the occupants will still be protected.

Additionally, the overall security and privacy situation must also be considered. There may be buildings in the area where it would be inadvisable, from a security or privacy standpoint, to be flying close to without first obtaining permission to do so.

2.1.3.3 Congested areas

As part of the aim to protect uninvolved persons, flights within areas that are used for residential, commercial, industrial or recreational purposes (i.e. areas that are densely populated or likely to be occupied by large numbers of persons) have additional operational limitations placed on them.

UAS flights within these 'congested' areas may only be undertaken:

- by UA that are deemed to be small enough to not present a hazard;
- by UA that have been built to specific product safety standards;

Note: in both of the cases above, additional remote pilot competency requirements may also be required.

or,

- if authorised by the CAA.

2.1.3.4 Assemblies of people

Assemblies of people have been defined by an objective criterion related to the possibility for an individual to move around in order to limit the consequences of an unmanned aircraft that has become out-of-control.

There are no strict numbers defined above which a 'group of people' would turn into an 'assembly' of people as different situations would result in different conclusions. An assembly must be evaluated qualitatively, based on the ability of people within that group to 'escape' from any risk posed by the UAS operation.

Qualitative examples of assemblies of people are:

- sporting, cultural, religious or political events;
- beaches or parks on a sunny day;
- commercial streets during the opening hours of the shops;
- ski resorts/tracks/lanes;

- music festivals and concerts;
- marches and rallies;
- parties, carnivals and fêtes.

2.1.4 Tethered UAS operations

A tethered UAS operation is one where the unmanned aircraft remains securely attached (tethered) via a physical link to a person, the ground or an object at all times while it is flying. The tether normally takes the form of a flexible wire or a cable and may also include the power supply to the aircraft as well.

Operations with a tethered UAS can be used as an efficient solution in a number of cases, for example where an operating area is restricted, or when the required flight time exceeds the normal endurance of a free flying battery powered aircraft.

Tethered UAS that are powered and have a mass greater than 1kg are subject to the same basic operating regulations as all other unmanned aircraft and, where necessary, the same operational authorisation process. But the fact that the operation is tethered can be used as a significant mitigation factor when applying for an operating authorisation, thus greatly simplifying the overall process.

Tethered UAS with a mass of 1kg or less are not subject to the requirements within the UAS IR, but will instead be addressed within the forthcoming amendment to ANO 2016 (see 1.2.4.1).

2.1.5 Swarming UAS operations

Guidance regarding VLOS rotary wing UAS swarming operations can be found within [CAP 722E](#).

2.2 Categories of operation

UAS operations are regulated in a manner that is proportionate to the level of risk that the individual operation presents. This 'risk and operation centric' approach means that each operation will fall into one of three operating categories as described in 2.2.1, 2.2.2 and 2.2.3 below.

2.2.1 Open category

The Open category covers operations that present a low risk to third parties. Operations within this category are conducted within a set of basic and pre-defined limitations and do not require any further authorisation by the CAA.

The overall concept of the Open category is that it should be simple and straightforward for the user to understand.

2.2.1.1 Operational boundaries

Open category operations are bounded by three main factors:

- the maximum take-off mass/flying weight of the unmanned aircraft must be less than 25kg;
- the unmanned aircraft must be operated within VLOS (unless operating in accordance with the procedure described at A1.1.1); and
- the unmanned aircraft must not be flown further than 400 feet (120 metres) from the closest point of the surface of the earth (unless operating in accordance with the procedure described at A1.1.3);

All three of these factors must apply for an Open category operation. If not, then the operation must be conducted under the requirements of the Specific category (see 2.2.2) instead.

2.2.1.2 Open category subcategories

The Open category is then further divided down into three operational 'subcategories', primarily based on the proximity of the unmanned aircraft to uninvolved persons while in flight, as follows:

- **A1 (fly 'over' people)** – Operations in subcategory A1 can only be conducted

with unmanned aircraft that present a very low risk of harm or injury to other people due to their low weight, or their type of construction, or because they are a 'toy' (i.e. they are 'inherently harmless'). But for privacy and security reasons, flight over assemblies of people is not permitted.

Note: For a transition period until 31 December 2022, some 'legacy' unmanned aircraft with a mass that is less than 500g may also be used in subcategory A1, provided that the remote pilot has successfully completed an additional competency examination (the A2 CofC as described in 4.2.3.1.2) in order to mitigate the increased risk.

- **A2 (Fly 'close to' people)** – Operations in subcategory A2 can only be conducted with some very particular types of unmanned aircraft. These types must be compliant with a particular product safety standard which allows use in the A2 subcategory (see 2.3.1.3 below), although a transition period also permits the restricted use of some other types (see Note). Flights can be conducted to a minimum safe horizontal distance of 30 metres from uninvolved persons, and this can be further reduced to 5 metres horizontally when the system's 'low-speed mode' is selected. In addition, the remote pilot must have successfully completed an additional competency examination (the A2 CofC as described in 4.2.3.1.2) in order to operate in this subcategory.

Note: For a transition period until 31 December 2022, some 'legacy' unmanned aircraft with a mass that is less than 2kg may also be used in subcategory A2, but they cannot be flown within a horizontal distance of 50 metres from uninvolved persons. The remote pilot must also have successfully completed the same A2 CofC examination.

- **A3 (Fly 'far from' people)** – This category covers the more general types of unmanned aircraft operations. The unmanned aircraft may only be flown in areas that are completely clear of uninvolved persons and may not be flown within 150 metres horizontally of areas that are used for residential, commercial, industrial or recreational purposes.

2.2.1.3 Open category product standards

A key element of the Open category is that any unmanned aircraft that are sold for use within this category will also be subject to a set of product standards. The overall concept is similar to the safety marking schemes that are used for items such as electrical products etc.

In order to achieve this standardisation, unmanned aircraft that are intended to be sold within the UK (often also referred to as the 'market') have been subdivided into 5 'classes'. These classes, which are labelled from 'C0' to 'C4' provide a link to the

operational subcategories as follows:

- Class **C0** - may be flown in all subcategories.
- Class **C1** - may be flown in all subcategories.
- Class **C2** - may only be flown in subcategories A2 or A3.
- Class **C3** - may be flown in subcategory A3 only.
- Class **C4** – may be flown in subcategory A3 only.

The specific descriptions of each Class of unmanned aircraft are listed at 3.1. UAS products 'placed on the market' (i.e. sold to the general public for the first time) for use in the Open category on or after 1 January 2023 must be compliant with one of the above 'UAS Classes'. Manufacturers may, however, place UAS products on the market with a UAS Class marking in advance of this date.

The product standards cover a range of topics including mass, build quality/type of construction, maximum speed, noise limits, remote identification and geoawareness functions, provision of user manuals, plus a host of other elements. The standards are intended to ensure that the UAS product is safe, provided that it is used within the boundaries of the appropriate subcategory.

It is most important to note that an unmanned aircraft product can only be allocated within a UAS Class if it has been manufactured to the relevant product standard, independently assessed as being compliant, and visibly labelled as such.

UAS that are not allocated within a UAS Class, either because they are 'home built' or were placed on the market prior to 1 January 2023 without a Class marking, may continue to be operated indefinitely, but only within certain strict provisions, some of which are only applicable for a 'transitional period'. Full details of these provisions are contained in Annex A, within Sections A2.1, A2.2 and A2.3 (as appropriate for each subcategory).

2.2.1.4 Open category – interpretation of 'Mass'/'Weight'

Although the UAS Regulations make reference to 'maximum take-off mass' (MTOM) throughout, as defined in Article 2 of the UAS IR, this term creates some confusion when referring to 'home built' or other 'legacy' unmanned aircraft where an MTOM has not been defined by the manufacturer. The term 'take-off mass' is also used when referring to legacy aircraft, but only within one article (Article 22 – transitional arrangements) and the term is not specifically defined.

To clarify the situation the UK interprets these terms within the Open category only as follows:

- Unmanned aircraft marked with a Class marking (C0 to C4) – MTOM will continue to be used as defined
- Unmanned aircraft without a Class marking – any reference to MTOM or ‘take-off mass’ should be taken to mean the weight of the unmanned aircraft at the point of take-off for that particular flight (which is referred to as the ‘flying weight’)

2.2.2 Specific category

The Specific category covers operations that present a greater risk than that of the Open category, or where one or more elements of the operation fall outside the boundaries of the Open category.

The key element of the Specific category is that the UAS operator is required to hold an operational authorisation, which has been issued by the CAA.

This operational authorisation will be based on the CAA’s evaluation of a safety risk assessment that has been produced by the UAS operator or, in some circumstances, has been ‘pre-defined’ and published by the CAA.

The operational authorisation document sets out the privileges and limits of the operation. Given the name of the category, each operational authorisation is specific to the named UAS operator and is dependent on the risk assessment and evidence supplied to the CAA by that operator.

Further details are provided at 2.3 below.

2.2.2.1 Specific category – use of certified UA or certified equipment

Certified UA and/or certified equipment may be used for Specific category operations as a means of risk reduction or as a mitigating measure in the risk assessment.

The use of certified UA or equipment does not mean that the whole flight operation is then transferred to the Certified category, but if the certification of those products is relied upon within the risk assessment, then all aspects/conditions related to that certification (such as routine maintenance, scheduled servicing and the qualifications of the organisations and personnel carrying out those duties) must also be complied with.

‘Certified equipment’ is considered to be any aircraft installed equipment for which the relevant approved organisation has demonstrated compliance against a recognised technical standard and performance requirement, and has received a form of certification from a recognised competent aviation authority that attests such compliance (e.g. a European Technical Standard Order (ETSO) approval).

2.2.3 Certified category

The Certified category covers operations that present an equivalent risk to that of manned aviation; because of this they are be subjected to the same regulatory regime (i.e. certification of the unmanned aircraft, certification of the UAS operator, licensing of the remote pilot).

UK regulations relating to the Certified category are still being developed and are not yet published. Until unique UAS regulations are available, the principles set out in the relevant manned aviation regulations for airworthiness, operations and licensing will be used as the basis for regulating the certified category.

2.2.3.1 Boundary with the Specific category

UAS operations in the 'certified' category include operations with a high risk.

Being dependent on the safety risk assessment process, and the nature and risk of the type of operation concerned, the boundary between 'specific' and 'certified' category cannot be expressed purely in terms of mass of the UA.

The combined effect of Article 6 of the UAS IR and Article 40 of the UAS DR is that UAS operations must be conducted in the 'certified' category when they:

- Involve a UA with a characteristic dimension of 3m or more being flown over assemblies of people; or,
- involve the transport of people; or,
- involve the carriage of dangerous goods, that may result in high risk for third parties in case of accident.

Additionally, the CAA may determine that an operation, originally proposed for the specific category, must instead be conducted in the certified category. This would be the case when, having considered the risk assessment provided by the UAS operator, the CAA considers that the risk of the operation cannot be adequately mitigated without:

- the design, production and maintenance of the UAS being certified; and
- the UAS operator being certified; and,
- the remote pilot being licensed (unless the UAS is autonomous)

2.3 Authorisation

The term 'authorisation' means official permission for something to happen, or the act of giving someone official permission to do something. Within aviation, and for the purposes of this document, this generally means any 'official permission' given by the CAA.

For UAS matters, the authorisation requirements are largely driven by the operating category as follows:

- Open category – No authorisation required. The limitations of the category are set out in the regulations and cannot be changed.
- Specific category – An 'operational authorisation' is required to be held by the UAS operator and the conditions set out in the authorisation document.
- Certified category – Authorisation is provided through the provision of certification (of the aircraft and the UAS operator) and licencing (for the remote pilot) and compliance with the related conditions and/or specifications.

2.3.1 Operational Authorisation

For the Specific category, the operational authorisation document is the key element. Specific category operations must not be carried out unless the UAS operator is in possession of a valid operational authorisation and the conditions of the authorisation are followed by the UAS operator, plus any associated remote pilots.

In order to obtain an operational authorisation, the UAS operator must first conduct a risk assessment of the proposed operation and submit this as part of the application. Essentially, the aim of the risk assessment, along with the associated operations manuals, is to:

- outline the proposed operation ('what' the operator wants to do);
- describe the operational process that will be used ('how' the operator will do it);
- describe the technical aspects of the UAS to be used ('what' the operator will do it with);
- and then demonstrate that it can be done safely (provide a risk assessment/safety case).

Details on how to make an application for an operational authorisation can be found on the CAA's UAS webpages www.caa.co.uk/uas.

Operational authorisation holders are subject to regulatory oversight by the CAA; further details are provided at 4.1.3.

Note: An operational authorisation issued by the CAA only addresses the flight safety aspects of the UAS operation in the UK and does not constitute permission to disregard the legitimate interests of other statutory bodies such as the Police and Emergency Services, Highways England, Data Commission, Ofcom or local authorities.

2.3.1.1 Risk Assessments

The authorisation process (and thus the authorisation requirements) aims to ensure that the public and other airspace users are not exposed to unacceptable risk introduced by UAS operations.

Each application for an operational authorisation (other than one based on a PDRA) must be accompanied by a risk assessment.

Further guidance on the preparation and submission of risk assessments is provided in [CAP 722A](#).

2.3.2 Pre-defined Risk Assessments (PDRA)

A PDRA is a shortened set of prescriptive conditions that must be complied with by a UAS operator in order to conduct a pre-determined type of operation.

In these cases, the CAA conducts the risk assessment, rather than each individual operator, and then publishes a short series of requirements (covering topics such as remote pilot competency, ops manual contents etc) that the UAS operator must provide to the CAA as part of a 'shortened' application for an operational authorisation. This is a prescriptive set of instructions that must be followed, leading to a 'known' operation with a known and understood risk, that must be authorised on the basis of following the set of instructions. Much like following a cake recipe exactly, the intention is to produce an identical cake every time; and an identical safety risk is presented by the operation.

This type of approach would apply to operations that would most likely be conducted by a large number of operators (i.e. it is a pre-defined scenario), but the safety mitigations are relatively simple.

Individual PDRAs are listed in Annex B at B1.3.

Note: The UAS operator must still apply to the CAA for an operational authorisation in order to fly under the terms of a PDRA.

2.3.3 Standard Scenarios (STS)

Reserved for future use.

Note: *The concept of ‘standard scenarios’ is omitted in the retained version of the UAS IR and therefore will not be used in the UK for the foreseeable future.*

2.3.4 The Light UAS Certificate (LUC)

The UAS IR makes provision for an optional light UAS operator certificate (LUC) scheme, which allows the CAA to issue privileges to UAS operators, including the possibility of authorising certain elements of their own operations. This is essentially an ‘augmented operational authorisation’ but requires a significant additional investment from the operator’s side, particularly regarding the safety management aspects.

Note: *As there is some significant potential for misunderstanding of the LUC’s purpose, UAS operators considering the LUC should first contact the CAA in order to discuss their options and the next steps before making an application.*

Additional guidance can also be found in Annex D, section D2C.

2.4 Airspace

This section outlines the operating principles associated with UAS flights both in segregated and non-segregated airspace within the UK.

2.4.1 Basic Principles

UK aviation legislation is designed to enable the safe and efficient operation of all aircraft in all classes of airspace. UAS operators must work within this same regulatory framework.

The table below sets out the basic airspace requirements for UAS.

	Controlled Airspace (Class A-E)	Danger, Restricted, Prohibited Areas (EG D, EG R, EG RU, EG P)	Aerodrome Flight Restriction Zones
Open Category Operations	Not Applicable <i>Accommodated through the operating limitations of the Open category</i>	Applicable <i>These are usually applicable to all aircraft, including unmanned aircraft. Full details for restricted and prohibited areas can be found within the SI that sets out the airspace restriction. Some areas are only applicable to unmanned aircraft.</i>	Applicable
Specific Category Operations	As set out within the Operational Authorisation <i>Controlled airspace requirements are generally not applied to VLOS UAS operations with a mass less than 25Kg, but may be applied to some operations. All airspace restrictions (Danger, Restricted and Prohibited areas, and FRZs) are applicable.</i>		
Certified category Operations	The same requirements that relate to manned aircraft are applicable		

Table 1 – Basic airspace requirements as applied to individual operating category

In order to integrate with other airspace users, UAS operators must ensure that their operation does not pose any additional risk to other airspace users. A UA must not be

flown if the appropriate safety provisions cannot be made or if such operations would have an unreasonably negative impact on other airspace users.

VLOS flights can be accommodated relatively easily in most situations, but BVLOS operations require much greater attention in relation to airspace access.

Unless special provision is made with the Air Traffic Service Unit (ATSU) handling the UAS activity, the provision of an Air Traffic Service (ATS) to an unmanned aircraft must be transparent to the controller. In other words, the controller must not have to do anything different using radiotelephony or landlines than he or she would for other aircraft under his or her control, nor must the controller have to apply different rules or work to different criteria. The following points are of note:

- Remote pilots must be able to comply with instructions from the ATS provider and with equipment requirements applicable to the class of airspace within which they intend to operate. ATS instructions must also be complied with in a timescale comparable with that of a manned aircraft.
- All UAS callsigns must include the word "UNMANNED", on first contact with the ATS provider, to ensure that air traffic controllers are fully aware that they are dealing with a UAS flight.

If “special provisions” are made with the associated ATSU, it is essential that these do not reduce the situational awareness of other airspace users.

2.4.2 UAS Operations in Non-Segregated Airspace

For BVLOS flights that are conducted in airspace that is not segregated, the aircraft's performance and all communications with the ATS provider must be continuously monitored by its remote pilot. In order to comply with ATS instructions in a timescale comparable with that of a manned aircraft, it is imperative that the remote pilot is always capable of immediately taking active control of the UA.

Special equipment (e.g. Secondary Surveillance Radar (SSR) Transponder) mandated for manned aircraft in certain classifications of airspace must also be considered a minimum requirement for UAS intending to fly in the same airspace.

An approved method of assuring terrain clearance is also required.

UAS flights must be able to comply with the Instrument or Visual Flight Rules (IFR or VFR) as appropriate to the class of airspace and the weather conditions.

2.4.3 UAS Operations within Segregated Airspace

The UK uses Danger Areas as the primary method of airspace segregation for UAS

operations.

For flights within segregated airspace, whilst some restrictions may still apply, an unmanned aircraft will generally be given freedom of operation within the bounds of the allocated airspace, subject to any agreed procedures and safety requirements. An authorisation to operate will take into account the risks associated with any unintended excursion from the allocated airspace and it will also consider the possibility of airspace infringements. In addition, measures that may be put in place to enhance the safety of UAS activities will also be considered in the authorisation process.

While segregated airspace, by its nature, provides exclusive use of that airspace to the UAS activity, boundaries are not impervious to aircraft infringements. In order to enhance the safety of UAS operations, the following constraints may be imposed:

- Where available, the remote pilot is to make use of an ATS provider to monitor UAS flights and to provide a service to them and to other aircraft operating in the vicinity of the segregated airspace;
- Communications are to be maintained between the ATS provider and the remote pilot.

Procedures are to be put in place for, amongst others, emergency recovery, loss of control link and the avoidance of infringing aircraft.

Until UAS can comply with the requirements for flight in non-segregated airspace, one-off or occasional BVLOS UAS flights outside permanently established segregated airspace (i.e. DAs) may be accommodated through the establishment of Temporary Danger Areas (TDAs). However, TDAs must not be considered to be a convenient 'catch all' for short notice UAS activities that can simply be requested, and implemented, without due consideration for other airspace users. TDAs will mainly be used for longer term measures, where activities have been properly planned and prepared, and adequate time is available for full consideration by the CAA's Airspace Regulation team along with full promulgation. TDAs are covered more fully in 2.4.3.1 below.

2.4.3.1 Temporary Danger Areas (TDA)

It is recognised that there may be occasions when UAS flights are planned to take place outside an established DA; in these cases, one or more TDAs could be established to temporarily provide the appropriate segregation. Although the use of TDAs offers a flexible tool for segregating specific portions of airspace on a temporary basis, it is important to emphasise that segregation effectively denies airspace to otherwise legitimate users.

Details regarding the application process to establish a TDA can be found within [CAP 1616](#).

Any queries relating to TDAs should also be directed to arops@caa.co.uk.

2.4.3.1.1 TDA Sponsorship

The requirement for sponsorship of a TDA is identical to that required for any other DA. Details regarding DA sponsorship, including Terms of Reference, are contained in the following document [SARG Policy: Policy for Permanently Established Danger Areas and Temporary Danger Areas](#).

2.4.4 VLOS Operations in Controlled Airspace and Flight Restriction Zones

Whilst permission is not required for VLOS flights below 400ft within controlled airspace (if outside an FRZ, and in compliance with the other applicable requirements of the Open category or the operational authorisation), there are still a number of considerations that must be taken into account when operating in such areas.

Major airports exert a significant influence over the characteristics of the overall airspace structure and often require that any pilots operating at low-level under VFR adhere to notified routes and procedures to avoid traffic conflict. This is particularly true of VFR helicopter flights in and around London, which are often under active control and confined to a route-structure with changing altitude limitations. Information on such low-level VFR helicopter route structures is provided in the Aeronautical Information Publication (AIP) and portrayed on Helicopter Route VFR charts, for example the London Control Zone chart (Scale 1: 50,000, Series GSGS 5542). Operators are strongly advised to have a current copy of these charts when operating nearby.

2.4.5 Prohibited and Restricted Areas

Prohibited Areas and Restricted Areas, as notified in the AIP apply to unmanned aircraft (irrespective of their size) as well as manned aircraft. Where approval is required to enter these areas, permission must be sought in accordance with the entry requirements as set out in the Statutory Instrument that established the specific area.

2.4.5.1 London Restricted Areas EG R157, R158 and R159

The Air Navigation (Restriction of Flying) (Hyde Park) Regulations 2017, Air Navigation (Restriction of Flying) (City of London) Regulations 2004 and Air Navigation (Restriction of Flying) (Isle of Dogs) Regulations 2004, lay down restrictions on aircraft operations, including UAS, within three defined airspace areas:

- EG R157 (vicinity of Hyde Park);
- EG R158 (vicinity of the City of London); and
- EG R159 (vicinity of the Isle of Dogs).

These Restricted Areas are described in the AIP in ENR 5.1 and are marked on VFR charts. The restrictions require, with certain exceptions, that no aircraft fly below 1,400 feet Above Mean Sea Level (AMSL) within these areas unless in accordance with an Enhanced Non-Standard Flight (ENSF) clearance issued by the appropriate ATC unit.

The procedure for gaining an ENSF clearance for these Restricted Areas is described in AIP ENR 1.1 section 4 and the procedure to obtain the clearance is facilitated by NATS. Operators can utilise the web-based application process within the [NATS website](#) and will then need to comply with any conditions imposed by the clearance. Operators must note that the ENSF process also involves security considerations that would apply to any flight by an unmanned aircraft. The ENSF process requires a minimum of 28 days' notice.

2.5 Aerodrome Restrictions

2.5.1 Flight Restriction Zones

Flight Restriction Zones (FRZ) are implemented at the majority of UK aerodromes (a complete list can be found in the AIP, and on the DroneSafe Website). Their purpose is to enhance safety for other airspace users within the vicinity of an aerodrome.

FRZs are always active.

In order to operate within an FRZ, permission must be sought from the appropriate authority, either the Air Traffic Service unit (ATSU) or the Aerodrome Operator. This may be obtained through an online platform, or directly from the aerodrome. The procedure is normally outlined on the aerodrome website, otherwise the ATSU may be contacted directly, contact details can be found within the AIP. An approval in principle may be issued in advance, which must normally be followed by an 'on the day' approval from the appropriate air traffic service unit, or aerodrome operator. In some cases, a standing agreement may be appropriate, and agreed by both parties, which grants permission on a standing basis for a specific operation.

FRZs are defined in article 94A of the ANO and comprise three sections:

- A cylinder, with the same dimensions as the Aerodrome Traffic Zone (ATZ);
- Runway Protection Zones (RPZs);
- Additional Boundary Zones.

The ATZ is an existing airspace structure, which applies to manned aircraft, and is a 2.0 or 2.5 NM radius cylinder which extends to 2000 ft above aerodrome level, centred around the centre point of the longest runway.

The RPZs are rectangular blocks, starting at the runway threshold and extending out 5 km along the extended runway centreline, which are 1 km wide and extend to 2000 ft above aerodrome level

The Additional boundary zones exist where a line drawn that is 1km beyond the airfield boundary, extends outside of the ATZ. This additional volume is called the 'additional boundary zone'. This also extends to 2000 ft above aerodrome level.



Figure 2 – Gatwick airport Flight Restriction Zone

These three areas make up the overall FRZ, for which permission to fly within must be obtained from the ATC or Aerodrome Flight Information Service (AFIS) unit or from the aerodrome operator if no ATC/AFIS is present.

Permission to fly above 400 feet (120 metres) within the FRZ may be granted by the ATC or AFIS unit, without requiring further permission from the CAA, providing the flight remains entirely within the FRZ. If no AFIS or ATC unit is present, then flight above 400 feet (120 metres) within the FRZ is not permitted unless permission has been granted by the CAA.

In order to mitigate safety risks associated with UAS operating within an FRZ and interacting with manned aircraft, the following NOTAM action is strongly recommended by the CAA. Any operation within the specific category will include such a requirement within the conditions of the authorisation.

In the case that FRZs overlap with each other, or with other airspace, then permission must be obtained to enter each portion of airspace.

	Within Operating Hours of Air Traffic Service Unit (Air Traffic Control, Aerodrome Flight Information Service or Air Ground Radio service)		Outside Operating Hours of Air Traffic Service Unit (Air Traffic Control, Aerodrome Flight Information Service or Air Ground Radio service)	
	Within Operating Hours of Air Traffic Service Unit (Air Traffic Control, Aerodrome Flight Information Service or Air Ground Radio service)		Outside Operating Hours of Air Traffic Service Unit (Air Traffic Control, Aerodrome Flight Information Service or Air Ground Radio service)	
	Below 400ft	Above 400ft	Below 400ft	Above 400ft
ATZ Portion of FRZ			NOTAM (Requested by aerodrome via NOTAM Office)	NOTAM (Requested by aerodrome via NOTAM Office)
Portion of FRZ outside the ATZ		NOTAM (requested in advance via AROps@caa.co.uk)		NOTAM (requested in advance via AROps@caa.co.uk)

Full details of NOTAM and permission requirements for UAS operations within FRZs can be found in the AIP (ENR 1.1 Section 4.1.8).

2.6 Cross Border Operations

For the purposes of this guidance, international boundaries are considered to be coincident with lateral FIR/UIR boundaries.

UK UAS operators planning to operate beyond an international FIR/UIR boundary must comply with the regulatory and ATM requirements applicable to the territories over which the UAS is flown; these may differ from UK requirements. Guidance on foreign national procedures is to be sought from the appropriate State National Aviation Authority (NAA), and any permissions or authorisations are to be sought directly from that NAA. This requirement stems from Article 8 of the Convention on International Civil Aviation ('Chicago Convention'), which states that:

- "No aircraft capable of being flown without a pilot shall be flown over the territory of a contracting State without special authorisation by that State and in accordance with the terms of such an authorisation. Each contracting State undertakes to insure (*sic*⁵) that the flight of such an aircraft without a pilot in regions open to civil aircraft shall be so controlled as to obviate danger to civil aircraft".

For the purposes of the Convention the territory of a State shall be deemed to be the land areas and territorial waters adjacent thereto under the sovereignty, suzerainty, protection or mandate of such state (Chicago Convention Article 2).

ICAO requirements concerning the authorisation of UAS flight across the territory of another State are published at Appendix 4 to ICAO Annex 2, Rules of the Air.

2.6.1 Non-UK operators operating within the UK (Third country operators)

Note 1: The term 'third country' means any country or territory other than the United Kingdom.

Third country UAS operators (those that have their principal place of business, are established, or reside outside of the UK) must first register as a UAS operator in the UK.

Once registered, they must then comply with the same requirements as set out for an equivalent UK UAS operator.

Note 2: There is a degree of scope for valid national documents relating to operator certification, remote pilot competency or even national operational authorisations to be accepted by the CAA as part of a risk assessment. This is particularly the case where the regulatory environment in the UAS operator's parent country is similar to that of the

⁵ ICAO's use of the word 'insure' should be read as 'ensure'

UK (e.g. EU Member States)

Article 41 point 3 of the UAS DR also offers the facility for any third country itself (i.e. the State, not individual UAS operators) to ask the CAA for recognition of its own certificates or authorisations for the purpose of operating within the UK. Prior to any recognition of these documents, the CAA will first be required to ensure that those documents provide the same level of safety as their UK equivalents.

2.6.2 UK operators operating outside of the UK

2.6.2.1 Operations within EU Member States

A UK operator wishing to operate within the EU, or an EASA associate Member State (Iceland, Liechtenstein, Norway and Switzerland), must comply with the requirements of the EU versions of the UAS IR and DR (i.e. **not** the versions 'retained' in UK domestic law).

UK UAS operators are considered to be 'Third-country UAS operators' to the EU and so in the first instance, must refer to Article 41 of the EU version of the UAS DR.

The effect of this is that the National Aviation Authority (NAA) of the EU Member or Associate State where a UK UAS operator first plans to operate becomes the 'parent NAA' for that operator throughout the EU. The UK operator must register within this Member State and deal with the 'parent NAA' for all certificates, operational authorisations, declarations etc.

Access to the websites of individual EU Member States, including a link to their 'drones' webpages, can be obtained via this link [EASA Light-MS](#).

2.6.2.2 Operations within non-EU member States

UK UAS Operators wishing to operate within any State other than one which is a member of the EU or EASA Associate Member must comply with the requirements that are set out for UAS operations within that State. In the first instance, operators should consult the guidance documentation that has been prepared by the relevant NAA.

2.7 Dangerous goods – carriage by unmanned aircraft

Dangerous goods must not be carried by UA without approval from the CAA.

The carriage of dangerous goods by UA in the UK may be carried out in the specific and certified categories of operation but only when approved by the CAA. Dangerous goods carriage by UA is a new policy area for the CAA. It is likely that supporting procedures and guidance will evolve over time as evidence and experience refines the system.

2.7.1. Operating category – applicability to dangerous goods

Open category – dangerous goods must not be carried in the Open category (UAS IR Article 4, paragraph 1(f)).

Specific category – dangerous goods may be carried in the Specific category unless assessed as a high risk for third parties in case of accident (UAS IR Article 6).

Certified category – dangerous goods can be carried in the Certified category (UAS IR Article 6).

2.7.2. Application requirements

Applications to carry dangerous goods are processed by a separate 'Dangerous Goods Team' within the CAA and a different process is followed. Therefore, UAS operators must make a separate 'Dangerous Goods' application to their application for an operational authorisation.

These applications can be submitted at the same time.

Application for operational authorisation – apply to the UAS Unit using the established procedure detailed in 2.3.1.

Application for approval to carry dangerous goods – follow the procedure outlined 2.7.2.1 below.

2.7.2.1. Application for approval to carry dangerous goods

UAS operators must refer to the [CAA dangerous goods approvals webpage](#) for the most up-to-date information and to ensure all application requirements are met and then:

- Complete CAA Form [SRG 2807](#)

- Submit the appropriate fee using Payment Form [SRG 2812](#) and send to the Dangerous Goods Office
- Details of costs can be found in the [CAA Scheme of Charges - Air Operator and Police Air Operator Certificates](#)

2.8 Security considerations

This section offers guidance to industry on how to implement and satisfy the requirements for security through all UAS lifecycle activities (i.e. initial concept, development, operation and maintenance and decommissioning). In this context, security refers to the security of the unmanned aircraft, including both physical and cyber elements.

UAS operating in non-segregated airspace must not increase the risk to existing airspace users and must not deny airspace to them. This policy requires a level of safety and security equivalent to that of manned aviation.

UAS must have adequate security to protect the system from unauthorised modification, interference, corruption or control/command action. For further information on Cyber Security please refer to the following link: [Cyber-Security](#)

2.8.1 Security factors for consideration

2.8.1.1 Holistic approach

When considering security for the UAS it is important to take a holistic approach, paying equal cognisance to technical, policy and physical security for the UAS as a whole. Utilising this approach will help ensure that issues are not overlooked that may affect security and ultimately safety.

By utilising proven industry approaches to the protection of Confidentiality, Integrity and Availability, the security measures that are applied can benefit the UAS operator by assuring availability of service and the integrity and confidentiality of both data and operations.

2.8.1.2 Aspects to be addressed

Security aspects are required to address particular potential weaknesses to UAS such as employees, location, accessibility, technology, management structure and governance.

Such security aspects include but are not limited to:

- The availability of system assets, e.g. ensuring that system assets and information are accessible to authorised personnel or processes without undue delay;

- Physical security of system elements and assets, e.g. ensuring adequate physical protection is afforded to system assets;
- Procedural security for the secure and safe operation of the system, e.g. ensuring adequate policies such as Security Operating Procedures are drafted, applied, reviewed and maintained;
- Data exchange between system elements, e.g. ensuring the confidentiality and integrity of critical assets is maintained during exchanges within the system, over communication channels and by other means such as physical media;
- Accuracy and integrity of system assets, e.g. ensuring threats to system assets caused by inaccuracies in data, misrouting of messages and software/hardware corruption are minimised, and actual errors are detected;
- Access control to system elements, e.g. ensuring access to system assets is restricted to persons or processes with the appropriate authority and 'need-to-know';
- Authentication and identification to system assets, e.g. ensuring all individuals and processes requiring access to system assets can be reliably identified and their authorisation established;
- Accounting of system assets, e.g. ensuring that individual accountability for system assets is enforced so as to impede and deter any person or process, having gained access to system assets, from adversely affecting the system availability, integrity and confidentiality;
- Auditing and Accountability of system assets e.g. ensure that attempted breaches of security are impeded, and that actual breaches of security are revealed. All such attempted and actual security incidents must be investigated by dedicated investigation staff and reports produced;
- Object Reuse of system assets, e.g. ensure that any system resources re-usage, such as processes, transitory storage areas and areas of disk archive storage, maintains availability, integrity and confidentiality of assets;
- Asset Retention, e.g. ensuring that system assets are securely retained and stored whilst maintaining availability, integrity and confidentiality.

Any identified and derived requirements would then sit within each identified security aspect and be applied (where necessary) to parts of the UAS, e.g. ground based system (including the communications link) and the UA itself. The requirements must be ultimately traced to the overall policy requirements.

2.8.1.3 Security process

Any agreed security design, evaluation and accreditation process will be integrated (where necessary) with the existing certification, approval and licensing processes utilised for manned aircraft.

The security design, evaluation and accreditation process will be considered as a factor to the operational scenario, including but not limited to:

- Applicable flight rules;
- Aircraft capabilities and performance including kinetic energy and lethal area;
- Operating environment (type of airspace, overflown population density);
- Opportunities for attack and desirability.

The operational scenarios, along with other applicable factors, must be combined with possible weaknesses to the system to determine a measure of perceived risk. A possible security lifecycle for the UAS is shown in Figure 1 and this particular phase is referred to as the risk assessment phase of the process.

Risk management techniques must then be utilised to reduce the perceived risk to an acceptable level of residual risk. As shown in Figure 1 this phase is referred to as the risk mitigation phase of the process.

The risk management techniques implemented are verified and evaluated for effectiveness in a regular cycle of 'action and review' ensuring optimum effectiveness is maintained throughout the lifecycle. As shown in Figure 1 this phase is referred to as the validation and verification phase of the process.

Although the approach above is directly applicable to technical security it must be borne in mind that this process must be supported by the application of both good physical security and procedural security and these could be drawn up by interactions between industry, the CAA and Government agencies.

2.8.2 Current UAS security work

The current security research work draws on sector experience and recognised security standards. Through liaison with Government agencies, system security policies are formed that are not only thorough due to their holistic approach but also achievable due to the recognition that systems will have varying operational roles.

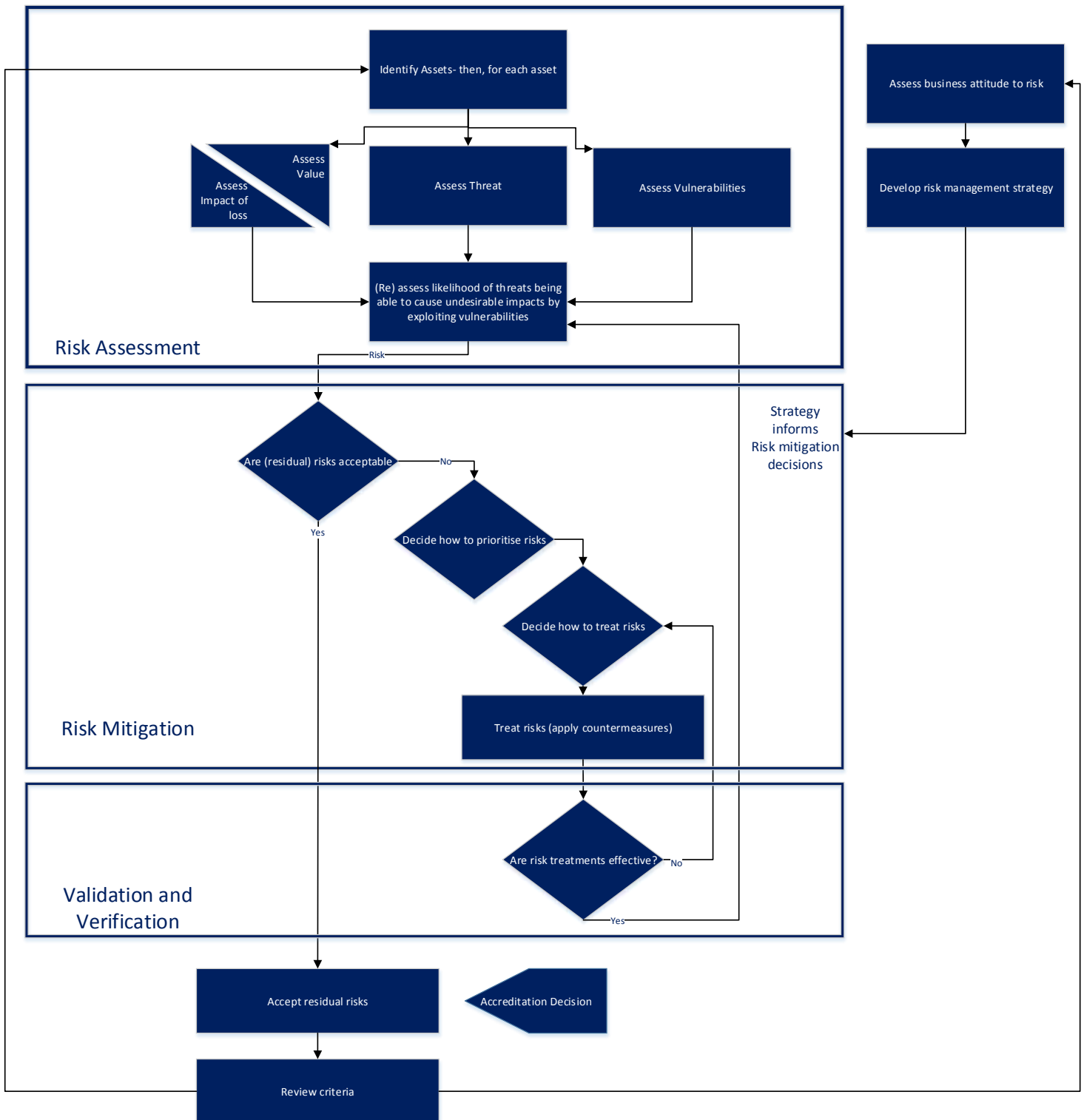


Figure 3 – Security assessment process

2.9. UAS occurrence reporting

2.9.1. UAS occurrences – what you need to do

This section will walk you through the actions you need to take if there has been an occurrence involving an unmanned aircraft and you are wondering if you need to report it, who you need to report to and how you report it.

2.9.2. Have you got the most up-to-date information?

UAS occurrence reporting is evolving and the CAA may need to make changes to occurrence reporting policy and guidance. To ensure you have the most up-to-date information, you must also check the UAS Unit [latest updates](#) webpage in addition to the information in this document.

2.9.3. The purpose of occurrence reporting

Occurrence reporting systems are not established to attribute blame or liability.

Occurrence reporting systems are established to learn from occurrences, improve aviation safety and prevent recurrence.

The purpose of occurrence reporting is to improve aviation safety by ensuring that relevant safety information is reported, collected, stored, protected, exchanged, disseminated and analysed. Organisations and individuals with a good air safety culture will report effectively and consistently. Every occurrence report is an opportunity to identify root causes and prevent them contributing to accidents where people are harmed.

The safe operation of UAS is as important as that of manned aircraft. Injuries to third parties, or damage to property, can be just as severe. Proper investigation of each accident, serious incident or other occurrence is necessary to identify causal factors and to prevent repetition. Similarly, the sharing of safety related information via good reporting is critical in reducing the number of future occurrences.

2.9.4. What organisations in the UK have a reporting requirement?

The Air Accidents Investigation Branch (AAIB) and the Civil Aviation Authority (CAA) have separate reporting requirements. It may be necessary to report to one or both. The regulations that describe these requirements are explained, below.

2.9.5. Occurrence reporting regulations

The applicable regulations (as retained in UK domestic law) are:

- a. [Regulation \(EU\) 996/2010](#) on the investigation and prevention of accidents and incidents in civil aviation.
- b. [Regulation \(EU\) 376/2014](#) on the reporting, analysis and follow-up of occurrences in civil aviation.

Note: this regulation was amended by [Regulation \(EU\) 2018/1139](#) on common rules in the field of civil aviation (The Basic Regulation).

- c. [Implementing Regulation \(EU\) 2015/1018](#) laying down a list of classifying occurrences in civil aviation to be mandatorily reported.

2.9.6. Occurrence reporting flowcharts

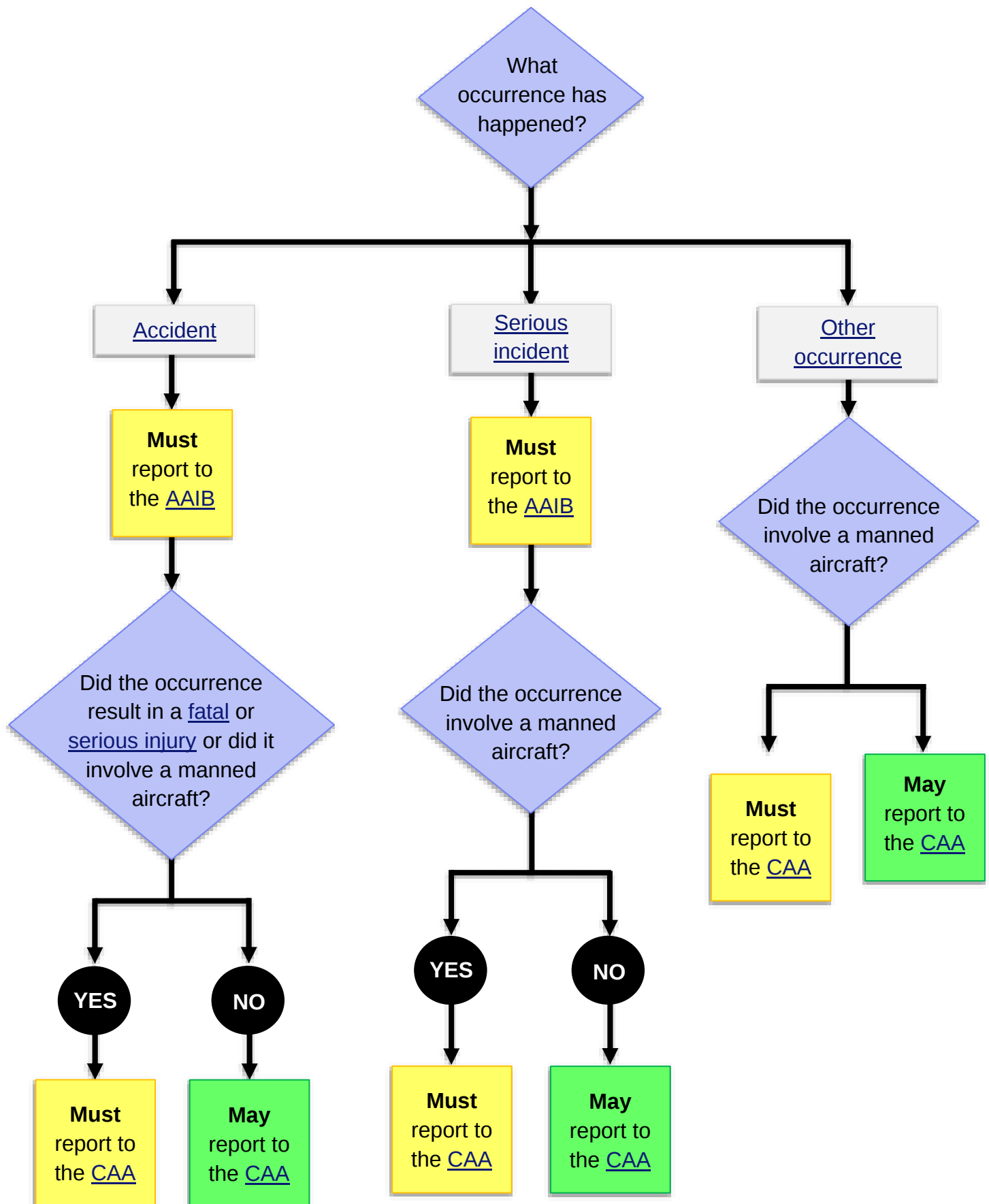
The flowcharts below will help you find out three things:

- **What** occurrences you need to report
- **Who** you need to report to
- **How** you report

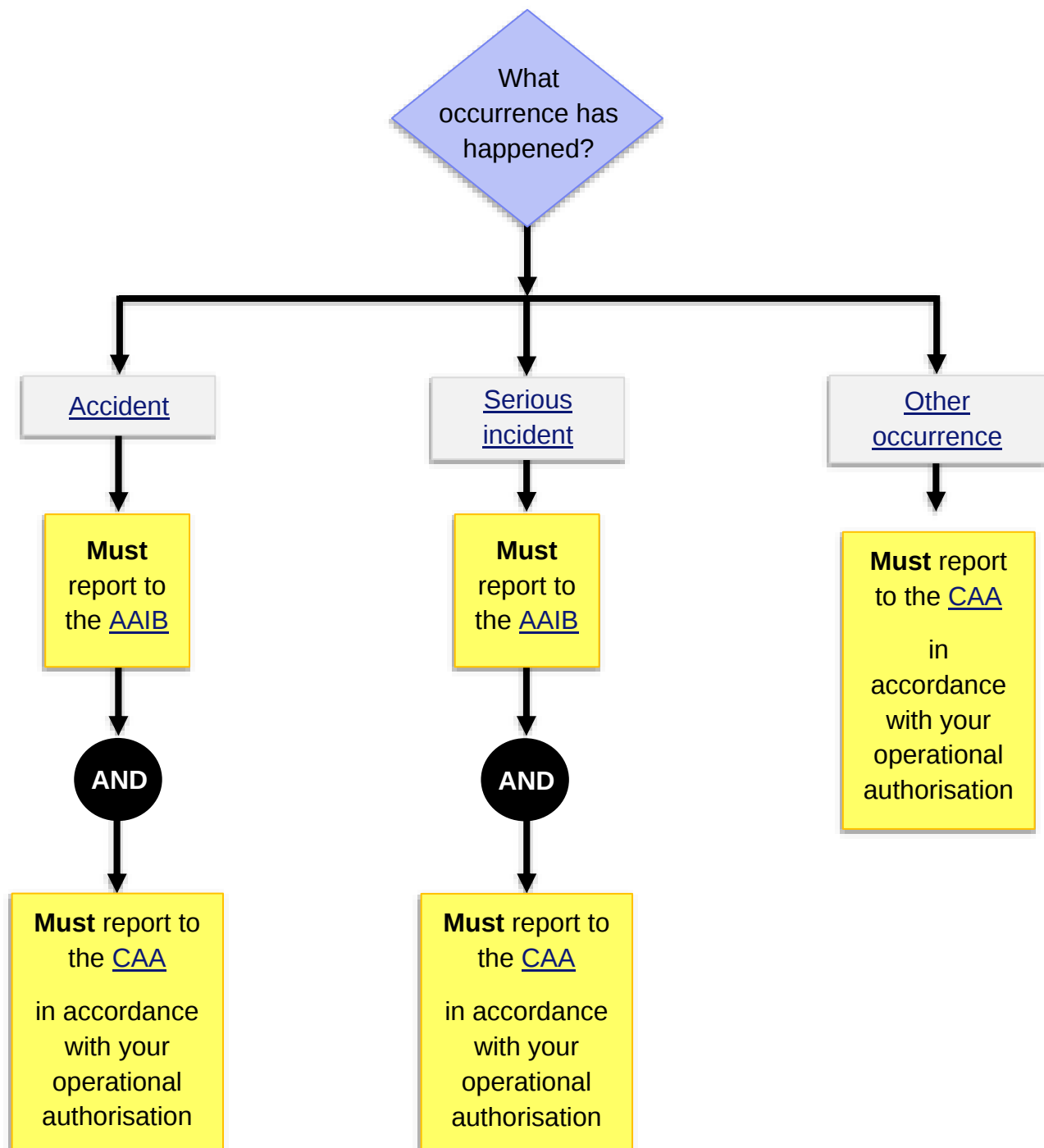
There is a flowchart for the open category and another for the specific category. Each flowchart contains links to sections in this guidance containing key definitions and other information to help you understand why and how to report to the AAIB and/or the CAA.

Yellow boxes mean mandatory reporting is required and green boxes mean reporting is voluntary. Voluntary reporting is useful to provide opportunity for safety lessons to be learned more widely from an occurrence. More engaged air safety cultures tend to do more voluntary reporting.

2.9.6.1. Open category occurrence reporting flowchart



2.9.6.2. Specific category occurrence reporting flowchart



2.9.7. Definitions

The definitions in this section are from Regulation (EU) 376/2014 and Regulation (EU) 996/2010.

Occurrence

Any safety-related event which endangers or which, if not corrected or addressed, could endanger an aircraft, its occupants or any other person and includes in particular an accident or serious incident.

Accidents and serious incidents are classifications of occurrence.

Accident

An occurrence associated with the operation of an aircraft which, in the case of a manned aircraft, takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to move with the purpose of flight until such time it comes to rest at the end of the flight and the primary propulsion system is shut down, in which:

- a. a person is fatally or seriously injured as a result of:
 - being in the aircraft, or,
 - direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or, — direct exposure to jet blast, except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew; or
- b. the aircraft sustains damage or structural failure which adversely affects the structural strength, performance or flight characteristics of the aircraft, and would normally require major repair or replacement of the affected component, except for engine failure or damage, when the damage is limited to a single engine, (including its cowlings or accessories), to propellers, wing tips, antennas, probes, vanes, tires, brakes, wheels, fairings, panels, landing gear doors, windscreens, the aircraft skin (such as small dents or puncture holes) or minor damages to main rotor blades, tail rotor blades, landing gear, and those resulting from hail or bird strike, (including holes in the radome); or
- c. the aircraft is missing or is completely inaccessible.

Serious incident

An incident involving circumstances indicating that there was a high probability of an accident and is associated with the operation of an aircraft, which in the case of a

manned aircraft, takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to move with the purpose of flight until such time it comes to rest at the end of the flight and the primary propulsion system is shut down.

Fatal injury

An injury which is sustained by a person in an accident and which results in his or her death within 30 days of the date of the accident.

Serious injury

An injury which is sustained by a person in an accident and which involves one of the following:

- a. hospitalisation for more than 48 hours, commencing within 7 days from the date the injury was received;
- b. a fracture of any bone (except simple fractures of fingers, toes, or nose);
- c. lacerations which cause severe haemorrhage, nerve, muscle or tendon damage;
- d. injury to any internal organ;
- e. second- or third-degree burns, or any burns affecting more than 5 % of the body surface;
- f. verified exposure to infectious substances or harmful radiation.

2.9.8. Occurrence

2.9.8.1. The regulations

Occurrences must be reported in accordance with the requirements of Regulation (EU) 376/2014 and Implementing Regulation (EU) 2015/1018.

Some of the occurrences in those regulations clearly only apply to manned aircraft, however, many equally apply to unmanned aircraft.

2.9.8.2. Additional UAS occurrences that must be reported

In addition to those listed in the regulations above, other, more UAS specific occurrences must also be reported should they or a similar occurrence be experienced

or observed by you. These occurrences are listed below but the list is not exhaustive.

When you are considering whether an occurrence is reportable, you should also take into account other situations where the same thing could have happened. For example, the actual occurrence may have been 'benign' as it happened in a remote area. However, if the full scope of how the aircraft could be operated is taken into account, for example over people, could the same occurrence in a different situation result in a more serious outcome?

Operation of the aircraft

- Unintentional loss of control
- Loss of control authority over the aircraft
- Aircraft landed outside the designated area
- Aircraft operated beyond the limitations established in the relevant operating category or operational authorisation
- Aircraft operated without required licencing, registration or operational authorisation
- Aircraft operated in an unairworthy or unflightworthy condition

Technical malfunction/failure of the aircraft or command unit

- Loss of command and control link (C2 link)
- Battery failure/malfunction
- Powerplant failure
- Aircraft structural failure (for example, part of the aircraft detaches during operation)
- Errors in the configuration of the command unit
- Display failures
- Flight programming errors
- Navigation failures

Confusion/liaison errors between flight crew members (human factors)

- Inter crew communication
- Briefing
- Competency oversights

Interaction with other airspace users and the public

- Conflict with another aircraft, such that a risk of collision may have existed
- Infringement of restricted/reserved airspace (Inc. Flight restriction zones [FRZ] around aerodromes)
- Inadvertent flight within close proximity of uninvolved persons (i.e. within the prescribed separation distances)

Other emergencies

- Any occurrence where the safety of the aircraft, operator, other airspace users or members of the public is compromised or reduced to a level whereby potential for harm or damage is likely to occur (or only prevented through luck).

2.9.9. Reporting a UAS occurrence to the AAIB

The AAIB

The purpose of the AAIB is to improve aviation safety by determining the circumstances and causes of air accidents and serious incidents and promoting action to prevent recurrence.

What UAS occurrences must be reported to the AAIB?

All UAS accident and serious incidents are required to be reported to the AAIB, regardless of weight or whether they are being used for commercial purposes.

Who must report UAS occurrences to the AAIB?

‘Any person involved’ who has knowledge of an aircraft accident or serious incident in the UK must report it to the AAIB. ‘Any person’ includes (but is not limited to) the owner, operator, and remote pilot of a UAS.

A more detailed list can be found on the [AAIB website](#).

Regulations

The applicable regulations (as retained in UK domestic law) are:

- a. [Regulation \(EU\) 996/2010](#) on the investigation and prevention of accidents and incidents in civil aviation.
- b. [Statutory Instrument 2018 No.321](#) The Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 2018.

Note: The regulations stated above apply at publication date of this CAP and you should refer to the [AAIB website](#) for up-to-date information on air accident investigation regulations.

2.9.9.1. How to report a UAS accident or serious incident to the AAIB

Details of how to report a UAS accident or serious incident can be found on the [AAIB website](#).

2.9.9.2. The AAIB UAS investigation policy

The AAIB will investigate a UAS accident if it was being operated under a CAA operational authorisation or if the UA has a take off weight greater than 20 kg. If the UAS accident involves a fatality and the UA was being operated under a CAA permission or it was above 20 kg, then the AAIB will deploy a team to the accident site and carry out a field investigation. If it isn't a fatal accident, the AAIB will send a 'UAS Accident Report Form' to the remote pilot to collect the details.

Further details of the AAIB UAS investigation policy can be found in [AAIB Annual Safety Review 2018](#).

2.9.9.3. Any questions?

Contact the [AAIB](#) if you have any questions about reporting occurrences to the AAIB.

2.9.10. Reporting a UAS occurrence to the CAA

What UAS occurrences must be reported to the CAA?

UAS occurrences must be reported to the CAA in accordance with the occurrence reporting flowcharts in this document.

Using the flowcharts will help you find out whether the occurrence need to be reported to the CAA.

Who must report UAS occurrences to the CAA?

A UAS operator, remote pilot or member of a UAS support crew that experiences or observes an occurrence.

How to report a UAS occurrence to the CAA

Reports are submitted using the European Co-ordination Centre for Accident and Incident Reporting Systems (ECCAIRS) reporting portal.

The reporting portal can be found [here](#).

Guidance on how to use the portal can be found in [CAP 1496](#).

A note about the specific category

The CAA will expect reporting in accordance with the specific category flowchart when an occurrence takes place at a time when the aircraft or its remote pilot is doing something that does require authorisation.

The CAA will expect reporting in accordance with the open category flowchart when an occurrence takes place at a time when the aircraft or its remote pilot is doing something that does not require authorisation.

Operators and remote pilots carrying out flights in the specific category must be familiar with the guidance of this document **and** the reporting requirements in their authorisation.

This approach is intended to minimise the mandatory reporting requirement on operators and remote pilots. It will also keep mandatory reporting requirements aligned and proportionate to the safety risk of the operation.

[Further information on mandatory and voluntary occurrence reporting](#)

Further information can be found in [CAP 382](#).

[Reporting analysis and software solutions for organisations](#)

Further guidance for organisations can be found in [CAP 382](#).

CHAPTER 3 | Engineering and Technical Guidance

3 Engineering and Technical Guidance

3.1. Classes of UAS

3.1.1. Open category UAS Classes

UAS intended to be sold on the UK and EU market, primarily for use within the Open category are subject to a set of product standards, which are intended to assure that that a particular UAS is safe to be used within a designated subcategory of the Open category.

These UAS are subdivided into 5 'classes' which are labelled C0 to C4, as listed below, with the lowest class numbers presenting the lowest theoretical risk to persons:

- Class **C0** - (can be flown in all subcategories) Very small unmanned aircraft, including toys, that:
 - are less than 250g maximum take-off mass
 - have a maximum speed of 19m/s (approx. 42.5 mph)
 - are unable to be flown more than 120m (400ft) above the take-off point
- Class **C1** – (can be flown in all subcategories) Unmanned aircraft that:
 - are either:
 - less than 900g maximum take-off mass, or;
 - are made and perform in a way that if they collide with a human head, the energy transmitted will be less than 80 Joules
 - have a maximum speed of 19m/s (approx. 42.5 mph)
 - are designed and constructed so as to minimise injury to people

The product standards also cover other aspects such as noise limits, height limits and requirements for remote identification and geoawareness systems.

- Class **C2** – (can be flown in subcategory A2 [close to people] or A3 [far from people]) Unmanned aircraft that are:
 - less than 4kg maximum take-off mass
 - designed and constructed so as to minimise injury to people
 - equipped with a low-speed mode' which limits the maximum speed to 3m/s

(approx. 6.7 mph) when selected by the remote pilot

The product standards also cover other aspects such as noise limits (but different from C1), height limits and requirements for remote identification and geoawareness systems, plus additional requirements if it is to be used during tethered flight.

- Class **C3** – (flown in subcategory A3 [far from people] only) Unmanned aircraft that possess automatic control modes (such as found in typical multicopter ‘drones’) which are:
 - less than 25kg maximum take-off mass

The product standards also cover other aspects covering height limits and requirements for remote identification and geoawareness systems. There are also additional requirements if it is to be used during tethered flight, but there is no specified noise limit (because the aircraft is intended to be flown ‘far from people’).

- Class **C4** – (flown in subcategory A3 [far from people] only) Unmanned aircraft that do not possess any automation, other than for basic flight stabilisation (and so are more representative of a ‘traditional’ model aircraft) which are:
 - less than 25kg maximum take-off mass

The full details of the product standards for each class are set out in the Annex to the UAS DR. These standards only apply to unmanned aircraft that are intended to be sold on the UK market, either fully assembled or in kit form.

Unmanned aircraft which do not comply with the requirements of classes C0 to C4 are able to continue to be operated indefinitely within subcategory A3 (far from people) and, if they are less than 250g, within subcategory A1 (over people).

3.1.2. Specific category

UAS used in the Specific category are not subject to any particular classification. Their technical standards are dependent on the proposed type of operation and its associated risk assessment.

‘Certified’ equipment may be used within the ‘specific’ category, however a UAS subject to certification shall comply with the applicable requirements set out in Commission Regulations Nos. (EU) 748/2012, (EU) 2015/640 and (EU) 1321/2014.

3.1.3. Certified category

The design, production and maintenance of a UAS must be certified if any of the

following conditions are met:

- it has a characteristic dimension of 3 m or more, and is designed to be operated over assemblies of people;
- it is designed for transporting people;
- it is designed for the purpose of transporting dangerous goods and requires a high level of robustness to mitigate the risks for third parties in case of an accident

Additionally, the CAA may determine that an operation proposed for the specific category must instead be conducted with a UAS that has been certified. This would be the case when, having considered the risk assessment provided by the UAS operator, the CAA considers that the risk of the operation cannot be adequately mitigated unless the design, production and maintenance of the UAS is certified (see also 2.2.2.1).

3.2 Airworthiness/Flightworthiness/Certification Principles

This chapter offers basic high-level guidance on what aircraft certification is and how the activities associated with aircraft certification, which are more generally referred to as 'initial airworthiness', interrelate with the activities associated with 'continuing' and 'continued' airworthiness. The text provides an overview of the objectives of the airworthiness and certification processes and is intended to give a general understanding of the various aspects of civil aircraft certification and the related organisational oversight activities.

This is a general outline only; reference should still be made to other airworthiness documentation. The principles outlined below apply only to certified UAS platforms in the context of this document

The boundaries for where certification is required are set out in 3.1.3 above, as well as Article 40 of the UAS DR and Article 6 of the UAS IR.

The detailed principles for the certification of autonomous systems have not been developed yet. Once the regulatory framework has been published and adopted then this document will be updated.

3.2.1 What Level of Certification is Required?

This section offers guidance on the level of certification required for each UAS type. Where no formal airworthiness certification is required guidance is given on the approach to take.

The level of certification required for an aircraft or UAS is based upon the intended use.

As described in 3.2.4 below, at the highest level, aircraft have a Certificate of Airworthiness which is underpinned by Type Certification, continued and continuing airworthiness processes, and design and production organisation approvals. These aircraft are flown by licensed and rated pilots under the procedures of an approved operator and thus are capable of international operations under the mutual recognition arrangements set out by ICAO.

At the opposite end of the spectrum, some aircraft are not required to hold any airworthiness approvals but can be operated commercially under cover of an operational authorisation or permit to fly, provided they are suitably separated from third parties and property, as well as other airspace users.

Compliance with the most demanding requirements provides for a widest range of operational privileges, but a lack of 'demonstrable airworthiness' can still be accommodated, albeit with restrictions placed on the operation, where appropriate.

This approach is intended to provide a reasonable and proportionate level of regulation. This is based on the scale and level of risk each category of aircraft and its use could pose to both the general public and their property, whether on the ground or in another aircraft. The challenge, therefore, is to match the operational aspirations, and the risk this could pose, with proportionate airworthiness requirements that provide adequate management of this risk.

3.2.1.1 Aircraft Classification

The current certification framework established and used by EASA, the UK CAA, and other NAAs, classifies aircraft based on the simple discriminates of type (e.g. balloon, fixed or rotary wing) and mass. This reflects the historic developments in manned aviation but is not necessarily fully appropriate for the certification of UAS and may need to be adapted. However, until such time as alternative classification protocols are agreed, this system is in place.

Work is being developed at an international level to categorise new and innovative classes of aircraft e.g. Hybrid and e-VTOL aircraft.

UAS fall within the remit of Annex IX of the Basic Regulation, unless they are State aircraft or fall within the exceptions defined in Annex I.

3.2.2 General Safety Assessment Points

This section offers guidance on some general safety assessment issues for UAS Certification and Safety Assessment of aircraft systems.

The intent of a Safety Assessment is to demonstrate that the aircraft is safe enough for the manner and type of operation it is intended to perform. It is not intended here to describe any of the many different types of assessment or analyses that can be undertaken, but to outline the basic aspects to be considered.

It is important however to recognise that Safety Assessments, if conducted as a fundamental and iterative design process, can provide benefits in terms of the level of safety achievable. This also achieves a degree of reliability or availability possible and even minimise the cost of ownership through effective maintenance schedules.

If the Safety Assessment is considered simply as a retrospective analysis the result can only reflect the frozen design. Whilst this could be sufficient, it does also carry the risk that any shortfall can only be addressed by redesign or by limitations or restrictions on the use - which could be significant enough to preclude viable operation.

3.2.2.1 Assessment Steps

A Safety Assessment may be considered in simple steps:

- Determination of the set of aircraft level threats/hazards related to functional failures are identified;
- The severity of the consequence for each of these failure conditions is determined/classified;
- This classification could be different for differing scenarios, e.g. during different phases of flight;
- The target level of safety (TLOS) is assigned for each failure condition;
- The systems and component failures that could contribute to each of these failure conditions is assessed or analysed to establish if the individual TLOS is met;
- Compliance with each individual failure condition and the overall aircraft level target is shown.

Within the airworthiness requirements set, as discussed below, the aircraft certification specifications contain specific requirements and levels of safety defined in probability terms. For smaller classes of aircraft, the airworthiness requirements may not define levels of safety to this detail – hence the method of demonstrating compliance is open for discussion and may be able to be based on judgement and justified arguments rather than detailed probabilistic analysis. This is clearly important as, with lower levels of robust component reliability data, the task of developing probability analyses is more challenging.

3.2.2.2 Safety Assessment Considerations

Each of the UAS design requirement sets will include system safety requirements. These are often referred to as paragraph number 1309 of the applicable CS (e.g. CS-XX.1309). In some more recent design requirement sets, the paragraph number is XX.2510. This requires that the probability of a failure is inversely proportional to the severity of its effect at aircraft level. Therefore, high criticality systems are required to have an extremely low probability of failure.

These certification requirements were established many years ago based on in-service experience (accident data etc) and a desire to set a standard that would drive improvements in what was then being achieved. For each class of passenger transport aircraft (large and small fixed wing aircraft, rotorcraft, etc.), an acceptable fatal accident rate was defined, e.g. 1 accident in 10 million flight hours (10^{-7} per flight hour), for a

large fixed wing aircraft.

Then based on simple assumptions regarding the number of aircraft systems and potentially critical failures in each of these, a target level of safety was defined for each critical failure. This is described in detail within the advisory material that goes with the requirement.

The validity of using these probability targets for UAS is currently a debated subject. Clearly, they relate to passenger transport aircraft and the safety of passengers carried. However, it must be noted that by protecting persons on board an aircraft, it is implied that third parties on the ground will also be protected.

There is also some discussion that the types of operation undertaken by passenger aircraft are quite different to the range of operations undertaken by UAS and so once again, the probability targets may not be appropriate. However, the safety assessment process already accounts for this to some extent because, due to these differences, the consequence or severity of effect could be quite different, and so result in a different target level of safety.

For UAS, the safety assessment and any analysis or justification to demonstrate compliance with the level of safety target is primarily based on the aircraft system and its associated failure mechanisms. The aircraft system is the total system required for safe flight and landing, e.g. the aircraft, command unit, command and control datalinks and any launch or landing/recovery systems.

In principle, it does not place any reliance on external factors that may mitigate the failure; these are the safety nets that could prevent the worst-case scenario.

It must also be noted that where the simple assumptions made in the certification safety assessment requirements are not valid (e.g. 'independent' vs 'integrated' systems, 'simple' vs 'complex' systems, and the number of critical failure conditions), it may be necessary to impose more stringent targets to individual failure conditions in order to meet the aircraft target level of safety.

For UAS operating in the Specific category, the proportionate approach that is taken does not necessarily require a safety assessment to the level described above. However, the safety case and risk assessment approach does still require consideration of the hazards (including those that could be due to aircraft system failures), their severity, and justification of how these will be mitigated and managed. It is therefore required that some level of assessment and justification of how and why hazards are suitably managed will be necessary, albeit not necessarily to the level that uses detail probability-based analyses. This will be assessed by the CAA prior to any operational authorisation being issued to the applicant.

Risk analysis and safety case guidance for applicants is contained in [CAP 722A](#).

3.2.2.3 Other considerations

The value of the safety assessment process in the development of maintenance programmes (e.g. the type and frequency of maintenance actions), must also be recognised. The outputs of the processes provide useful data to determine what maintenance activities are required and how frequently they will be performed to maintain the appropriate level of aircraft integrity. These maintenance actions can prevent critical failures (e.g. by replacing items before they are likely to fail, or by detecting problems before operation of the aircraft). Not only does this support safety but it has the potential to save money – it is usually cheaper in terms of both money and time to fix a minor problem before it becomes a serious problem.

3.2.3 Certification

Certification is the legal recognition by the certification authority that a product, service or organisation complies with the applicable requirements.

Certification comprises the activity of technically checking the product, service, organisation or person, and the formal recognition of compliance with the applicable requirements by issue of a certificate, licence, approval, or other documents as required by applicable regulations.

The rationale behind certification for UAS is that the same target levels of safety that apply to manned aircraft should also apply to UAS being used for higher risk operations. This should ensure the safety of third parties on the ground and in the air.

Therefore, certification is the process to define and establish a set of operational and technical parameters that the aircraft must operate within. This does not mean that because the product is certified that it may be suitable for all envisaged types of operations. Therefore, operational restrictions may also be applied in addition to the airworthiness requirements.

Generally, it is the manufacturer (i.e. the organisation responsible for designing and constructing the aircraft) that will apply to its respective National Aviation Authority (NAA) for certification. NAAs do not generally certify platforms for individuals acting as operators, unless they are also the designer and manufacturer of the platform.

3.2.3.1 Lead Agency/Competent Authority

The competent authority in the United Kingdom will be the Civil Aviation Authority.

Currently within Europe the regulatory framework is defined by the European

Commission (EC) and enacted by the European Aviation Safety Agency (EASA) and National Airworthiness Authorities (NAA). The regulatory framework responsibilities are therefore shared between EASA and member state NAAs.

The regulatory framework and sharing of roles and responsibilities is described within the EASA Basic Regulation (Regulation (EU) 2018/1139). EASA is the primary agency for all rulemaking activities and conducting initial and continued airworthiness aspects.

Within the Basic Regulation, certain aircraft categories are currently defined to be outside of scope and hence these aircraft remain subject to national regulation. This applies to all aircraft carrying out military, customs, police, search and rescue, firefighting, coastguard or similar activities or services (State aircraft). In this context all Unmanned Aircraft are subject to EU Regulations except the cases stated above. A few other exceptions to this are also defined, although almost all refer to manned aircraft – these are commonly referred to as Annex I aircraft. These are defined within Annex I of the EU Basic Regulation. UAS are covered under Annex IX of the EU Basic Regulation.

EASA is the designated authority for all certification tasks within the European Union, but responsibility for these tasks change at the end of the EU Exit transition period (23:00/11pm on 31 December 2020) as follows:

- Until 31 December 2020, the UK CAA cannot carry out certification tasks on UAS, unless instructed or contracted to do so by EASA. Therefore, applicants requiring certification should apply directly to EASA in the first instance;
- From 1 January 2021 these tasks will revert to the CAA. Please refer to the CAA website for further details and updates on this subject;
<https://info.caa.co.uk/brexit/>

3.2.3.2 International recognition

3.2.3.2.1 Bi-lateral agreements and working arrangements

Bilateral agreements and arrangements allow the airworthiness certification of civil aeronautical products to be shared between two countries.

A Bilateral Aviation Safety Agreement (BASA), Memorandum of Understanding (MoU) or Working Arrangement (WA) and their associated implementing procedures provide for technical cooperation between national civil aviation authorities. They help reduce duplication of activity and aim for mutual acceptance of certificates.

In addition to airworthiness certification, BASAs, MoUs and WAs provide for bilateral cooperation across other areas of aviation, including maintenance, flight operations, and environmental certification.

For aircraft certification and maintenance, additional implementation procedures will cover specific issues such as design approval, production acceptance, export airworthiness approval, post-design approval activities, technical cooperation and maintenance.

For further information on Bilateral agreements please refer to the CAA website: [Bilateral-agreements](#)

3.2.4 Certification objectives

Annex 8 of the Chicago Convention contains the SARPS for Airworthiness. These are a system of internationally agreed standards and recommended practices by which each ICAO contracting State can establish a means to ensure that a minimum level of safety is established and achieved. This process enables States to mutually recognise the airworthiness of individual aircraft operating within each other's airspace.

As not all types of aviation require routine international operating capability, each State can define and establish its own standards and practices for these 'national activities'. Within Europe this has, for most aircraft types, been harmonised across states through the EU Commission and the EASA, as described above.

Therefore, it is important to recognise that the headline title of airworthiness/certification is a means by which the competent authority of a State can establish and attest to compliance with an agreed set of standards. These standards cover the necessary range of aircraft types and the activities to be undertaken; typically, the standards applied can be, and usually are, different for varying classes of aircraft and their intended use. For example:

- To comply with the ICAO international requirements aircraft must be operated under cover of an Operational Approval; each aircraft must have a valid Certificate of Airworthiness (which is underpinned by an approved Type Design) and be flown by appropriately qualified and licensed flight crew.

At the other end of manned aviation, small personal use (recreational) aircraft may only need to have a Permit to Fly, which is a national approval. This limits use to that country only and could include limitations and conditions on where and when it can be flown (e.g. class of airspace, weather conditions, etc). It must also be noted that a national approval precludes automatic rights of use/operation in another country. However, this does not prevent use or operation in another country, but it does mean each NAA will need to determine how and what it will allow by separate process.

3.2.5 Initial, Continuing and Continued Airworthiness

Within the certification and airworthiness system there are three basic processes to set and maintain required standards. These processes determine and maintain the intended level of safety:

- Initial airworthiness

The initial airworthiness processes are those used to determine the applicable requirements and establish that an aircraft design is demonstrated to be able to meet these requirements. This includes the safety targets and the development of instructions for use and ongoing care/maintenance. It would also cover the elements of production, i.e. those aspects of taking the approved design and manufacturing the end product to the point of a useable aircraft. This phase must be completed prior to an aircraft entering into service.

- Continuing airworthiness

The continuing airworthiness process refers to the system of management of the aircraft and the scheduling and actioning of ongoing preventative and corrective maintenance to confirm correct functioning and to achieve safe, reliable and cost-effective operation.

- Continued airworthiness

Continued airworthiness refers to the monitoring, reporting and corrective action processes used for in-service aircraft to assure they maintain the appropriate safety standard defined during the initial airworthiness processes throughout their operational life.

In parallel with each of these processes, there are schemes that require or provide for organisation approvals, e.g. design, production, maintenance and organisation approvals. These approvals enable the NAAs to recognise capability within a company system; this limits the level of investigation and oversight that may be necessary to establish compliance against the regulatory standards applicable to individual products.

3.2.5.1 Initial Airworthiness Processes

The initial airworthiness process establishes a required level of airworthiness integrity for an aircraft and to demonstrate that this level of integrity can be achieved. Integrity must be taken to include all aspects of the design (structurally and systemically) to cover safety, reliability, availability, capability, etc.

When the required level of airworthiness integrity is met and consistently shown to be achieved, the aircraft can be considered to provide an acceptable level of safety; this covers both the vehicle (and any person(s) on board, if applicable) and, by inference from continued safe flight, to persons and property on the ground.

The initial airworthiness processes have the following basic elements for design and production:

- Establishment of the design/certification requirements (certification specifications) which define the high-level design criteria and showing that these are met.
- The design organisation aspects which covers the capability and competence of the company for the design of the complete aircraft, systems or individual parts.
- The production organisation aspects which cover the capability and competence for the manufacture and assembly of the complete aircraft, systems or individual parts in accordance with the approved design and testing of the aircraft prior to delivery.

The design organisation must demonstrate to the certification authority that the proposed design is compliant with the established and agreed certification specifications or other requirements. The production organisation is responsible for showing that the end product is in conformance to the design.

For current categories of manned aircraft, there are already established design/certification requirements, such as the EASA Certification Specifications (e.g. Large Aeroplanes (CS-25), Large Rotorcraft (CS-29), Very Light Aircraft (CS-VLA), and Very Light Rotorcraft (CS-VLR)). These provide guidance material on the intent of the requirement and methods of showing compliance that are acceptable to the competent authority. It is recognised that these do not fully address the range of aircraft potentially possible, nor how the technology elements relevant to UAS may cross the boundaries between the categories of the requirements.

Except for the very smallest aircraft, where the safety aspect is controlled by separation and operational management, each class of aircraft will have some level of safety requirement. At the highest end, where a formal certification approval is necessary, this safety assessment requirement for "Equipment, Systems and Installations" and the associated guidance material is already defined in the Certification Specifications under paragraph CSXX.1309 (in some more recent design requirement sets, the paragraph number is XX.2510). However, this may not be wholly appropriate for all categories of aircraft.

3.2.5.2 Continuing airworthiness processes

The continuing airworthiness processes assure that in-service aircraft are managed and maintained and that these actions are performed correctly. To be performed correctly, this must be done by appropriately competent and authorised persons, and in accordance with the instructions developed by the design organisation, so that the assumptions and considerations made during the design, particularly in respect of

safety, remain valid. As a result, these processes also need effective communication between the operator, maintenance organisations and the design organisations to ensure that necessary information is shared and if necessary corrective actions taken.

The continuing airworthiness process will support any modifications, repair or component replacement once an aircraft has entered service. This is achieved by not only undertaking the incorporation of the changes, but also in the management of configuration records, updating of maintenance instructions, etc. This process will last for the entire life span of the aircraft remaining in service.

3.2.5.3 Continued airworthiness processes

The continued airworthiness processes are intended to provide a closed loop monitor and corrective action cycle for in-service aircraft to assure that the intended level of safety is maintained. The process starts with activity within the certification work (for example the development of the maintenance schedules and instructions on how to perform this activity). Thereafter, it includes the monitoring of experience of in-service aircraft and, when necessary, the definition and promulgation of corrective action instructions.

The development of maintenance schedules typically considers and uses information from the aircraft design and safety assessment processes to determine what maintenance activities are required and how frequently they will be performed to maintain the appropriate level of aircraft integrity (for example replacing parts before they would typically wear out or fail will prevent the consequence of this and hence aid both safety and commercial costs).

The monitoring and reporting processes support the collection and analysis of in-service information and enable the design organisation to be satisfied that the overall level of safety is being achieved, or if necessary, to determine and promulgate corrective actions to address problem areas.

If these programmes are run correctly, they have the potential to save organisations money – it is usually cheaper in terms of both money and time to fix a minor problem before it becomes a serious problem.

3.2.6 General certification requirements

The approach taken by the UK CAA for certification is, in principle, the same as that followed by EASA. Within this process, the actual requirements that make up the certification basis, must be shown to be met and complied with. These requirements may well be different for other NAAs due to the views, experience and concerns of each country.

3.2.6.1 Applicability

UAS 'whose design is subject to certification' (i.e. aircraft that meet the conditions specified in Annex IX of the Basic Regulation 2018/1139) must comply with Article 6 of the UAS IR and Article 40 of the UAS DR (see 2.2.3.1).

3.2.6.2 Basic principles

The initial airworthiness or "Type Certification" process can be considered to follow a simple flowline, albeit there may be parallel paths in obtaining Design Organisation Approval (DOA) and Production Organisation Approval (POA), where these are necessary, which must come together at key cross-contact points.

All certification tasks, irrespective whether they are performed internally or allocated to an NAA shall be executed following the provisions of this procedure.

The certification project process can generally be divided in the following phases:

- Phase 0: Definition and agreement of the working methods with the applicant.

The objective of this phase is to check applicant's eligibility and establish the Team of experts.

- Phase I: Technical Familiarisation and establishment of the Initial Certification Basis.

The objective of this phase is to provide technical information about the project to the Team of experts to enable the definition of an agreement on the initial Competent Authority Certification Basis.

- Phase II: Agreement of the Certification Programme and Level of Involvement.

The objective of this phase is the definition of, and the agreement on, the proposed means of compliance for each requirement of the Certification Basis and the identification of the Certification Team's Level of Involvement.

- Phase III: Compliance determination.

The objective of this phase is to demonstrate compliance with the applicable Certification Basis and environmental protection requirements and provide the Competent Authority with the means by which such compliance has been demonstrated and declare that compliance has been demonstrated.

- Phase IV: Technical closure and issue of the Approval.

The objective of this phase is to technically close the investigation and issue the Certificate.

Certification Review Items (CRI) and Certification Action Items (CAI) are raised whenever it is foreseen in the procedure. However, CRI and CAI may also be raised in the course of a certification project whenever it is deemed necessary.

Procedure users are advised to consult the UG.CERT.00002 [AW of Type Design](#) for additional guidance where necessary.

From the above processes the derivation of the applicable requirements is clearly a key aspect. However, the current manned requirements set does not align with the types/size/mass of aircraft that are being developed as UAS.

Unfortunately, the timeline for developing requirements is likely always to be behind the rate of technological advancement. The current approach is therefore to identify the category that fits as best as possible to the type/classification of the aircraft – and subtract what is not necessary and add to fill the gaps where required. The gaps can be filled by parts of other requirement sets, where practicable, and/or by developing new material where necessary.

- For example: a simple fixed wing aeroplane design may align well with the VLA (Very Light Aeroplanes) category with respect to structure and control surface actuation etc. However, because of the UAS aspects, the design may have a sophisticated command and flight control system, which is not addressed in CS-VLA. Use of the relevant sections of CS-23 or even CS-25 may be applicable.

The following list defines the different certification categories for aircraft:

CS – 23 Normal, Utility, Aerobatic and Commuter Aeroplanes. [cs-23](#)

CS – 25 Large Aeroplanes. [cs-25](#)

CS – 27 Small Rotorcraft. [cs-27](#)

CS – 29 Large Rotorcraft. [cs-29](#)

CS – VLA Very Light Aircraft. [cs-vla](#)

CS – VLR Very Light Rotorcraft. [cs-vlr](#)

The main difficulty with this approach, apart from the commercial risk prior to agreement with the competent authority for design, is the potential lack of cohesion between the safety target levels from the different standards.

Work is being undertaken through various international bodies, such as JARUS, to establish Certification Specifications (CS) for Unmanned Aircraft Systems: [JARUS CS-UAS](#) and [JARUS CS-LURS](#) and [CS-LUAS](#).

These certification specifications may be adopted by competent authorities to assist in the certification process. These need to be agreed between the applicant and the competent authority beforehand.

At present, the UK has not formally adopted any CS publications for UAS. When any certification specification is adopted this will be communicated to the aviation industry.

3.2.6.2.1 Additional Certification Specifications

There are additional CS used in aviation for engines, propellers, airborne CNS and aircraft noise. These need to be considered by the equipment designer when designing equipment seeking approval from the relevant competent authority.

Examples of this include:

AMC 20 General Acceptable Means of Compliance for Airworthiness of Products, Parts and Appliances.

CS – APU Auxiliary Power Units.

CS – E Engines.

CS – ETSO European Technical Standard Orders.

CS – P Propellers.

CS – 36 Aircraft Noise.

This list is not exhaustive; readers should refer to the UK CAA and EASA website for further guidance.

3.2.6.2.2 Special Conditions - SC

Special detailed technical specifications, named special conditions (SC), may be established for a specific product if the related airworthiness code does not contain adequate or appropriate safety standards. These are usually required because:

- The product has novel or unusual design features relative to the design practices on which the applicable airworthiness code is based; or
- The intended use of the product is unconventional; or
- Experience from other similar products in service or products having similar design features has shown that unsafe conditions may develop.

Some of the existing SC that have been issued have a “generic” characteristic, i.e. they are applicable to all products, or all products incorporating a certain technology, or all aircraft performing certain specific operations. Some of these SC have been used for many years on several certification projects.

One recent example, published by EASA, is SC – VTOL [EASA SC-VTOL](#)

3.2.6.2.3 Restricted Type Certificate – R(TC)

A restricted type certificate may be applied for when a type certificate is inappropriate, and the aircraft is designed for a special purpose for which the Competent Authority agrees deviations from the full requirements that provide a sufficient level of safety for the intended use.

3.2.6.2.4 Supplemental Type Certificate – STC

A supplemental type certificate (STC) is a type certificate (TC) issued when an applicant has received Competent Authority approval to modify an aeronautical product from its original design. The STC, which incorporates by reference the related TC, approves not only the modification but also how that modification affects the original design.

3.2.6.2.5 Permit to Fly

An aircraft that does not meet the International Civil Aviation Organisation (ICAO) certification standards required for the issue of a Certificate of Airworthiness (C of A) may be issued a permit to fly, subject to satisfying certain requirements and only operated within certain limitations.

A permit to fly will not be issued to an aircraft that is eligible for the issue of a C of A but may be issued in the event of a C of A becoming temporarily invalid.

3.2.7 Other airworthiness and technical information

The text below describes other airworthiness related terms that relate to product certification and continuing airworthiness. These are high level descriptions. Further information can be found on the related websites and other published documents.

- **C of C – Certificate of Conformance:** This is a certificate issued to a product which declares that the product meets the required standard for use on an aircraft. It is generally issued against a very generic standard and is mainly used for consumable type products in aviation, e.g. fasteners and other miscellaneous type items.
- **ETSO – European Technical Standard Order:** This is a detailed airworthiness specification issued by the European Aviation Safety Agency (EASA). An ETSO ensures that a part or appliance complies with a minimum performance standard.

In all cases, the installer must apply for an installation approval on-board the aircraft; [EASA ETSO](#)

- **TSO – Technical Standard Order**: This is issued by the Federal Aviation Administration (FAA). A TSO is a minimum performance standard for specified materials, parts, and appliances used on civil aircraft. When authorised to manufacture a material, part, or appliances to a TSO standard, this is referred to as ‘TSO authorization’. Receiving a TSO authorization is both design and production approval. Receiving a TSO authorization is not an approval to install and use the article in the aircraft. It means that the article meets the specific TSO and the applicant is authorised to manufacture it; [FAA TSO](#)
- **SB – Service Bulletin**: A Service Bulletin is the document used by manufacturers of aircraft, their engines or their components to communicate details of modifications which can be embodied in aircraft. If an available modification is judged by the manufacturer to be a matter of safety rather than simply product improvement, then these would be issued as an Alert SB in which case a corresponding Airworthiness Directive (AD) would usually then be issued by the appropriate NAA.
- **SIL – Service Information Letter**: This is a document is used by manufacturers of aircraft, their engines or their components to communicate details of advisory action or other ‘useful information’ about their products which may enhance safety, reliability or reduce repetitive costs.
- **AD – Airworthiness Directive**: An Airworthiness Directive is a notification to owners and operators of certified aircraft that a known safety deficiency with a particular model of aircraft, engine, avionics or other system exists and must be corrected. Therefore, it is mandatory for an aircraft operator to comply with an AD. AD’s are only published by competent authorities.

3.2.7.1 Standards bodies

There are multiple standards bodies that are engaged with the development of standards for aeronautical products such as UAS. Such bodies include EUROCAE, ASTM, RTCA etc. Readers should refer to the respective bodies’ websites for further information.

The CAA may choose to accept suitable standards from these bodies as deemed appropriate for application in the certification of UAS.

3.2.8 Interrelationship between the Three Stages of Airworthiness Oversight

3.2.8.1 Initial and Continued Airworthiness

During the initial certification of an aircraft, the initial and continued airworthiness processes may be considered to run concurrently because the information developed within the initial airworthiness processes feeds into the continued airworthiness processes to develop the “instructions for continued airworthiness”, i.e. the maintenance schedules and tasks which need to reflect the assumptions and considerations of use of the aircraft.

In principle, once it has been demonstrated both the initial airworthiness and continued airworthiness requirements have been met, an aircraft type will be issued with a Type Certificate (TC).

Type Certificates are currently only issued to the following products:

- Aircraft
- Engines
- Auxiliary Power Unit (APU)
- Propellers

The development of all other types of aircraft system is required to be overseen by the Type Certificate applicant.

Once an aircraft, engine, APU or propeller holds a Type Certificate any changes will fall into the following categories:

- Major Change – This is a significant change to the design of an aircraft, engine, propeller or related system that is designed and implemented by the holder of the Type Certificate.
- Supplemental Type Certificate (STC) – This is a significant change to the design of an aircraft, engine or propeller that is not designed and implemented by the holder of the relevant Type Certificate.
- Minor Change – This is a non-significant change to the design of an aircraft, engine, propeller or related system which is not permitted to affect the extant aircraft, engine or propeller level safety assumptions.
- Change in Operational Use – This is a change to the operational use of an aircraft, engine or propeller that falls outside the agreed scope of use defined during the initial and continued airworthiness processes. In principle this must be discussed and agreed with the relevant TC holder, but this is not actually mandated.

Clearly any change to a certificated system that does not involve the TC holder has

potential implications for aviation safety.

Note 1: *In UAS the Command Unit is an integral component to the UAS. Therefore, it is envisaged that this may require its own TC or appropriate documentation that evidences that the equipment meets the minimum performance requirements.*

Note 2: *The DAA capability will not receive its own standalone TC. This will form part of the overall TC issued to the UAS by the Competent Authority.*

3.2.8.2 Continuing Airworthiness

The continuing airworthiness process begins with an evaluation of an organisation to determine whether or not it meets the basic requirements to be allowed to perform initial and/or continued airworthiness functions.

This process seeks to determine compliance against one or more of a number of organisational approval requirements documents:

- Part 21 – “Certification of Aircraft and Related Products, Parts and Appliances, and of Design and Production Organisation”. In simple terms, this document applies to organisations involved in initial airworthiness.
- Part M – “Continuing Airworthiness Requirements”. This relates to organisations that are responsible for managing and overseeing maintenance tasks and maintenance scheduling.
- Part 145 – “Approved Maintenance Organisations”. This applies to organisations that perform continued airworthiness related tasks under the management of an organisation approved to Part M.
- Part 147 – “Maintenance Training Organisational Approvals”. This applies to organisations that are responsible for the provision of aviation maintenance related training and examinations.
- Part 66 – “Certifying Staff”. This documents the competency requirements for maintenance personnel that are responsible for signing off aircraft or aircraft systems as serviceable. This is commonly referred to a licenced engineer.

Further information on these regulations and requirements may be found on the EASA website: [EASA Airworthiness](#), as well as the CAA website: [UK CAA Airworthiness](#)

No organisation is permitted to work within the aviation industry unless they either have the relevant approvals, as dictated by the continuing airworthiness processes or they are overseen by an organisation that holds the relevant approval. This is intended to ensure that any aviation work is performed with a degree of integrity commensurate to the risk associated with that activity. Once an approval has been granted, the continuing airworthiness process runs concurrently with the initial and continued airworthiness

processes to ensure that an appropriate level of organisational integrity is maintained to support the individual project/aircraft level tasks overseen by the initial and continued airworthiness processes.

If the initial and/or continued airworthiness processes identify organisational risks, this information is passed back in to the continuing airworthiness processes to ensure that these risks are managed appropriately.

3.3 Communications, Navigation and Spectrum

It is the responsibility of the UAS operator to ensure that the radio spectrum used for the C2 Link and for any payload communications complies with the relevant Ofcom requirements and that any licenses required for its operation have been obtained.

It is also the responsibility of the operator to ensure that the appropriate aircraft radio licence has been obtained for any transmitting radio equipment that is installed or carried on the aircraft, or that is used in connection with the conduct of the flight and that operates in an aeronautical band

3.3.1 C2 Link Communications

This section provides:

- Information regarding on the use of frequencies to support UAS operations;
- Frequency bands that are potentially available to support UAS C2 and DAA systems, their limitations and required authorisation of their use.

It also sets out the CAA's position in respect to

- the spectrum currently available
- the limitations on and the application process for its use by the UAS industry
- the process for seeking access to alternative spectrum

3.3.1.1 Introduction

The provision of a reliable C2 Link is essential to the safe and expeditious operation of UAS. Although many existing aeronautical systems that support safety critical applications operate in suitably allocated and protected spectrum, these are often not suitable for UAS operations.

In 2012 the allocations in the frequency band 5 030 – 5 091 MHz were suitably modified to allow for terrestrial and satellite support for UAS. Additionally, in 2015 some frequency bands were identified that might be able to provide further satellite support for UAS operations for which studies are still on-going to identify the conditions under which these frequency bands could be used.

The CAA's overall aims are:

- to ensure that frequencies used to support safety critical UAS functionality meet

both international and national regulations/legislation;

- to ensure that all frequencies used to support safety critical UAS functionality have been co-ordinated and licensed in accordance with the appropriate licensing regime;
- to ensure that any such licence obtained provides suitable protection to the use of that frequency appropriate to the functionality and safety criticality of the systems being supported and the area of operation;
- to assist in the identification of suitable dedicated spectrum to support UAS safety-critical functionality.

3.3.1.2 The Radio Regulatory Framework

The International Telecommunication Union (ITU), a sister UN agency to ICAO, is responsible for the global management of the radio frequency spectrum. Its prime objective is to ensure interference free operation of radiocommunication systems. This is achieved through the implementation of the Radio Regulations and regional agreements. Within the UK, management of spectrum is the responsibility of Ofcom.

The availability of spectrum and the licencing regime under which it operates will vary dependant on the operational requirement (e.g. within or beyond visual line of sight etc), environment (e.g. urban/rural etc,) and the safety criticality (e.g. separation, kinetic energy etc) of the function being supported.

3.3.1.3 Spectrum Availability

The following frequency bands are appropriately allocated within the Radio Regulations to support UAS Command & Control and/or Detect and Avoid systems. However, their potential use to support such systems will be subject to compatibility with incumbent and known future systems operating or intended to operate in the relevant frequency band.

Frequency Band	Potential Use	Protected / Unprotected	Comment
255 - 526.5 kHz	Detect & Avoid	Protected	Aeronautical use: for Non-Directional Beacons with 0.5 kHz channelization Other Information None

34.945 – 35.305 MHz	Detect & Avoid	Unprotected	Other Information Power limited to 100 mW, 10 kHz channelization
74.8 – 75.2 MHz	Detect & Avoid	Protected	Aeronautical use: Marker beacons with a fixed centre frequency of 75 MHz Other Information: None
108 – 117.975 MHz	Command & Control and/or Detect & Avoid	Protected	Aeronautical use: Instrument Land System with 50kHz channelization, VHF Omni-Ranging with 50 kHz channelization, Ground Based Augmentation System with 25 kHz channelization & VHF Data Link Mode 4 with 25 kHz channelization. Other Information: None
117.975 – 137 MHz	Command and Control	Protected	Aeronautical use: analogue voice communications with 8.33 kHz channelization, VHF Data Link Modes 2 & 4 with 25 kHz channelization Other Information: None
328.6 – 335.4 MHz	Detect & Avoid	Protected	Aeronautical use: Instrument Landing System with 150 kHz channelization. Other Information: None
960 – 1 165 MHz	Command & Control and/or Detect & Avoid	Protected	Aeronautical use: Distance Measurement Equipment with 1 MHz channelization, Secondary Surveillance Radar on 1030 & 1090 MHz, Automated Collision Avoidance System on 1030 & 1090 MHz, Automatic Dependent Surveillance – Broadcast on 1090 MHz and Universal Access Transceiver on 978 MHz Potential future use for a new air ground communication system as well as UAS Command & Control Other Information: Shared with MoD's Joint Tactical Information Distribution System
1 165 – 1 215 MHz	Detect & Avoid	Protected	Aeronautical use: Distance Measurement Equipment with 1 MHz channelization Other Information: Planned use by high precision/integrity Global Navigation Satellite Systems and shared with MoD's Joint Tactical Information Distribution System
1 215 – 1 350 MHz	Detect & Avoid	Protected	Aeronautical use: En-route primary radar above 1260 MHz

			Other Information: Global Navigation Satellite Systems below 1260 MHz
2 400 – 2 500 MHz	Command & Control and/or Detect & Avoid	Unprotected	Aeronautical use: None Other Information: Power limited to 100 mW with a requirement for “listen before talk” or “detect and avoid” mitigation and a maximum power spectral density of 10 mW/MHz
2 700 – 3 100 MHz	Detect & Avoid	Protected	Aeronautical use: Airport approach and windfarm mitigation radar Other Information: None
4 200 – 4 400 MHz	Command & Control and/or Detect & Avoid	Protected	Aeronautical use: radio altimeters that sweep across the whole frequency band and wireless avionic intra-communication Other Information: None
5 000 – 5 030 MHz	Command & Control and/or Detect & Avoid	Protected	Aeronautical use: None currently but is available for aeronautical satellite communication Other Information: None
5 030 – 5 091 MHz	Command & Control and/or Detect & Avoid	Protected	Aeronautical use: Microwave Landing System at Heathrow and reserved for co-ordinated use by both terrestrial/satellite UAS communication systems Other Information: None
5 091 – 5 150 MHz	Command & Control and/or Detect & Avoid	Protected	Aeronautical use: Aeronautical mobile airport communication system Other Information: MoD use for telemetry
5 150 – 5 250 MHz	Detect & Avoid	Protected	Aeronautical use: None Other Information: None
5 350 – 5 470 MHz	Detect & Avoid	Protected	Aeronautical use: None Other Information: None
5 725 – 5 875 MHz	Command & Control	Unprotected	Aeronautical use: None

	and/or Detect & Avoid		Other Information: Power limited to 25mW
8 750 – 8 850 MHz	Detect & Avoid	Protected	Aeronautical use: none Other Information: None
9 000 – 9 200 MHz	Detect & Avoid	Protected	Aeronautical use: Airport surface movement radar Other Information: None
9 300 – 9 500 MHz	Detect & Avoid	Protected	Aeronautical use: Airport surface movement radar & airborne weather radar Other Information: Used for maritime radar
13.25 – 13.4 GHz	Detect & Avoid	Protected	Aeronautical use: None Other Information: None
15.4 – 15.7 GHz	Detect & Avoid	Protected	Aeronautical use: None Other Information: None
66 – 71 GHz	Detect & Avoid	Protected	Aeronautical use: None Other Information: None
76 – 81 GHz	Detect & Avoid	Unprotected	Aeronautical use: None Other Information: Use of the frequency band 76 – 77.5 GHz is restricted to ground use only
95 – 100 GHz	Detect & Avoid	Protected	Aeronautical use: None Other Information: None

Table 2 - Spectrum Allocation

Applications for the assignment of frequencies within the bands identified or otherwise must be addressed to Ofcom.

Note 1: Any proposed use that does not conform to the regulatory limits applicable within a frequency band will need to be shown to be compatible with incumbent systems and approved/ licenced by Ofcom.

Note 2: Any aircraft system transmitting on 1030 MHz, as may typically be used in collision warning or Detect and Avoid systems, must not be operated without an approval from the National IFF and SSR Committee (NISC) (see CAP 761).

3.3.1.4 Allocation of Spectrum

The CAA supports Ofcom by providing the UK lead on issues related to aeronautical spectrum, including UAS. For information on how to participate in the process for the identification and allocation of spectrum that can be used to support UAS operations contact the CAA.

Licencing of frequency allocations is the responsibility of Ofcom and hence, where required, all applications for a frequency assignment should be directed in the first instance to Ofcom. In frequency bands where the CAA is the assigning authority, then the application will be passed to the CAA by Ofcom so that the CAA can conduct the technical work, but Ofcom still remains the licencing authority.

Where a frequency licence is required (e.g. in protected frequency bands or where powers exceed the current regulatory limits) the CAA will not be able to issue a permission or exemption.

3.3.1.5 Use of 35 MHz, 2.4 GHz and 5.8GHz

There are no specific frequencies allocated for use by UAS in the UK. However, the most commonly found are 35 MHz, 2.4 GHz and 5.8 GHz.

35 MHz is a frequency designated for model aircraft use only, with the assumption that clubs and individuals will be operating in a known environment to strict channel allocation rules. It is therefore not considered to be a suitable frequency for more general UAS operations (i.e. not in a club environment) where the whereabouts of other users is usually difficult to assess.

2.4 GHz is a licence free band used for car wireless keys, household internet and a wide range of other applications. Although this is considered to be far more robust to interference than 35 MHz, operators must act with appropriate caution in areas where it is expected that there will be a high degree of 2.4 GHz activity.

In addition, operations close to any facility that could cause interference (such as a radar station) could potentially disrupt communications with the UAS, whatever the frequency in use.

3.4 Electronic Conspicuity

The UK's airspace is a finite resource. The rapid growth in UAS operations is driving changes to the way air traffic is managed and aircraft are segregated. UAS are expected to co-exist with manned aircraft and there must be means for each aircraft to be able to identify and respond to the other aircraft. While most UAS operations are expected to operate at lower altitudes, some UAS are also expected to operate at higher altitudes. To integrate new and existing airspace users into the finite volume of airspace safely and efficiently, all conventional aircraft must be able to 'see, be seen and avoid', and UAS must be able to 'detect and be detected' by means of available and recognised Electronic Conspicuity (EC) technology if operating BVLOS in non-segregated airspace. This section offers guidance to industry on the use of available and recommended EC solutions. The UK is considering a number of options including a mandate on the use of Electronic Conspicuity in the UK airspace.

3.4.1. EC terminology

EC is an umbrella term for technologies that can help airspace users and ATS to be more aware of aircraft operating in the same airspace with the ability to 'see and be seen', or 'detect and be detected'.

The term 'EC solutions' refers to the devices, systems, and infrastructure that bring these technologies to market and ensure that they are interoperable.

'Full adoption' of EC solutions means that all users operating in a designated block of airspace can be detected electronically.

3.4.2. EC as a concept

EC could help to reduce the number of mid-air collisions through increasing both the quantity and quality of information for remote pilots, increasing their situational awareness. The CAA recognises that the development of EC solutions for UAS will be an evolutionary process and may take number of years for individual EC technologies to reach maturity.

Although a range of technologies, devices, services and infrastructure could achieve a degree of EC, this does not mean that any technology, infrastructure, service or device which involves a form of conspicuity will automatically be classified as EC compatible or authorised. In order to be authorised as 'EC compatible' a piece of equipment, device or service will first have to satisfy certain minimum performance, reliability, safety, interoperability and efficiency standards.

UAS operators should be aware of the certain obligations before buying and using an EC device. Full details on these aspects can be found in [CAP 1391 Electronic conspicuity devices](#) .

Note: *A Mode S transponder does not fall under the scope of CAP1391 and the requirement for light weight low power Mode S does not meet the performance requirement of a general transponder certification requirement. However, there is scope for the use of some transponders if they meet ETSO or FAA TSO certification standard. For more information on certification standards, please refer to 3.2.*

3.5 Radar and Surveillance Technologies

The following requirements are applicable to all civil UAS operating BVLOS within non-segregated UK airspace (the London and Scottish Flight Information Regions [FIR] and Upper Flight Information Regions [UIR]), regardless of origin.

3.5.1 Introduction

UAS must be able to interact with all other airspace users, regardless of the airspace or aircraft's flight profile, in a manner that is transparent to all other airspace users and Air Navigation Service Providers (ANSPs), when compared to manned aircraft. Unmanned Aircraft must be interoperable with all surveillance systems, without any additional workload for ATCOs, manned aircraft pilots or other remote pilots. UAS must include suitable equipment to satisfy any applicable equipage requirements of the airspace in which they are operating, such as Transponder Mandatory Zones (TMZs) or Radio Mandatory Zones (RMZs) to be interoperable with other airspace users and ATC. Where a UAS employs a collision avoidance system with reactive logic, any manoeuvre resulting from a perceived threat from another aircraft must not reduce the effectiveness of a TCAS II resolution advisory manoeuvre from that aircraft.

3.5.2 Surveillance technologies

This section is complementary to the Detect and Avoid (DAA) guidance contained in 3.6 below.

There are various ways in which aircraft communicate and broadcast information about their position and can otherwise be made conspicuous. Air traffic management is achieved through a combination of surveillance technologies such as ground-based radar, ADS-B and Wide Area Multilateration (WAM). All these technologies offer some degree of Electronic Conspicuity. This section sets out the most prominent surveillance technologies, their basic characteristics and functionally.

The primary means of cooperative surveillance within the UK is SSR Mode Select Elementary Surveillance (Mode S ELS). However, within certain areas of UK airspace, the carriage of an SSR transponder is not mandatory (see UK AIP Gen 1.5). In such airspace, where an Air Traffic Radar service is not mandatory, 'see and avoid' is often the primary means of separation of aircraft. Until it is possible to equip UAS with DAA capabilities that comply with appropriate future requirements and the SSR carriage policy, any UA intended to be operated in an area where it requires surveillance services must be equipped with a functioning SSR Mode S transponder, unless operating within the terms of an exemption from this requirement.

Electronic Conspicuity (EC) devices offer an alternative, low cost option for cooperative airborne surveillance that can effectively signal an aircraft's presence to other similarly equipped airspace users, thereby enhancing situational awareness for those users. EC may assist remote pilots in remaining clear of other aircraft when operating beyond visual line of sight.

3.5.2.1 ADS-B

Automatic Dependent Surveillance- Broadcast (ADS-B) based Electronic Conspicuity is the modern version of surveillance via which the aircraft determines its own position using GNSS and periodically broadcasts its four-dimensional position (latitude, longitude, altitude, and time), velocity, airspeed, identity, and other additional relevant data as appropriate to the potential ground systems or to nearby aircraft. ADS-B data can be used to facilitate airborne traffic situational awareness, spacing and separation. A major difference between ADS-B and ground based radar surveillance system is that there is no interrogation or two-way contract.

ADS-B OUT refers to the transmission of data from one UAS to the another UAS or UAS to manned aircraft or UAS to the remote pilot or system on the ground.

ADS-B IN refers to the on-board receipt of ADS-B OUT data by another UAS or manned aircraft and allows for the display of nearby aircrafts to the remote pilot.

3.5.2.1.1 ADS-B frequencies

Under existing arrangements, ADS-B devices exchange information at 1090 MHz. However, this could lead to spectrum congestion in low level airspace. ICAO has issued a letter to States prohibiting the use of 1090 MHz below 500 feet. The UK is currently exploring the use of 978 MHz for UAS to mitigate the risk of spectrum overloading at 1090 MHz.

3.5.2.2 Radar Surveillance

There are two types of ground-based radar systems that can be used for surveillance and aircraft traffic management:

- Primary Surveillance Radar (PSR) is a conventional radar that illuminates a large portion of space with an electromagnetic wave that is reflected by the target aircraft. A PSR system is used to detect the position and movement of a non-cooperative target (with no equipment such as transponder or EC device on board). However, the Radar Cross Section (RCS) and size of certain

categories of aircraft will make detection by PSR systems difficult, especially at low-level.

- Secondary Surveillance Radar (SSR) is a Cooperative surveillance system which requires aircraft to be suitably equipped to be able to interact with surveillance sensors. Aircraft respond to ground interrogations via their on-board transponder. The global standard frequency for SSR to interrogate aircraft is 1030 MHz and aircraft replies on 1090 MHz via on-board transponder.

3.5.3 ICAO 24-bit Aircraft Address

The provision of Air Traffic Services (ATS) in a Mode S environment relies on a unique ICAO 24-bit Aircraft Address (AA) for selective interrogation of individual aircraft. In the SSR environment, the 24-bit AA is used as technical means of identification for use by the surveillance system, for example a Mode S SSR. ADS-B based EC devices also use 24-Bit AA as a means of system identification.

3.5.3.1 24-bit AA for EC devices

EC devices including Light weight Low power Mode-S transponders are designed to be portable, and potentially move from one UA to another; Different rules will need to apply to them. This section explains the licensing obligation and responsibilities of both manufacturers and UAS operators.

- The EC device should not be pre-loaded with an ICAO 24-bit address.
- The device should allow for the ICAO 24-bit address to be programmable or reprogrammable by the user. Manufacturers should put in place a means of mitigating incorrect 24-bit entry, such as a requirement to enter the 24-bit address twice. A function should also exist to clear the programmed 24-bit ICAO address, and to alert the user should no ICAO 24-bit address be entered. Full instructions on how to complete these tasks should be contained within the device operating manual.
- Attention of manufactures is also drawn to more detailed instructions and guidance contained in CAP1391 Chapter 6 and Annex A.
- If an EC device is bought to use on an UAS, the owner is required to contact the CAA Infrastructure Section (email: NISC@caa.co.uk) shortly after buying the device. The operator must confirm their contact details and the make, model and serial number of the EC device. The CAA will then allocate the EC device a unique ICAO 24-bit address. The address can then be used on

multiple Unmanned aircraft without re-programming.

- If the EC device is re-sold, the vendor should clear any registered aircraft 24-bit code from the device before sale. The new purchaser should contact the CAA at the above email address to allow records to be updated and a unique code allocated if necessary.

3.5.4 Special purpose transponder codes

If a UAS is equipped with a transponder and operating in an area where use of the transponder is necessary, the capability to change SSR code whilst in flight must be included.

SSR code 7400 is used in order to notify ATC of a lost C2 Link. The UAS must be able to select this in such circumstances.

3.6 Detect and Avoid (DAA) capabilities

3.6.1 Introduction

Detect and Avoid is a generic expression which is used to describe a technical capability that is at least equivalent to the 'see and avoid' principle used in manned aviation to avoid collision with other aircraft and obstacles. When operating VLOS, the rules apply to UAS in the same way that VFR apply to manned aircraft. However, BVLOS UAS operations in a non-segregated airspace will not normally be permitted without an acceptable DAA capability. In order to maintain the appropriate levels of safety, a suitable method of aerial collision avoidance is required for all UAS operations.

Note: *The use of 'First Person View R/C' equipment is not considered to be acceptable for use as a DAA solution.*

In order to be able to gain access to all classes of airspace without segregation, UAS will have to be able to display a capability that is equivalent to the existing safety standards applicable to manned aircraft types. These capabilities will need to be appropriate to the class (or classes) of airspace within which they are intended to be operated.

This section outlines the position of the CAA in respect of its role in assisting the UAS industry to find solutions to achieving a capability and level of safety which is equivalent to the existing 'see and avoid' concept. Of course, a Detect and Avoid (DAA) capability is only one of a number of requirements that will need to be addressed for safe operation of UAS, particularly for operations in non-segregated airspace.

3.6.2 General

The overriding principle when assessing if proposed UAS DAA functions are acceptable is that they must not introduce a greater hazard than currently exists for manned aviation. The UAS must be operated in a way that enables it to comply with the rules and obligations that apply to manned aircraft within the same class of airspace, particularly those applicable to separation and collision avoidance.

An EC based solution could, if the airspace within which it is used was suitably mandated to be fully 'cooperative', enable DAA capabilities to be achieved by UAS in a shorter timeframe.

3.6.3 Separation Assurance and Collision Avoidance Elements

Separation and collision avoidance are two distinct and potentially independent elements

to a DAA capability, as described below. DAA replaces the capability that is provided in a manned aircraft by the pilot looking out of window which should include minimum of following functions:

- Detect and avoid traffic (aircraft in the air and on the ground) in accordance with the Rules of the Air;
- Detect and avoid all airborne objects, including gliders, hang-gliders, paragliders, microlights, balloons, parachutists etc;
- Enable the remote pilot to determine the in-flight meteorological conditions;
- Avoid hazardous weather;
- Detect and avoid terrain and other obstacles.

3.6.3.1 Detect Function

The detect function is intended to identify potential hazards (other aircraft, terrain, weather etc.) and notify the appropriate mission management and navigation systems.

3.6.3.2 Avoid Function

The avoid function may be split down into two parts:

3.6.3.2.1 Separation Assurance/Traffic Avoidance

This term is used to describe the routine procedures and actions that are applied to prevent aircraft getting into close proximity with each other. Any resolution manoeuvring conducted at this stage must be conducted in accordance with the Rules of the Air. When flying in airspace where the provision of separation is the responsibility of ATC, however, the remote pilot must manoeuvre the aircraft in accordance with ATC instructions, in the same fashion as is done for a manned aircraft.

3.6.3.2.2 Collision Avoidance

This is the final layer of conflict management and is the term used to describe any emergency manoeuvre considered necessary to avoid a collision; such a manoeuvre may contradict the Rules of the Air or ATC instructions. While the remote pilot would normally be responsible for initiating a collision avoidance manoeuvre, an automatic

function may be required in order to cater for collision avoidance scenarios where the remote pilot is unable to initiate the manoeuvre in sufficient time (e.g. due to C2 Link latency issues or lost C2 Link scenarios).

3.6.4 Minimum DAA Requirements for Routine Operations

For routine BVLOS operations in non-segregated airspace a DAA capability will always be required unless the UAS operator is able to provide the CAA with clear evidence that the operation that is being proposed will pose no hazard to other aviation users.

The minimum level of DAA capability that is required may be adjusted in accordance with the flight rules under which the UA flight is being conducted and class of airspace that the UA is being flown in as follows

3.6.4.1 IFR flights within controlled airspace (Classes A to E)

A Collision Avoidance capability will be required

- ATC separates from other traffic (although in Class D and E, the pilot of a conflicting VFR flight holds the separation responsibility)
- As for manned aviation, a collision avoidance capability is required in case the 'normal' separation provision fails
- If the flight is conducted wholly within controlled airspace where the operation of a transponder is mandatory, then a collision avoidance capability that is cooperative (e.g. ACAS) would be acceptable

If there is any possibility that the UAS will/might leave controlled airspace and enter non-segregated Class G airspace during the flight (including in an emergency), then the collision avoidance capability must be 'non-cooperative', unless there are other airspace measures in place that would still allow a cooperative system to be used; this includes airspace such as a Transponder Mandatory Zone, airspace above FL100 (where the operation of a transponder is required) etc.

3.6.4.2 VFR flights within controlled airspace, or any flight within Class G airspace

A Separation Assurance/Traffic Avoidance capability **and** a Collision Avoidance capability will be required

- The remote pilot is the separator for all conflicts, with the same responsibilities as the pilot of a manned aircraft

3.6.5 Factors for Consideration When Developing a DAA Capability

To ensure that a DAA capability can provide the required level of safety, it must address a number of component functions including:

- threat detection
- assessment of the collision threat
- selection of an appropriate avoidance manoeuvre
- execution of a manoeuvre that is compatible with the aircraft's performance capabilities and airspace environment

The CAA does not define the matters to be taken into account for the design of aircraft or their systems. However, for the guidance of those engaged in the development of DAA systems, some of the factors that may need to be considered are listed below:

- Ability to comply with the Rules of the Air;
- Airworthiness;
- Control method, controllability and manoeuvrability;
- Flight performance;
- Communications procedures and associated links.
- Security (physical and cyber);
- Emergency actions, reversionary or failure modes in the event of degradation of any part of the UAS and its associated Control and/or Relay Stations;
- Actions in the event of lost communications and/or failure of on-board DAA equipment;
- Ability to determine real-time meteorological conditions and type of terrain being overflown;
- Nature of task and/or payload;
- System authority of operation and control;
- Method of sensing other airborne objects;
- Remote pilot level of competence;
- Communications with ATS providers, procedures and links with control station;
- Means of launch/take-off and recovery/landing;
- Reaction logic to other airspace objects;

- Flight termination;
- Description of the operation and classification of the airspace in which it is planned to be flown;
- Transaction times (e.g. including delays introduced by satellite links);
- Address both cooperative and non-cooperative air traffic.

3.7 Remote identification (Remote ID)

Remote ID is the ability of a UAS to provide identification information that can be received by other parties. The purpose of Remote ID is to assist CAA, Law enforcement and Security agencies to identify a rogue UA or remote pilot or operator who appears to be operating in an unsafe manner or in an area where the UA is not permitted to fly. Remote ID builds on the CAA Drone and model aircraft registration and education service (DMARES) framework.

‘Direct remote identification’ refers to a system that ensures the local broadcast of information about a UA in operation, including the marking of the UA, so that this information can be obtained without physical access to the UA itself.

‘Network remote identification’ is a system that transmits information through a connection with a network. In this case, the receiver does not receive the information directly, but through the network.

3.7.1 Remote ID requirements

3.7.1.1 Open category

The product standards in the UAS DR require that any UAS marked as Class C1, C2 or C3 must have a direct remote ID capability; this must be active (i.e. switched on) and up to date whenever the UA is being flown.

If any other UA is equipped with a remote ID capability, this must be active and up to date whenever the UA is being flown in the Open category.

3.7.1.2 Specific category

UAS operators are required to ensure that each UA is installed with a remote ID system by 2 December 2021.

From this date it must be active (i.e. switched on) and up to date whenever the UA is being flown.

Note: *This requirement is aimed at the use of remote ID as one of the necessary elements for the functioning of future UTM systems.*

3.7.1.3 Transmission Options

If equipped with a **Direct Remote Identification System** it shall allow, in real time

during the whole duration of the flight the periodic transmission of at least the following data, in a way that it can be received by existing mobile devices:

- the UAS operator registration number and the verification code provided by the CAA
- the unique serial number of the UA
- the time stamp, the geographical position of the UA and its height above the surface or take-off point
- the route course measured clockwise from true north and ground speed of the UA
- the geographical position of the remote pilot
- an indication of the emergency status of the UAS

If equipped with a **Network Remote Identification System** it shall allow, in real time during the whole duration of the flight, the transmission from the UA using an open and documented transmission protocol, in a way that it can be received through a network, of at least the following data:

- the UAS operator registration number and the verification code provided by the CAA
- the unique serial number of the UA
- the time stamp, the geographical position of the UA and its height above the surface or take-off point
- the route course measured clockwise from true north and ground speed of the UA
- the geographical position of the remote pilot or, if not available, the take-off point
- an indication of the emergency status of the UAS

3.8 UAS Traffic Management (UTM)

ICAO defines UTM as:

“a specific aspect of air traffic management which manages UAS operations safely, economically and efficiently through the provision of facilities and a seamless set of services in collaboration with all parties and involving airborne and ground-based functions.”

The concept of UTM, or U-space as it is referred to within the EU, is still in its relative infancy and regulations are still under development. Further details will be provided within this section once further progress has been made.

For more information for the CAA’s current position on UTM, please refer to [CAP1868 - A Unified approach to the Introduction of UAS Traffic Management](#).

3.9 Autonomy and Automation

3.9.1 Introduction

This guidance relates to the regulatory interpretation of the term “autonomous” and provides clarification on the use of high authority automated systems in civil UAS.

The dictionary definition of autonomy is “freedom from external control or influence”. The need to meet the safety requirements, defined in the various Certification Specifications under CS XX.1309, for "Equipment, Systems and Installations" means that at this point in time all UAS systems are required to perform deterministically. This means that their response to any set of inputs must be the result of a pre-designed data evaluation output activation process. As a result, there are currently no UAS related systems that meet the definition of autonomous.

In general, automated UAS systems fall in to two categories:

- Highly automated – those systems that still require inputs from a human operator (e.g. confirmation of a proposed action) but which can implement the action without further human interaction once the initial input has been provided.
- High authority automated systems – those systems that can evaluate data, select a course of action and implement that action without the need for human input. Good examples of these systems are flight control systems and engine control systems that are designed to control certain aspects of aircraft behaviour without input from the flight crew.

The concept of an “autonomous” UAS is a system that will do everything for itself using high authority automated systems. It will be able to follow the planned route, communicate with Aircraft Controllers and other airspace users, detect, diagnose and recover from faults and operate at least as safely as a system with continuous human involvement. In essence, an autonomous UAS will be equipped with high authority control systems that can act without input from a human.

3.9.2 What is the Difference between Automation and Authority?

Automation is the capability of a system to act using a set of pre-designed functions without human interaction (e.g. robotic manufacturing).

The level of authority a system has is defined by the results that the system can achieve. For example, a flight control computer may only be able to command a shallow roll angle, whereas the human flight crew will be able to demand a much higher angle of roll. A full authority system will be able to achieve the same results as a human operator.

3.9.3 Use of High Authority Automatic Systems

High authority automatic systems have the capability to take actions based on an evaluation of a given dataset that represents the current situation including the status of all the relevant systems, geographical data and environmental data.

Although these systems will take actions based on an evaluation of a given dataset, they are required to be deterministic in that the system must always respond in the same way to the same set of data. This means that the designs of the associated monitoring and control systems need to be carefully considered such that the actions related to any given dataset are appropriate and will not hazard either the aircraft or any third parties in the same area.

High authority automatic systems are usually composed of a number of sub-systems used to gather data, evaluate data, select an appropriate set of actions and issue commands to related control systems. These systems can include flight management systems, detect and avoid systems, power management systems, etc.

In a UAS a system can have authority over two types of function: general control system functions (e.g. flight control computers) and navigational commands.

3.9.4 Delegation to a High Authority Automatic System

The concept of high authority automatic systems covers a range of varying degrees of system authority ranging from full authority where the systems are capable of operating without human control or oversight to lesser levels of authority where the system is dependent upon some degree of human input (e.g. confirmation of proposed actions).

The level of authority a system can have with respect to navigational commands may vary during any flight, dependent upon the hazards the aircraft is faced with (e.g. terrain or potential airborne conflict with other aircraft) and the time available for the human operator to effectively intervene. If the aircraft is flying in clear airspace with no nearby terrain the system may be designed such that any flight instructions (e.g. amendment to a flight plan) are instigated by a human operator. However, if the aircraft is faced with an immediate hazard (terrain/other aircraft) and there is insufficient time for a human operator to intervene (based on signal latency etc.) the UAS will need to be able to mitigate that risk. These mitigations may include the use of full authority automatic systems.

Although it is anticipated that most systems will be operated using a lesser level of authority, the design of the overall system (command unit, the aircraft itself and related operational procedures) will need to take account of the failure conditions associated with loss of the command and control communications link between the control station and

the aircraft and this may drive a need for the use of full authority systems.

3.9.5 Potential Future Developments

3.9.5.1 Learning/Self-Modifying Systems

A learning, or self-modifying system is one that uses data related to previous actions to modify its outputs such that their results are closer to a previously defined desired outcome. Although learning systems do have the potential to be used in UAS, the overall safety requirements (for example the need to comply with CS XX.1309) still apply. This means that it may not be possible to use these systems to their full potential.

It is also important to note that these systems have the potential to be more susceptible to the effects of emergent behaviour and, as such, the evaluation of such systems would out of necessity need to be very detailed.

3.9.5.2 Other Potential Developments

It is possible that, at some point in the future, the aviation industry may consider the use of non-deterministic systems to improve overall system flexibility and performance.

Whilst there are no regulations that specifically prohibit this, the use of non-deterministic systems will drive a number of system and operational safety assessment issues that will need to be addressed before the use of this type of technology could be accepted for use in aviation.

3.9.6 Human Authority over Autonomous UAS

The general principle to be observed is that all UAS must be under the command of a remote pilot. Dependent upon the level of autonomy, a remote pilot may simultaneously assume responsibility for more than one aircraft, particularly when this can be accomplished safely whilst directing the activities of one or more other remote pilots. However, if this option is to be facilitated the applicant will need to demonstrate that the associated human factors issues (displayed information, communication protocols, etc) have been fully considered and mitigated.

3.9.7 Safe Operation with Other Airspace Users

Autonomous UAS must demonstrate an equivalent level of compliance with the rules and procedures that apply to manned aircraft. Therefore, this will require the inclusion of an approved Detect and Avoid capability when UAS are operating in non-segregated airspace.

3.9.8 Compliance with Air Traffic Management Requirements

Any autonomous UAS operation is expected to work seamlessly with⁶ ATM providers and other airspace users. The autonomous UAS will be required to comply with any valid ATC instruction or a request for information made by an ATM unit in the same way and within the same timeframe that the pilot of a manned aircraft would. These instructions may take a variety of forms and, for example, may be to follow another aircraft or to confirm that another aircraft has been detected in an equivalent manner to being “*in visual sight*”.

3.9.9 Emergencies

The decision-making function(s) of any autonomous UAS must be capable of handling the same range of exceptional and emergency conditions as manned aircraft, as well as ensuring that malfunction or loss of the decision-making function(s) itself does not cause a reduction in safety.

3.9.10 Factors for Consideration when Applying for Certification of Autonomous Systems

3.9.10.1 Data Integrity

Autonomous systems select particular actions based on the data they receive from sensors related to the aircraft environment (airspeed, altitude, met data etc), system status indicators (fault flags, etc), navigational data (programmed flight plans, GPS, etc.) and command and control data received from control stations. As such, UAS developers will need to ensure that any data related to autonomous control has a sufficient level of integrity such that the ability to comply with basic safety requirements is maintained. This will require the development of appropriately robust communication and data validation systems.

⁶ This means that air traffic controllers should not have to do anything different using radiotelephony or landlines than they would for other aircraft under their control, nor should the controller have to apply different rules or work to different criteria.

3.9.10.2 Security

An autonomous system must be demonstrated to be protected from accepting unauthorised commands, or from being “spoofed” by false or misleading data. Consequently, UAS will have a high degree of dependence upon secure communications, even if they are designed to be capable of detecting and rejecting false or misleading commands. Security issues are covered in more detail at 2.8.

CHAPTER 4 | Personnel

4 Personnel

4.1 The UAS Operator

As with any other form of aviation, the *operator*, is viewed as being the central and essential element of a successful aircraft operation. Aviation regulation principles largely concentrate on the conduct and oversight of the operator; in simple terms, *“if the operator is organised and efficient, then the operation will be safe and effective”*.

The “UAS operator” is defined as ‘any legal or natural person operating or intending to operate one or more UAS’.

Note: ‘natural person’ is the term used when legally referring to a human being and ‘legal person’ is the term used when legally referring to an organisation/company or similar.

4.1.1 Minimum age

The minimum age for a natural person to become a UAS operator in the UK is 18 years of age, within any category of operation.

The minimum age for operators of Unmanned aircraft is defined as follows:

- **Small Unmanned aircraft:** Set out within SI 2019 No. 1286- in the Air Navigation (Minimum Age for Operators of Small Unmanned Aircraft) Regulations 2019.
- **All other Unmanned Aircraft:** The CAA will not accept applications for registration as a UAS operator within any category, from persons who are below the age of 18.

4.1.2 Responsibilities of the UAS operator

The UAS operator is responsible for the overall operation of the UAS, and most specifically the safety of that operation. This includes the conduct of any safety risk analysis of the intended operations.

The UAS operator’s responsibilities that are particular to each operating category are listed at Annexes A, B and C. A more general set of responsibilities is listed below.

4.1.2.1 Operational procedures development/operations manual

The UAS operator is responsible for developing procedures that are adapted to the type of operations and to the risks involved, and for ensuring that those procedures are complied with.

The extent of the detail that needs to be provided within those procedures will clearly vary depending on the relative complexity of the operation and/or the organisation involved.

- Open category - written procedures may not always be necessary, especially if the UAS operator is also the only remote pilot. The limitations of the Open category and the operating instructions provided by the UAS manufacturer may be considered sufficient. If more than one remote pilot is employed, the UAS operator should:
 - develop and produce procedures for in order to coordinate the activities between its employees; and
 - establish and maintain a list of their personnel and their assigned duties.
- Specific category – an operations manual, detailing the scope of the organisation and the procedures to be followed would be required as a minimum. This should be expanded as necessary to cover any increased complexity in the types of UAS being flown, or of the types of operation being conducted.
- Certified category – the full suite of documentation, as expected for an equivalent manned aircraft operation, will be required.

4.1.2.2 Remote pilots and other operations and maintenance personnel

The UAS operator is responsible for:

- nominating a remote pilot and any associated personnel for each flight;
- ensuring that all nominated personnel are sufficiently competent to conduct the flight;
- ensuring that all nominated personnel are sufficiently briefed on the tasks that they are required to perform;
- ensuring that all remote pilots are fully familiar with the UAS operator's operating procedures and the operating instructions provided by the manufacturer of the UAS.

4.1.2.2.1 Use of contracted remote pilots

When authorised by the CAA to do so, UAS operators are permitted to utilise remote pilots on

an individual contract basis. In so doing, the UAS operator maintains responsibility for the safety of the operation and for ensuring that the competence and obligations of the remote pilot are met in the same way as would be if the contracted remote pilot was an employee of the UAS operator. UAS operators that do not discharge their responsibilities for contracted remote pilots risk having their authorisations suspended or revoked.

4.1.2.3 Unmanned aircraft and associated supporting systems

The UAS operator is responsible for ensuring that the UAS provided for the operation:

- is suitable for the intended operation;
- is properly maintained and in a safe condition to be flown;
- supports the efficient use of radio spectrum in order to avoid harmful interference and that the relevant C2 Link frequencies being used are appropriately licensed.

4.1.3 Regulatory oversight of UAS operators by the CAA

Regulatory oversight is a crucial ingredient of an effective regulatory framework and the CAA is responsible for the oversight of UK civil aviation activities. The CAA uses a performance-based oversight process to deliver oversight in a proportionate manner.

Within the Specific and Certified categories, UAS operators are subject to a routine oversight programme in order to ensure that UAS operators continue to perform in a safe manner.

Due to its low risk nature, the Open category is not subject to any direct regulatory oversight by the CAA but is instead subject to direct enforcement by the police or any other appropriate enforcement authority.

The UAS operator must allow the CAA to undertake any oversight activities that are necessary to determine compliance with UAS Regulations and continued compliance any operational authorisations or operating certificates. This requirement is regardless of whether the UAS operator's activities are contracted or subcontracted to another organisation.

The UAS operator must allow the CAA to review any report, make any inspection and perform or witness any flight or ground examination that is necessary to check the validity of the UAS operator's authorisation.

4.1.3.1 Audits

The CAA will conduct an annual desktop review of the operations manuals, remote pilot currency logs and any other relevant information when UAS operators apply to renew their operational authorisation. In addition, some UAS operators will be selected for an 'on-site' audit on a random basis.

Depending on the complexity of the organisation or the operations being conducted by the UAS operator, performance-based oversight principles may dictate that the CAA's level of oversight is increased. This may mean more frequent audits of some UAS operators, or variations in the scope and manpower employed to conduct the audit.

On-site audits will be normally be scheduled with the UAS operator, although the CAA reserves the right to conduct audits at 'no notice' if such an action is considered necessary. Audits will be conducted by the UAS Unit and may be carried out at the UAS operator's 'base' and/or at an operating location while carrying out an operating task.

Any findings or observations will be discussed during the audit and a timescale for their rectification will be agreed.

Oversight reports will be distributed to UAS operators within 28 working days of completion of an audit. The UAS operator will be expected to respond within the allocated timescale detailing the actions it intends to take to rectify any identified issues. Further communication will continue as considered necessary by the CAA until the oversight report and associated findings/observations are closed.

4.1.3.2 Findings and observations

When objective evidence is found by the CAA during an audit or inspection that shows non-compliance with the applicable requirements, a finding will be notified to the UAS operator. In extreme cases, the UAS operator's operational authorisation or operating certificate may be limited, suspended or even revoked immediately.

Findings are classified as follows:

- A **level-one finding** is any non-compliance with these requirements that could lead to uncontrolled non-compliances and which could affect the safety of a UAS operation;
- A **level-two finding** is any non-compliance with these requirements that is not classified as level-one.

An *observation* may be raised where there is potential for future non-compliance if no action is taken, or where the CAA wishes to indicate an opportunity for safety

improvement or indicate something that is not considered good practice.

4.1.3.3 Subsequent actions

On receipt of a notification of a finding or an observation, the following actions must be taken:

- In the case of a level-one finding, the UAS operator shall demonstrate corrective action to the satisfaction of the CAA within a period of no more than 21 working days after written confirmation of the finding;
- In the case of a level-two finding, the corrective action period granted by the CAA shall be appropriate to the nature of the finding but shall not normally be more than six months. In certain circumstances and subject to the nature of the finding, the CAA may extend the six-month period subject to a satisfactory corrective action plan;
- In the case of an observation, corrective action is not obligatory, but a UAS operator would be expected to provide a sound reasoning as to why the observation is not being followed.

4.1.3.4 Suspensions and revocations

In some cases, a level-one or level-two finding may result in a limitation, suspension or revocation of an operational authorisation or operating certificate.

If notified of a suspension or revocation, the UAS operator shall provide the CAA with written confirmation of receipt of the notice of suspension or revocation within two working days of receipt.

- A provisional suspension means that a UAS Operators operational authorisation or operating certificate is suspended pending further investigation;
- A limitation means that only a specified part of the UAS Operators operational authorisation or operating certificate is suspended pending corrective action;
- A suspension means that the entire UAS Operators operational authorisation or operating certificate is suspended pending corrective action.

A revocation means that a UAS operator is no longer authorised to operate and may no longer exercise the privileges of any operational authorisation or operating certificate until a new application has been made and a new operational authorisation or operating certificate has been issued.

4.1.3.5 Fitness of character considerations

The CAA is under an obligation to be satisfied, on a continuing basis, of the fitness of character of individuals and post holders which it authorises or certifies in accordance with applicable legislation. Clearly, this obligation applies to the oversight of UAS operators.

The CAA will consider options for any regulatory intervention when available information indicates that a person may no longer have the fitness of character appropriate to the privileges of their licence, certificate or authorisation. The CAA has discretion in relation to how fitness of character is assessed and to the specific action that is taken in each circumstance.

Further details of the CAA's policy can be found [here](#) .

4.2 The Remote Pilot

The “remote pilot” is defined as ‘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.’

The remote pilot is therefore a key component in ensuring that UA are flown safely and legitimately.

4.2.1 Minimum age

The minimum ages for flying alone (i.e. without being supervised by an older/qualified person) within the UK are determined by the operating category as follows:

4.2.1.1 Open category

No minimum age - Privately built UAS with a flying weight of less than 250g, and toys within class C0

12 years - All other UAS within the Open category

Note 1: Remote pilots below 12 years of age may still fly a UA, but only when under the direct supervision of a remote pilot aged at least 16 years; the person being supervised must have already passed the ‘flyer ID’ test.

Note 2: The CAA understands that the Department for Transport expects to remove this age restriction completely in 2021.

4.2.1.2 Specific category

The minimum age for remote pilots operating within the Specific category is 14 years of age.

4.2.1.3 Certified category

The minimum age for flight within the Certified category is determined by the minimum age requirements of the licence that is used.

4.2.2 Responsibilities

The remote pilot is nominated for each flight by the UAS operator and is responsible for the overall conduct of that flight, with safety obviously being the primary consideration. Where other personnel are also involved in the operation, the remote pilot would normally also be expected to be 'in command' of those personnel.

The remote pilot's responsibilities that are particular to each operating category are listed at Annexes A, B and C. A more general set of responsibilities is listed below

4.2.2.1 General requirements

Remote pilots must:

- Have the appropriate remote pilot competency, dependent on the operating category to be able to conduct the flight within the designated operating category.
- Be fully familiar with the UAS operator's operating procedures.
- Be fully familiar with the operating instructions provided by the manufacturer of the UAS.

Remote pilots must not:

- Perform their duties while under the influence of psychoactive substances or alcohol or when they are unfit to perform their tasks due to injury, fatigue, medication, sickness or other causes (see 4.2.6 and 4.2.7 below for further details)

4.2.2.2 Pre-flight responsibilities

Before the flight is commenced, remote pilots must:

- Ensure that all information regarding the airspace within which the flight will take place has been checked and updated, and any relevant clearances or authorisations have been obtained.
- Ensure that the operating environment is compatible with the intended flight (weather conditions, electromagnetic energy conditions, survey of obstacles, uninvolved persons, critical infrastructure etc).
- Ensure that the UAS is in a serviceable condition to complete the intended flight as planned. This includes:

- updating any relevant geo-awareness data;
- the completion of any specified pre-flight checks;
- ensuring that the UA has sufficient fuel to complete the planned operation with any suitable reserve needed to cater for contingencies;

Note: the term “fuel” is intended to include all sources of energy for UA, to include (but not limited to) petroleum based, solar, battery or any future source that provides energy to the UA.

- The checking and, if necessary, programming of any lost C2 Link, return to home, or other emergency recovery function to confirm its serviceability;
- the security of any payloads fitted to the UA;
- the operation of any lighting and/or remote identification systems.

4.2.2.3 In-flight responsibilities

While the UA is in flight, remote pilots must:

- Comply with the operational limitations that are applicable to the operating category that the UA is being flown in;
- Avoid any risk of collision with other aircraft and discontinue the flight if it may pose a risk to other aircraft, persons, environment or property;
- Comply with the operational limitations regarding to any airspace reservations, Flight Restriction Zones or other UAS related geographical zones that are within or close to the area that the UA is being flown in;
- Comply with the operating procedures that are set out by the UAS operator;
- Ensure that the UA is not flown close to or inside any areas where an emergency response effort is ongoing, unless they have permission to do so from the responsible emergency response personnel.

Note: The term ‘emergency response effort’ covers any activities by police, fire, ambulance, coastguard or other similar services where action is ongoing in order to preserve life, protect the public or respond to a crime in progress. This includes activities such as road traffic collisions, fires, rescue operations and firearms incidents, although this list is not exhaustive.

4.2.3 Competency Requirements

Remote pilots must be competent to perform their duties.

The competency of the personnel involved in the operation of an unmanned aircraft is a major factor in ensuring that unmanned aircraft operations remain tolerably safe. Within any UAS operation, the primary focus is obviously placed on the competency of the remote pilot.

Following on with the principle of taking a risk-based approach, the regulations use the competency of the remote pilot as a way of complementing the other risk mitigations and so the precise level of competency that is required is dependent on the category of operation. The differing requirements are outlined below and are also listed at A3.2.2, B3.2.2 and C3.2.2 respectively.

4.2.3.1 Open category

Apart from subcategory A1 operations involving unmanned aircraft that have a mass of less than 250g, all remote pilots operating in the Open category are required to complete an online training course and successfully complete an online theory test before they can fly; Upon completion, a remote pilot will be issued with a 'flyer ID'. This is valid for 5 years, at which point it must be renewed.

This test is the 'foundation' upon which all other levels of remote pilot competency are built; it is a multiple-choice examination and there is no requirement to undertake any practical flight test. The testing package also includes an educational module known as '[The Drone and Model aircraft Code](#)' (the principle being similar to the Highway Code as used for car driving).

The theory test is accessed via the CAA's operator registration webpages and is at this link [Register and take the test to fly](#)

The individual competency requirements for each subcategory are listed below.

4.2.3.1.1 A1 subcategory

The remote pilot competency requirements for the A1 subcategory are dependent on the flying weight or class of UA being flown as follows:

UA mass/class	Competency requirements
Less than 250g or class C0	Read the user manual
C1	Obtain a 'flyer ID'
A1 Transitional (<500g)	Obtain a 'flyer ID' and an A2 CofC (see 4.2.3.1.2 below)

4.2.3.1.2 A2 subcategory

Flights within the A2 subcategory involve the operation of larger UA (less than 4kg flying weight) within residential, commercial, industrial or recreational areas (which may also be known as ‘congested areas’) and in closer proximity to uninvolved persons.

Because of the additional risks involved, remote pilots must successfully pass an additional theoretical examination to obtain an A2 Certificate of Competency (A2 CofC).

The A2 CofC is a remote pilot competency certificate primarily intended to assure safe operations of unmanned aircraft close to uninvolved persons. The certificate assures an appropriate knowledge of the technical and operational mitigations for ground risk (the risk of a person being struck by the unmanned aircraft).

The examination is conducted at an RAE test facility (see 4.2.4 below). Further details are contained within [CAP 722B](#).

4.2.3.1.3 A3 subcategory

Remote pilots flying within the A3 subcategory must be in possession of a ‘flyer ID’.

4.2.3.2 Specific category

Due to the wide-ranging scope of the Specific category, the remote pilot competency requirements also will vary widely, dependent on the type of operation being conducted.

Remote pilot competency requirements will be set out in each individual operational authorisation document. UAS operators will be expected to propose the levels of remote pilot competency through the risk assessment associated with the particular operation.

Depending on the type and complexity of the operation, competency requirements could range from as little as the ‘flyer ID’ test of the Open category, all the way up to a manned aircraft pilot’s licence or a ‘Remote Pilot Licence’ (when the RPL requirements are finalised).

For operations using a PDRA, the remote pilot competency requirements will be specified within the text of the relevant PDRA scenario (see GVC below).

4.2.3.2.1 The General VLOS Certificate (GVC)

The General VLOS Certificate (GVC), is a remote pilot competency certificate which has been introduced as a simple, 'one stop' qualification that satisfies the remote pilot competency requirements for VLOS operations within the Specific category.

The GVC satisfies the competency requirements of any published PDRA that involves VLOS flight.

The GVC is comprised of a theoretical examination and a practical flight test, which are both conducted at an RAE facility. The 'basic' GVC can also be augmented by additional 'modules' which address any additional remote pilot competency levels that may be required in order to comply with the requirements of slightly more complex operations, such as those involving 'airspace observers'.

Further details of the GVC can be found in [CAP 722B](#).

4.2.3.3 Certified category

For the certified category, the requirements are as follows, the remote pilot will be expected to hold either:

- an appropriate manned aviation pilot's licence associated with the type of operation being conducted (with appropriate mitigation related to the operation of the particular unmanned aircraft); or,
- an RPL (when the RPL requirements are published and applicable).

Note: *The requirements for the licensing and training of United Kingdom civil remote pilots have not yet been fully developed. United Kingdom requirements will ultimately be determined by ICAO Standards and Recommended Practices (SARPs). ICAO has developed initial standards for a Remote Pilot's Licence (RPL), but these are part of a larger SARPS package that will not become applicable until 2024 at the earliest. Until formal licensing requirements are in place the CAA will determine the relevant requirements on a case-by-case basis, taking into account additional factors such as the type of operation being conducted, and the system being operated.*

4.2.3.4 Remote pilot currency requirements

Remote pilot currency requirements are listed at B3.2.3 and C3.2.2.

4.2.4 Recognised Assessment Entities (RAE)

The Recognised Assessment Entity (RAE) Scheme has been developed to assist the CAA in assuring the competence of remote pilots for many of the 'large volume' VLOS operations that require an operational authorisation. The CAA approves RAEs to assess the competence of remote pilots against a specific set of requirements and to issue the appropriate certificate on the CAA's behalf. The names of all approved RAE organisations are published on the CAA's website.

Further information regarding RAEs can be found in [CAP 722B](#).

4.2.5 Transition plans for remote pilot competency

4.2.5.1 Open category

Remote pilots who obtained a 'Flyer ID' prior to 31 December 2020 may continue to fly in the Open category until the 'Flyer ID' expires, as follows:

- A1 subcategory – when flying a UA with an MTOM/'flying weight' of less than 250g;
- A3 subcategory – when flying a UA with an MTOM/'flying weight' of less than 25kg.

Further details are contained in A3.2.2.

4.2.5.2 Specific category

In general, the remote pilot competency elements within the Specific category are determined within the risk assessment that is provided by the UAS operator to the CAA. As a result, there are no unique transition requirements applicable to operations that were previously conducted under an OSC based permission or exemption. UAS operators are required to ensure that remote pilots remain competent to conduct their operations in compliance with the operational authorisation.

Further details can be found in B3.2.2 and B3.2.7. These are particularly relevant for remote pilots that are flying under an NQE 'full recommendation', or under an alternative qualification deemed acceptable in the previous edition of CAP 722.

4.2.6 Medical requirements

Remote pilots must not fly when they are unfit to perform their tasks due to injury, fatigue, medication, sickness or 'other causes'.

4.2.6.1 Open category

While there are no specific requirements or medical standards set out for operations in the Open category, as an outline guide remote pilots should apply the same considerations that they would before driving a motor vehicle or riding a pedal cycle on the road.

4.2.6.2 Specific category

The medical requirements for operations within the Specific category will be set out in the operational authorisation. Normally, this will be achieved by reference to the medical requirements that have been set out by the UAS operator in its operations manual, although in some cases, additional requirements may be expressed more precisely.

UAS operators will be expected to propose details of their required medical standards through the risk assessment associated with the particular operation.

4.2.6.3 Certified category

Remote pilots in the Certified category must comply with the medical standards of the licence that they hold.

4.2.7 Alcohol and psychoactive substances – limitations

The UAS IR sets out some basic requirements regarding the remote pilot's responsibilities in regard to alcohol and psychoactive substances (drugs) while conducting flying duties.

These limitations are applied in conjunction with the operating category as follows:

4.2.7.1 Alcohol

4.2.7.1.1 Open Category

The regulatory requirement is that remote pilots must not perform their duties under the influence of alcohol. [UAS.OPEN.060(2)(a)]

- While no actual limits are specified, the alcohol consumption limitations that are prescribed for driving a car may be considered as an appropriate limit when flying in the Open category. (i.e. if you are fit to drive a car, then you should be considered fit to fly in the Open category)
- These limits are:

Level of alcohol	England, Wales & Northern Ireland	Scotland
Micrograms per 100 millilitres of breath	35	22
Micrograms per 100 millilitres of blood	80	50
Micrograms per 100 millilitres of urine	107	67

- Personnel carrying out support functions that are directly related to the safe operation of the UA while in flight, such as unmanned aircraft observers, or airspace observers, should comply with the same limitations. Remote pilots are directly responsible for ensuring that such personnel are fit to undertake their duties.

4.2.7.1.2 Specific category

The regulatory requirement is that remote pilots must not perform their duties under the influence of alcohol. [UAS.SPEC.060(1)(a)].

UAS operators will be expected to propose details of proposed alcohol limits for operational personnel within the risk assessment associated with their particular operation, and will be reflected within the operational authorisation.

- While no actual limits are specified, because of the more advanced nature of flying in the Specific category, and in particular the requirement to comply with the precise conditions of the operational authorisation, the limits prescribed for manned aviation in [Railways and Transport Safety Act 2003](#) (RTSA 2003) Section 93 should be complied with.
- These limits are:

Level of alcohol	All UK nations
Micrograms per 100 millilitres of breath	9
Micrograms per 100 millilitres of blood	20
Micrograms per 100 millilitres of urine	27

- Personnel carrying out support functions that are directly related to the safe operation of the UA while in flight, such as unmanned aircraft observers, or airspace observers, should comply with the same limitations. Remote pilots are directly responsible for ensuring that such personnel are fit to undertake their duties.

4.2.7.1.3 Certified category

The prescribed limits of alcohol for remote pilots, as set out in Section 93 of RTSA 2003 must be complied with.

- These limits are:

Level of alcohol	All UK nations
Micrograms per 100 millilitres of breath	9
Micrograms per 100 millilitres of blood	20
Micrograms per 100 millilitres of urine	27

4.2.7.2 Psychoactive substances

4.2.7.2.1 Open category

Remote pilots must not perform their duties under the influence of psychoactive substances. [UAS.OPEN.060(2)(a)]

4.2.7.2.2 Specific category

Remote pilots must not perform their duties under the influence of psychoactive substances. [UAS.SPEC.060(1)(a)].

4.2.7.2.3 Certified category

Remote pilots must not carry out any aviation function if their ability to perform the function is impaired because of drugs. [RTSA 2003 Section 92]

Note: For the purposes of RTSA 2003, the term 'drug' includes any intoxicant other than alcohol.

4.2.8 Radio Licensing

4.2.8.1 Use of Radio Telephony

There are some circumstances in which the use of VHF radiotelephony (RT) voice communications may be necessary and may form part of a mitigation within a risk assessment, for a specific category UAS operation. These are primarily situations where quick communication is needed with the air traffic service unit, and/or enhanced situational awareness for both the remote pilot, and other pilots, is necessary.

VHF RT within the Open category should not be used.

The use of VHF RT is strictly controlled for several reasons and will only be considered as a mitigation within a safety case for those operations which absolutely require it.

Such circumstances *may* include:

- Operations within the close vicinity of an aerodrome, where permission for entry into an FRZ/ATZ has been arranged and the use of VHF RT has been requested by the aerodrome
- Beyond Visual Line of Sight operations outside segregated airspace
- Operations in close vicinity to other, involved, manned aviation- such as air shows and displays

It is not possible to give an exhaustive list of such circumstances when the use of VHF RT is appropriate, and it is the responsibility of the operator to apply such a mitigation appropriately. Acceptance of such a mitigation within the safety case does not authorise its use. A number of requirements must also be met in order to legally make use of VHF RT, which are detailed below.

If the operation is approved with such a mitigation, then the following requirements must be met and detailed within the operations manual, and may also be set out within the conditions of the operational authorisation:

- Suitable VHF radio must be installed on the unmanned aircraft, and a relay to the ground station provided to enable remote pilot communication. The equipment and installation must be approved by EASA or the CAA. A ground-based VHF radio must not be used.
- Appropriate licence held by the remote pilot; this will normally be an FRTOL, which must be issued by the CAA following recommendation from an

examiner. Further information can be found [here](#).

- Appropriate radio licence; the radio must either be licenced, or have an exemption from the wireless telegraphy act, to operate. Ofcom issue these licences. Further information can be found on the Ofcom aeronautical licencing web pages [here](#).

Further information on radio requirements can be found in AIP GEN 1.5 section 5.

In some cases, an innovation and trial licence may be suitable. Further information on the Ofcom Innovation and trial licence can be found [here](#).

The use of radiotelephony on aeronautical band radios within the Specific category for contact with air traffic control should be limited to exceptional circumstances and be carried out as directed by the air traffic service unit with which the remote pilot needs to communicate. In the vast majority of circumstances VHF RT is not required, and other methods of communication and/or procedural mitigations are sufficient.

CHAPTER 5 | Human Factors and Safety Management

5 Human Factors and Safety Management

5.1 Introduction

This Chapter offers guidance to industry on how to address the Human Factors issues associated with the design, operation and maintenance of UAS and the proper development, implementation and assurance of a Safety Management System (SMS) as defined in ICAO Annex 19 (Safety Management System).

It is recognised by the CAA that it is important to include effective Human Factors considerations in the design, operation and maintenance of UAS.

The fundamental concepts of Human Factors in aviation are covered by CAP 719. Additional guidance on human factors issues associated with aircraft maintenance is provided in CAP 716.

It is important to recognise that the human is an integral element of any UAS operation and, therefore, in addition to the existing Human Factors issues that relate to aviation development, operation and maintenance, several unique Human Factors issues associated with remote operation will also need to be addressed.

This guidance outlines several Human Factors recommendations related to the design, production operation and maintenance of UAS flown routinely in UK airspace.

Of equal importance is the principle of an effective Safety Management System (SMS) as detailed in ICAO Annex 19 which defines the steps to follow the identification of hazards, safety reporting, risk management, performance measurement and safety assurance. A Safety Management System program is important for both manned and unmanned aviation. Correct application of the Safety Management System in all categories of operations is important, and will ensure the operation is managed in line with appropriate safety parameters.

5.2 Human Factors

5.2.1 General Human Factors

A systems approach must be adopted in the analysis, design and development of the UAS. This approach deals with all the systems as a combined entity and addresses the interactions between those systems. Such an approach must involve a detailed analysis of the human requirements and encompass the Human Factors Integration domains:

- Manpower;
- Personnel;
- Training;
- Human Engineering;
- System Safety;
- Health Hazards.

5.2.2 Design Human Factors

There are two groups of Human Factors issues that need to be addressed for design:

- Human factors issues affecting design teams;
- Design induced remote pilot or maintenance human factors issues.

5.2.2.1 Human Factors that affect design Teams

There are two levels of Human Factors issues that need to be addressed for design:

- Human factors that affect design teams;
- Design induced remote pilot or maintenance human factors issues.

Each of these issues can result in a design team making an error and failing to detect it before the aircraft or aircraft system enters service. These errors

can result in operational or maintenance problems (system failures, inappropriate maintenance etc) and can even drive additional human factors issues in other aviation domains such as the flight deck or maintenance because of a lack of quality assurance or control to avoid human error.

Organisations developing UAS must ensure that the programme management aspects of their projects address potential Human Factors issues (e.g. provision of appropriate work spaces and instructions, effective control of the number of simultaneous demands made on individuals, effective control of the rate of requirement change, management of fatigue etc). The process to achieve this must be described to the authority for any proposed certification project.

5.2.2.2 Design Induced Remote Pilot Human factors

The set of design induced remote pilot Human Factors issues includes but is not limited to:

- Non-optimal workspace layout which increases the likelihood of errors;
- Failure to provide on a timely manner relevant information for planning or corrective actions to the remote pilot;
- Incorrect amount of information or documentation provided to the Remote Pilot so that effective assimilation is not possible. Incorrect prioritisation of alerts;
- Insufficient notice of the need to perform a task (possibly related to data latency or poor planning);
- Inadequate, incomplete or ambiguous procedures, work instructions;
- Lack of clarity regarding where to find the relevant control instructions (Standard Operating Procedures, Aircraft Flight Manuals etc);
- Non-obvious system mode changes or mode confusion.

Each of these issues may result in a remote pilot either making an error or failing to detect an aircraft safety issue.

Organisations developing UAS must ensure that any identified potential Human Factors issues (e.g. management of information to the pilot so that

he/she can integrate this effectively, effective control of the number of simultaneous demands made on remote pilots etc) are addressed and mitigated as part of the UAS development processes. How this will be achieved must be described to the authority for any proposed certification project.

5.2.2.3 Design Induced Maintenance Human Factors

The set of design induced maintenance Human Factors issues includes but is not limited to:

- Incomplete situation awareness (because of missing/inadequate information and/or data latency);
- Information overload/underload;
- Incorrect prioritisation of alerts;
- Insufficient notice of the need to perform a task (possibly related to data latency or poor planning);
- Inadequate, incomplete or ambiguous procedures, work instructions;
- Lack of clarity regarding where to find the relevant control instructions (Standard Operating Procedures, Aircraft Flight Manuals etc);
- Non-obvious system mode changes.

Each of these issues can result in a maintenance error which could result in an aircraft safety issue.

Organisations that are developing UAS must ensure that any identified potential maintenance Human Factors issues (e.g. provision of clear and unambiguous task instructions etc) are addressed and mitigated as part of the UAS development processes. How this will be achieved must be described to the authority for any proposed certification project.

5.2.3 Operational Human Factors

In addition to operational Human Factors issues, experienced in other parts of the aviation system, the physical separation of the remote pilot introduces several issues that must be considered. These include but are not limited to:

- Degradation of information due to remote operation and associated lack of multi-sensory feedback, which does not allow the remote pilot to correctly understand how the UAS is operating or provides misleading information;
- Temporal degradation resulting from data latency, pilot recognition, pilot response and pilot command latency over the data link requires consideration in the design of controls and displays;
- The remote pilot's risk perception and behaviour may be affected by the absence of sensory/perceptual cues and the sense of a shared fate with the vehicle;
- Bandwidth limitations and reliability of the data link compromising the amount and quality of information available to the remote pilot and thereby limiting his/her awareness of the UAS status and position;
- If the remote pilot swaps with another remote pilot during a long flight, issues around effective hand-over procedures and communication must be mitigated (further details are provided later in this document).

It is therefore important to:

- Avoid presenting misleading cues and to consider alternative methods of representing the UAS data;
- Prioritise relevant data sent over the C2 Link to satisfy the needs for all phases of the operation;

Ensure that data link characteristics and performance (such as latency and bandwidth) are taken account of within the relevant information and status displays in the Command Unit.

5.2.3.1 Authority Control

The remote pilot is ultimately responsible for the safe conduct of the aircraft. They will, therefore, be required to sanction all actions undertaken by the aircraft whether that is during the planning stage (by acceptance of the flight plan) or during the execution of the mission via authorisation, re-plans or direct command. Though fully autonomous operation of a UAS is not currently envisaged, certain elements of a mission may be carried out without human intervention (but with prior authorisation). A good example of this is the Collision Avoidance System where, due to possible latency within the C2 Link, the remote pilot may not have enough time to react and

therefore the on-board systems may need to be given the authority to take control of the aircraft.

This level of independent capability, that must operate predictably and safely when required, can also be harnessed as a deliberative function throughout the flight. This supports a change in the piloting role from a low-level manual type of control to an effective high-level decision maker. Due to the nature of remote operation, the command unit need no longer be constrained to follow a traditional flight deck design philosophy and must be designed to fit the new operator role. Account may be taken of enhanced system functionality allowing the pilot to control the systems as required via delegation of authority.

A clear understanding of the scope of any autonomous operation and its automated sub-systems is key to safe operations. Specific areas that must be addressed include:

- User's understanding of the system's operation;
- User's understanding of what mode of operating the aircraft is in, and what level of control authority the system has
- Recovery of control after failure of an automated system;
- User's expertise in manual reversion (they will not necessarily be pilots);
- Boredom, habituation and fatigue of the pilot;

Design of the controls, including the design 'model', allowing the user to understand how the different levels of automation operate.

5.2.3.2 Ergonomics

The command unit will be the major interface between the remote pilot and the aircraft. The advice contained herein relates to the type of information and the nature of the tasks that would be undertaken at an command unit, it does not set the airworthiness, technical or security requirements. The ergonomic standards must ensure that the remote pilot works in an environment that is fit for purpose. That is;

- The environment does not create distractions;
- It provides a suitable and comfortable environment for a range of human crewmembers (for example different heights and other

anthropometrical measurements);

- It will allow the remote pilot to maintain alertness throughout a shift period;
- The ergonomics of the wider environment in which the command unit is located will be considered, including issues such as temperature and lighting.

The ergonomic requirements of 'handheld' (VLOS) remote pilot stations must also be considered. Careful consideration must be given to the environmental conditions that will be encountered when operating outdoors (excesses in temperature, wet or windy conditions etc.). The potential for distraction to the pilot is also much greater in this environment.

5.2.3.3 Remote Flight Crew Awareness

Several sub-systems associated with the operation of a UAS are likely to be complex in their operation and therefore may be automated. The system must provide the operator with appropriate information to monitor and control its operation. Provision must be made for the operator to be able to intervene and override the system (e.g. abort take-off, landing, go around).

5.2.3.4 Handovers to another command unit/Transfer of control between remote pilots

UAS operations may require the transfer of control to another remote pilot. This operation needs to be carefully designed to ensure that the handover is accomplished in a safe and consistent manner and would be expected to include the following elements:

- Offer of control;
- Exchange of relevant information;
- Acceptance of control;
- Confirmation of successful handover.

The exchange of information between remote pilots (co-located or remotely located) will require procedures that ensure that the receiving pilot has complete knowledge of the following:

- Flight Mode;
- UAS flight parameters and aircraft status;
- UAS sub-system status (fuel system, engine, communications, autopilot etc);
- Aircraft position, flight plan and other airspace related information (relevant NOTAMs etc.);
- Weather;
- The current ATC clearance and frequency in use;
- Positions of any relevant command unit control settings to ensure that those of the accepting command unit are correctly aligned with the transferring command unit.

The transferring pilot will remain in control of the unmanned aircraft until the handover is complete and the accepting pilot has confirmed that he is ready to assume control. In addition:

- Procedures to cater for the recovery of control in the event of a failure during the transfer process will be required;
- Special attention will be required when designing handover procedures involving a significant change in the control interface, for example between a VLOS 'Launch and Recovery Element' command unit and a BVLOS 'En-Route' command unit.

The effective Transfer of Controls between remote pilots procedures should be established on the Standard Operating Procedures (SOP) if required for the type of operation intended.

5.2.3.5 Crew Resource Management (CRM)

Crew Resource Management principles play an equally important role in the command unit as they do on a manned flight deck. The allocation and delineation of roles must ensure a balanced workload and shared or complementary understanding of the UAS status and proximity to other aircraft and flight paths to ensure that:

- The display design provides clear and rapid information retrieval matched to the human needs;
- The CU design promotes a clear and effective team co-ordination.

5.2.3.6 Fatigue and Stress

Fatigue and stress are contributory factors which are likely to increase the propensity for human error. Therefore, to ensure that vigilance is maintained at a satisfactory level in terms of safety, consideration must be given to the following:

- Crew duty times;
- Regular breaks;
- Rest periods and opportunity for napping during circadian low periods;
- Health and Safety requirements;
- Handover/Take Over procedures;
- The crew responsibility and task/cognitive workload (including the potential for 'boredom');
- Ability to mitigate the effects from non-work areas (e.g. financial pressure causing anxiety).

The work regime across the crew must take this into account. Where required, an effective Fatigue Reporting System should be implemented within the organisation to increase awareness of fatigue or stress risks and mitigate them accordingly.

Further information to support Fatigue Management approaches for safety relevant workers can be found in the ICAO Fatigue Management guidance material (Doc. 9966).

5.2.3.7 Degradation and Failure

Degradation of performance and failures will require a philosophy for dealing with situations to ensure consistent and appropriate application of warnings, both visual and auditory. The philosophy must ensure that:

The design provides good error detection and recovery;

The design is fail-safe and protects against inadvertent operator actions that could instigate a catastrophic failure;

In the event of degraded or total breakdown in the communication link the

status of the lost link will be displayed to the operator. Ideally the expected planned reactions of the UA to the situation will also be displayed to the operator;

Operating procedures are designed to be intuitive, not ambiguous and reinforced by training as required.

5.2.4 Maintenance Human Factors

The set of problems that can initiate Human Factors issues for maintenance teams is not dissimilar to other environments. These include but are not limited to:

- Insufficient time to perform a task;
- Insufficient training and experience to perform a task;
- Inadequate, incomplete or ambiguous procedures, work instructions;
- Inappropriate working environments that can lead to distraction (e.g. noisy offices, multiple demands on individual's time);
- Fatigue;
- Poor or non-existent working relationships with management and/or other teams.

Each of these issues can result in a maintenance team making an error and failing to detect it before the aircraft or aircraft system enters service. These errors can result in operational or maintenance problems (system failures, inappropriate maintenance etc.) and can even drive additional Human Factors issues in other aviation domains such as the flight deck or maintenance.

Organisations that are developing UASs must ensure that any maintenance Human Factors issues (e.g. provision of clear and unambiguous instructions) are addressed. How this will be achieved must be described to the authority for any proposed certification project.

5.2.5 Future Trends

Future developments in UAS Industry are moving towards reducing remote pilot workload through advanced decision support systems and enhanced

automation. Human Factors expertise will be central to such developments to produce a system that is not only safe but also ensures the correct level of crew workload for all mission tasks and phases of flight.

5.3 Safety Management

This section addresses general principles of an effective Safety Management System as described in ICAO Annex 19 – Safety Management System.

A safety management system (SMS) is a systematic approach to managing safety, including the necessary organisational structures, accountabilities, policies and procedures. (ICAO)

Even though the generic principles were initially focussed on manned aviation, it has been recognised that this system applies to many other industries and organisations for which their primary concern is the conservation of human life and property, reducing risks to a minimum tolerable level and as a result contributing to a safe, reliable and long-term operation.

5.3.1 The Four Pillars of an SMS

ICAO Annex 19 establishes Four basic pillars that form a complete Safety Management System. These are:

- Policy
- Risk management
- Assurance
- Promotion

The basic pillars are outlined below:

5.3.1.1 Policy

- Is the safety policy widely available and is the workforce fully engaged and supportive?
- Does the workforce appreciate the importance of hazard identification and safety reporting?
- Is adequate and timely feedback provided to the reporters?

These three questions apply across the entire organisation and are not confined to Flight Operations. This can only be achieved if management are likewise engaged and empowered to deliver the safety policy. What

evidence is available to demonstrate your enterprise approach to safety management? Items such as an increase in voluntary reporting rates for all departments can be used. Furthermore, the establishment of a Just Culture must be evidenced and must be used by management at all levels.

5.3.1.2 Risk Management

- Does the safety reporting system allow employees to submit hazard reports easily? If the system is complex or not easily accessible, the workforce will be reluctant to submit reports.
- Are the reports acted upon and is feedback provided to the reporters?
- Are risk registers up to date and accessible to management?
- How is the efficacy of risk controls/mitigations monitored?
- Is there adequate resource in place to meet the requirements of implemented risk controls?
- Are there processes in place to address both safety issue risk assessments and management of change?
- Does the risk process recognise that safety is only one part of the risk picture? Are risks assessed in terms of their impact on financial, reputation and environmental factors?
- Finally, how are risks communicated to the general workforce? Are diagrammatic representations such as Bow Tie visualisations used, that can be easily understood?

A primary objective of the risk control process should be to ensure that the appropriate resource is allocated to mitigate identified risks. Ideally, a register of all controls should be maintained alongside the risk register. All identified risks must be accepted by a responsible manager and high-level decisions should be made using risk-based analysis. Finally, there must be suitable processes in place to review and monitor all risks listed in the register as part of the assurance processes.

5.3.1.3 Assurance

- Are risk controls implemented and effective?
- Are controls reviewed regularly?
- Is the SMS improving continuously?
- Is the SMS delivering stated safety objectives?
- Has an Acceptable Level of Safety Performance (ALoSP) been agreed with the Regulator and can achievement of this be demonstrated?

Assurance is a key part of the SMS. Usually, the above requirements are met by the establishment of Safety Performance Indicators (SPIs) and Safety Performance Targets (SPTs). These items are discussed fully in Document 9859 (issue 4) and without these in place any organisation will find it difficult to demonstrate an ALoSP and continuous improvement of the SMS.

5.3.1.4 Promotion

Unless the safety policy and its objectives are communicated widely and in a format that is designed to engage all employees, it is unlikely to be effective. Poster campaigns can be useful, but short lived. Management must promote the safety policy continuously. This could be in the form of monthly safety newsletters by fleet managers (which could be a leading SPI if used). Again, this process should be adopted across all departments and whilst safety promotion is often positive in operational areas, the following questions should still be asked:

- Is it applied in all areas?
- How engaged are the other, non-operational, areas- for example, when did the commercial department last attend a risk assessment or a monthly safety meeting?

“Safety is no Accident. It Must be Planned”

Flight Safety Foundation

5.3.2 SMS Regulatory Framework

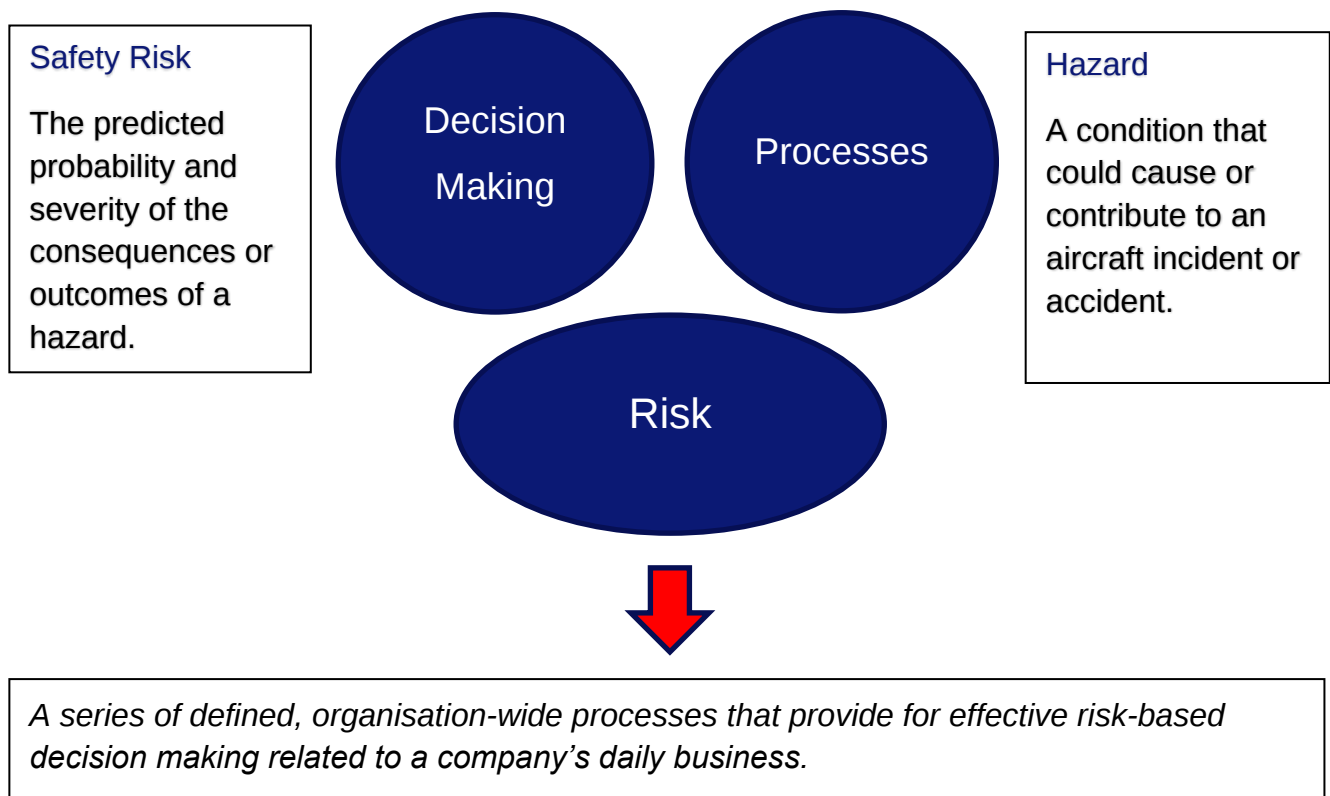
The ICAO Standards and Recommended Practices (SARPS) promulgated in several Annexes to the Chicago Convention require the implementation of a safety management system by the following aviation service provider organisations:

- Aircraft operators;
- Aircraft maintenance organisations;
- Air navigation services providers;
- Airport operators;
- training organisations;
- aircraft manufacturers.

UAS operators are currently not included in the above list of service providers. However, the 3rd edition (Amendment 2) of Annex 19 is likely to introduce new SARPs requiring UAS operators to have an effective SMS. This amendment is still being drafted, with an applicability date around 2026.

Because of the diverse relationships between the rulemaking bodies and the variety of aviation service provider organisations, it is of critical importance to standardise the SMS functions to the point that there is a common understanding of the meaning of SMS among all concerned organisations and authorities, both domestically and internationally. In this regard, the European Aviation Safety Agency (EASA) has implemented on the Unmanned Aircraft System (UAS) Certified Category the same basic principles as Manned Aviation, for which a proper and effective Safety Management System should be implemented by the organisation conducting the operation. For the upper level in the Specific Category, following a Safety Management System could be considered voluntarily with the intention of improving internal processes, accountabilities and in general enhancing the overall safety of the proposed operation.

5.3.3 General Safety Management System



5.3.4 Key Processes of an SMS

- **Hazard Identification**

A method for identifying hazards related to the whole organisation (operational + systemic hazards)

- **Safety Reporting**

A process for the acquisition of safety data not only related to product safety

- **Risk Management**

A standard approach for assessing risks and for applying risk controls

- **Performance Measurement**

Management tools for analysing how effectively the organisation's safety goals are being achieved

- **Safety Assurance**

Processes based on quality management principles that support continual improvement of the organisation's safety performance

5.3.5 Implementation and Assessment

Many aspects of safety management may already exist within an organisation. In order to introduce an SMS a gap analysis is the suggested first step to establish what components already exist, (E.g. for writing a safety case or risk assessment). It is important that the SMS corresponds to the size and complexity of the organisation and takes into consideration the nature of its operations.

Implementation steps could include:

- Obtain Senior Management buy-in;
- Appointing a Safety Manager / Team / Board;
- Undertake a gap analysis;
- Develop an implementation plan;
- Establish a risk assessment and control system;
- Use for internal occurrence reports, audit findings, organisational changes;
- Validate the matrix;
- Establish and encourage a reporting system and a hazard log;
- Produce a SMM or incorporate it into existing Exposition / Manuals;
- Training of staff;
- Ensure that all the SMS building blocks are in place;
- Consider contracted and subcontracted services;
- Proactively look for hazards;
- Establish the most significant safety issues and start to measure and manage them;
- Establish performance measures.

For the assessment of an SMS, CAA uses the SMS Evaluation Tool

(www.caa.co.uk/sms). The tool assesses the maturity of the SMS against the following levels: Present, Suitable, Operating and Effective.

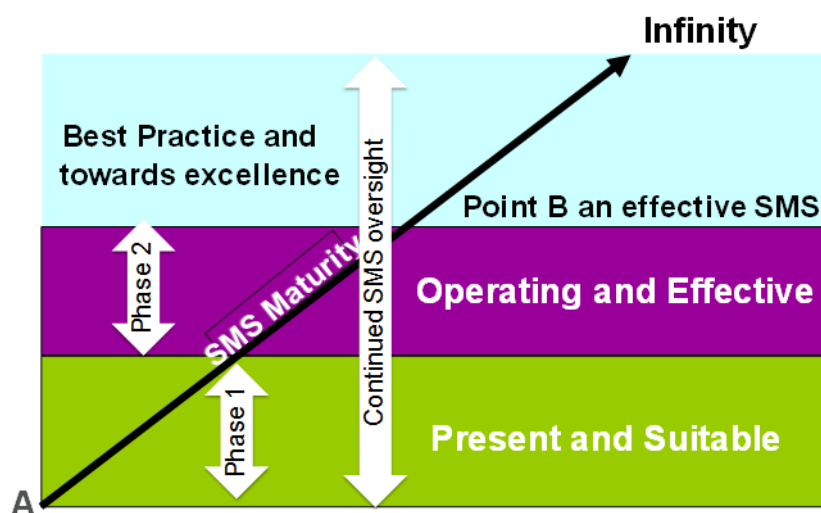
Present: There is evidence that the 'marker' is clearly visible and is documented within the organisation's SMS or MS Documentation.

Suitable: The marker is suitable based on the size, nature, complexity and the inherent risk in the activity.

Operating: There is evidence that the marker is in use and an output is being produced.

Effective: There is evidence that the marker is effectively achieving the desired outcome and has a positive safety impact.

In addition to being used for assessments by CAA, organisations are also able to use the tool internally to assess their SMS.



5.3.6 The Shell Model

The SHELL Model (Edwards, 1972) is a conceptual tool used to analyse the interaction of multiple system components. The figure below provides a basic depiction of the relationship between humans and other workplace components. The SHELL Model contains the following four components:

- Software (S): procedures, training, support, etc.;
- Hardware (H): machines and equipment;
- Environment (E): the working environment in which the rest of the L-H-S system must function; and

- Live ware (L): humans in the workplace.



Liveware. In the centre of the SHELL model are the humans at the front line of operations. Although humans are remarkably adaptable, they are subject to considerable variations in performance. Humans are not standardized to the same degree as hardware, so the edges of this block are not simple and straight. Humans do not interface perfectly with the various components of the world in which they work. To avoid tensions that may compromise human performance, the effects of irregularities at the interfaces between the various SHELL blocks and the central Live ware block must be understood. The other components of the system must be carefully matched to humans if stresses in the system are to be avoided. The SHELL Model is useful in visualizing the following interfaces between the various components of the aviation system:

- a) Liveware-Hardware (L-H). The L-H interface refers to the relationship between the human and the physical attributes of equipment, machines and facilities. The interface between the human and S H E L L 2-8 Safety Management Manual (SMM) technology is commonly considered with reference to human performance in the context of aviation operations, and there is a natural human tendency to adapt to L-H mismatches.

Nonetheless, this tendency has the potential to mask serious deficiencies, which may become evident only after an occurrence.

b) Liveware-Software (L-S). The L-S interface is the relationship between the human and the supporting systems found in the workplace, e.g. regulations, manuals, checklists, publications, standard operating procedures (SOPs) and computer software. It includes such issues as recency of experience, accuracy, format and presentation, vocabulary, clarity and symbology.

c) Liveware-Liveware (L-L). The L-L interface is the relationship among persons in the work environment. Since flight crews, air traffic controllers, aircraft maintenance engineers and other operational personnel function in groups, it is important to recognize that communication and interpersonal skills, as well as group dynamics, play a role in determining human performance. The advent of crew resource management (CRM) and its extension to air traffic services (ATS) and maintenance operations has created a focus on the management of operational errors across multiple aviation domains. Staff/management relationships as well as overall organizational culture are also within the scope of this interface.

d) Liveware-Environment (L-E). This interface involves the relationship between the human and both the internal and external environments. The internal workplace environment includes such physical considerations as temperature, ambient light, noise, vibration and air quality. The external environment includes operational aspects such as weather factors, aviation infrastructure and terrain. This interface also involves the relationship between the human internal environment and its external environment. Psychological and physiological forces, including illness, fatigue, financial uncertainties, and relationship and career concerns, can be either induced by the L-E interaction or originate from external secondary sources. The aviation work environment includes disturbances to normal biological rhythms and sleep patterns. Additional environmental aspects may be related to organizational attributes that may affect decision-making processes and create pressures to develop —workarounds or minor deviations from standard operating procedures.

5.3.7 Applying an SMS for the UAS Industry

The sensible and effective application of a Safety Management System to the different types of operations and categories is essential. These principles will help to contribute to the overall safety of the proposed operation and thus

reduce the risk of it causing harm to persons or property. SMS principles can be applied from the basic Open Category all the way up to the Certified Category. A good understanding of these principles, and the employment of a risk-oriented approach, will help to ensure a safe and reliable UAS operation.

ANNEX A | The Open Category

Annex A – The Open Category

Section A1 Operational Requirements

A1.1 General

A1.1.1 Type of operation

VLOS only, but a single ‘unmanned aircraft observer’ may be used as follows:

- The remote pilot is still responsible for the safety of the flight.
- the unmanned aircraft observer must be positioned next to the remote pilot and they must be able to communicate clearly and effectively with each other.
- the unmanned aircraft must be in the VLOS of the unmanned observer at all times.

A1.1.2 Mass

The MTOM, or flying weight if appropriate, of the unmanned aircraft must be less than 25kg (see below for additional mass limitations for subcategories A1, A2 and A3).

A1.1.3 Maximum operating height

The unmanned aircraft must be maintained within 120 metres (400ft) from the closest point of the surface of the earth.

Exceptions:

- Obstacles taller than 105m may be overflowed by a maximum of 15m provided that:
 - a. The person in charge of the obstacle has requested this; and,
 - b. The unmanned aircraft must not be flown more than 50m

horizontally from the obstruction.

- Unmanned sailplanes (gliders) may be flown further than 120 metres (400ft) from the closest point of the surface of the earth, but they must not be flown higher than 120 meters (400ft) above the remote pilot.

A1.1.4 Dropping of articles

Not permitted.

A1.1.5 Carriage of Dangerous Goods

Not permitted.

A1.1.6 Insurance

Recreational or sporting flights:	Not required.
Non-recreational flights:	Third party cover required iaw (EC)785/2004.

A1.2 Subcategory A1

A1.2.1 Operating Area

No flights within restricted airspace (Restricted Areas, Danger Areas, FRZs) without relevant permission.

Flight permitted within residential, commercial, industrial and recreational areas.

A1.2.2 Separation from uninvolved persons

Class C0 and UA less than 250g flying weight:

- No flight over assemblies of people.

Class C1 and 'A1 Transitional:

- No intentional flight over uninvolved persons.

A1.2.3 'Follow-me' mode

'Follow-me' mode may be used for flight, up to a maximum distance of 50m from the remote pilot.

A1.3 Subcategory A2

A1.3.1 Operating Area

No flights within restricted airspace (Restricted Areas, Danger Areas, FRZs) without relevant permission.

Flight permitted within residential, commercial, industrial and recreational areas.

A1.3.2 Separation from uninvolved persons

Class C2:

- No closer than 30m horizontally.
- If 'low-speed mode' is activated – employ 1:1 rule (see 2.1.3.1.1), but never closer than 5m horizontally.

'A2 Transitional':

- No closer than 50m horizontally.

A1.4 Subcategory A3

A1.4.1 Operating Area

No flights within 150m horizontally of residential, commercial, industrial or recreational areas.

No flights within restricted airspace (Restricted Areas, Danger Areas, FRZs) without relevant permission.

A1.4.2 Separation from persons

No uninvolved persons to be present within the area of the flight.

No closer than 50m horizontally at any time.

Employ 1:1 rule when reacting to unexpected issues (see 2.1.3.1.1).

Section A2 UAS Technical Requirements

A2.1 Subcategory A1

A2.1.1 Permitted UA types

UA with a flying weight of less than 250g, maximum speed less than 19 m/s.

Class C0 UA.

Class C1 UA.

'A1 Transitional' UA (flying weight of less than 500g).

Note: only until 31 December 2022 and subject to additional remote pilot competency

A2.2 Subcategory A2

A2.2.1 Permitted UA types

Class C2 UA.

'A2 Transitional' UA (flying weight of less than 2kg).

Note: only until 31 December 2022

Any UA able to be used in subcategory A1.

A2.3 Subcategory A3

A2.3.1 Permitted UA types

UA with a flying weight of less than 25kg.

Class C3 UA.

Class C4 UA.

Any UA able to be used in subcategory A2.

Section A3 Personnel Requirements

A3.1 UAS Operator

A3.1.1 Minimum age

All categories: 18 years of age.

A3.1.2 Registration

UAS operator registration is subject to a charge as defined in the CAA Scheme of Charges. The latest details can be found by looking for the CAA Scheme of Charges (General Aviation).section of the CAA's website [here](#) .

A3.1.2.1 A1 Subcategory

Class C0 and UA less than 250g flying weight:

- UAS operator must be registered if the UA is able to capture personal data (i.e. a camera) and is not a toy⁷.
- Registration not required if the UA is either a toy, or it is not able to capture personal data.

Class C1 and 'A1 Transitional':

- UAS operator must be registered.

A3.1.2.2 A2 Subcategory

UAS operator must be registered.

⁷ To be classed as a toy, a product must be able to comply with the 'Toys (Safety) regulations 2011. Essentially, a 'toy' is a product that is considered to be suitable for use by a person who is under the age of 14 years. Therefore, if the product is not marked as such within its packaging, then it cannot be considered to be a toy.

A3.1.2.3 A3 Subcategory

UAS operator must be registered.

A3.1.3 Operations manual

Observe limitations of the Open category and the operating instructions provided by the UAS manufacturer.

If more than one remote pilot is employed, the UAS operator should:

- develop and produce procedures in order to coordinate the activities between its employees; and
- establish and maintain a list of their personnel and their assigned duties.

A3.1.4 Responsibilities

As detailed in 4.1.2 plus the following:

- ensure personnel are provided with all information related to any geographical zones that are relevant to the UAS.
- ensure that any applicable geo-awareness systems are up to date.
- if using a UA with a Class marking (C0 to C4), ensure that:
 - the class identification is affixed to the UA;
 - the remote pilot is in possession of the corresponding declaration of conformity.
- ensure that all involved persons have been informed of the risks and have explicitly agreed to participate.

A3.2 Remote Pilot

A3.2.1 Minimum Age

A1 subcategory (Toys within Class C0 and privately built UA less than 250g flying weight only):

- No minimum age.

A1 (Class C0 non-toys, legacy UA less than 250g, Class C1 and 'A1 Transitional'), A2 and A3 subcategories:

- 12 years of age (16 if supervising another remote pilot).

A3.2.2 Remote Pilot Competence Requirements

A3.2.2.1 A1 Subcategory

Class C0 and UA less than 250g flying weight

- read user manual provided with UA.

Class C1

- DMARES online learning and obtain flyer ID.

A1 Transitional

- A2 CofC.

A3.2.2.2 A2 Subcategory

DMARES online learning and obtain flyer ID; and
A2 CofC.

A3.2.2.3 A3 Subcategory

DMARES online learning and obtain flyer ID.

A3.2.3 Responsibilities

As detailed in 4.2.2.

A3.2.4 Alcohol and drug limitations

Remote pilots must not perform duties under the influence of psychoactive

substances or alcohol.

A3.2.5 Medical limitations

Remote pilots must not perform duties when unfit to perform their tasks due to injury, fatigue, medication, sickness or other causes.

ANNEX B| The Specific Category

Annex B – The Specific Category

Section B1 Operational Requirements

B1.1 Operational Authorisation

UAS operators must be in possession of an operational authorisation, issued by the CAA, before any operation within the Specific category is conducted.

The operational authorisation sets out the privileges that are afforded and the limitations that must be followed when conducting the operation.

B1.1.1 Applications

Applications for an operational authorisation must be made using the application process listed in the UAS webpages of the CAA website www.caa.co.uk/uas.

The application process uses an online electronic application form, which includes the facility to attach copies of any relevant information, such as remote pilot competence and risk assessments. The CAA is unable to accept documents stored and hosted in third party cloud servers.

Failure to submit all required documentary evidence will delay the assessment process.

B1.1.1.1 Charges

All applications are subject to the payment of the necessary fees as defined in the CAA Scheme of Charges. The latest details can be found by looking for the CAA Scheme of Charges (General Aviation).section of the CAA's website [here](#)

B1.1.1.1.1 Case 2 (Reduced charge) applications

The CAA Scheme of Charges provides for some selected situations where it is

anticipated that the time required for the CAA to process and authorise the application would be less than expected for the majority of applications. As a result, these 'Case 2', applications are charged at a lower rate.

The following types of operation (only) may be applied for under 'Case 2' status'

- Flights above 400ft/120 metres that are conducted under VLOS;
- Flights of UAS with a mass that is less than 25kg at reduced distances from uninvolved persons down to a minimum of 30 metres;
- 'Extended VLOS' (EVLOS) flights using a maximum of one observer.

All other applications must be made as 'Case 1'.

Note: *despite fitting into one of the Case 2 categories above, if the amount of work expended by the CAA while processing an individual application exceeds 4 hours (e.g. because the application is unclear, or poorly justified), the application would then become a 'Case 1' and the higher charge would apply.*

B1.1.2 Transitional arrangements – Previously held permissions or exemptions

All permissions and exemptions issued to UAS operators by the CAA prior to 31 December 2020, under the basis of the ANO, will remain valid until their expiry date, or 1 January 2022, whichever is earlier.

UAS operators wishing to renew after 31 December 2020 should apply for renewal in the usual way. In return, they will receive an operational authorisation document which will contain the same privileges and restrictions as the permission/exemption that it replaced.

B1.2 Risk Assessment

Unless this is covered by a PDRA, as detailed in B1.3 below, the UAS operator must provide a full risk assessment to the CAA in order to conduct operations in the 'specific' category.

The guidance and acceptable methodologies for completing a risk assessment are contained in [CAP 722A](#) .

Note: *After evaluation of the risk assessment by the CAA, it may be determined that the risk being presented is unacceptable to the CAA. In such cases, the operation would need to be 'raised' to the certified category, or at*

the very least, require the use of a certificated UAS.

B1.3 Pre-defined Risk Assessments (PDRA)

The purpose of a Pre-Defined Risk Assessment is to reduce the volume of evidence or safety mitigation required to be presented by a UAS operator. PDRAs are developed around simple, repeatable and high-volume types of UAS operation where the safety mitigations can be easily identified (and largely rely on a 'known' level of remote pilot competence). They result in an operational authorisation that is in a standardised format and with pre-defined operational limitations.

Individual UK PDRA documents are listed in the following pages.

B1.3.1 Application

Complete the online application form which is on the [CAA website](#)

B1.3.2 UKPDRA01**PRE-DEFINED RISK ASSESSMENT – UKPDRA01**

Operations within 150 metres of any Residential, Commercial, Industrial or Recreational Areas for UAS with a Maximum Take-Off Mass of less than 25kg

WHAT?

This PDRA is designed to enable VLOS operations with UAS in the areas that are likely to be more 'congested' than the areas where subcategory A3 operations are permitted. It provides the same operating privileges to those previously available under a 'Permission for Commercial Operations'.

WHEN?

UKPDRA01 enables the following operations:

- VLOS only, maximum 500 metres horizontally from remote pilot; use of a UA observer situated next to the remote pilot, is permitted
- Maximum height not to exceed 400 feet above the surface
- Flight permitted within 150 metres of any Residential, Commercial, Industrial or Recreational Area for UAS.
- No flight within 50 metres of any uninvolved person, except that during take-off and landing this distance may be reduced to 30 metres.
- No flight within FRZs unless permitted by the relevant aerodrome
- No flight over or within 150 metres of open-air assemblies of more than 1000 persons

WITH?

- UAS mass of less than 25kg (fixed wing or rotary wing to be defined)
- UAS equipped with a mechanism that makes it land in the event of loss or disruption of C2 Link
- Insurance cover to meet insurance regulatory requirements (EC 785/2004)

HOW?

- UAS Operators must produce an operations manual which details how the flights will be conducted. CAP 722A contains further details (only the ConOps element of the operations manual is required for this PDRA)
- All remote pilots involved in the operation must be in possession of a valid GVC

DOCUMENTS TO BE INCLUDED IN THE APPLICATION

- Operations manual
- Copy of GVC for all remote pilots intending to fly under the authorisation

B1.3.3 UKPDRA02**PRE-DEFINED RISK ASSESSMENT – UKPDRA02**

Flights for Research and Development Testing of
UAS with a Maximum Take-Off Mass (MTOM)
between 25kg and 150kg

WHAT?

This PDRA is designed to enable short term initial research and development flights to be conducted, within a sterile area away from people and property. It allows a UAS manufacturer/developer to conduct initial 'proof of concept' flight tests without the need to produce a full risk assessment for a product that may not prove to be feasible for further development.

WHEN?

UKPDRA02 enables the following operations:

- UA Operations for the purpose of research and development
- Flights must be conducted within a sterile area free of any uninvolved persons
- No flight within 50 metres horizontally from any uninvolved persons
- Maximum height not to exceed 400 feet above the surface
- Flights must be conducted at least 150 metres horizontally from any Residential, Commercial, Industrial or Recreational Area
- Daytime operations ONLY and within VLOS
- Maximum horizontal distance from the remote pilot must not exceed 250 metres, unless a lesser control link radio range has been specified by the manufacturer. Direct unaided visual contact with the said aircraft must be maintained, sufficient to monitor its flight path for the purposes of avoiding collisions
- Maximum speed:
 - 35 knots in any direction where the MTOM is less than 75kg
 - 25 knots in any direction where the MTOM is between 75kg and 150kg
 - Where the speed cannot be measured, the Unmanned Aircraft is not to be operated at a speed that is greater than a fast walking pace
- Articles may be picked up by, raised to, and dropped or lowered from the UA provided that the activity is confined to a sterile area defined for this purpose, and is conducted in a way that will not endanger persons or property
- Operations must not be conducted in controlled airspace (Class D and E), except with the permission of the appropriate Air Traffic Control Unit

- Operations must not be conducted within Aerodrome Traffic Zones (ATZ), Restricted Areas or Danger Areas unless the requirements for access to such airspace has been complied with.
- Carriage of persons is not permitted

WITH?

- UAS with a maximum Take-Off Mass (MTOM) between 25kg and 150kg
- UAS equipped with a mechanism that makes it land in the event of loss or disruption of C2 Link
- Insurance cover to meet insurance regulatory requirements (EC 785/2004)

HOW?

- UAS Operators must produce an operations manual which details how the flights will be conducted. CAP 722A contains further details (only the ConOps element of the operations manual is required for this PDRA)
- All remote pilots involved in the operation must be in possession of a valid GVC

DOCUMENTS TO BE INCLUDED IN THE APPLICATION

- Operations manual
- Copy of GVC for all remote pilots intending to fly under the authorisation

B1.4 Insurance

All unmanned aircraft, other than those with a maximum take-off mass of less than 20kg which are being used for sporting or recreational purposes, must be insured for third party risks in accordance with EU 785/2004.

B1.5 The Light UAS Certificate (LUC)

Discuss with CAA prior to commencing any work on an application.

B1.6 Model Aircraft Associations

Article 16 of the Implementing Regulation enables model aircraft clubs or associations to apply for an authorisation to operate in the Specific category which recognises the unique characteristics of model aircraft flying.

B1.6.1 Application

Model clubs or associations should apply for an authorisation by following the same process that is used for an operational authorisation, including the submission of a risk assessment as detailed in CAP 722A.

B1.6.2 Validity

The authorisation will have a specified validity period (initially 1 year), after which it may be renewed.

B1.6.3 CAA oversight

Model clubs and associations, and their operations, will be subject to routine auditing by the CAA in a similar style to the auditing process employed for Specific category UAS operators.

Section B2 UAS Technical requirements

B2.1 UAS Technical Details

Applicants must demonstrate and evidence that the platform being used will not present an unacceptable level of harm to other airspace users and 3rd parties on the ground.

Refer to CAP 722A for details of what must be contained in the operator's risk assessment.

Section B3 Personnel Requirements

B3.1 The UAS operator

B3.1.1 Minimum age

18 years of age.

B3.1.2 Registration requirements

The UAS operator must be registered.

UAS operator registration is subject to a charge as defined in the CAA Scheme of Charges. The latest details can be found by looking for the CAA Scheme of Charges (General Aviation) section of the CAA's website [here](#).

B3.1.3 Operations manual

An operations manual should be developed which details the scope of the organisation and the procedures to be followed.

This should be expanded as necessary to cover any increased complexity in the types of UAS being flown, or of the types of operation being conducted.

B3.1.4 Responsibilities

As detailed in 4.1.2 plus the following:

- establishing:
 - procedures to ensure that the applicable security requirements are complied with;
 - measures to protect against unlawful interference and unauthorised access;
 - procedures to ensure that all operations are in respect of Regulation (EU) 2016/679 (GDPR);

- guidelines for its remote pilots to plan UAS operations in a manner that minimises nuisances, including noise and other emissions-related nuisances, to people and animals.
- ensure that before conducting operations, remote pilots and all other personnel in charge of duties essential to the UAS operation:
 - have been informed about the UAS operator's operations manual;
 - obtain updated information relevant to the intended operation about any geographical zones.
- ensure that each operation is carried out within the limitations, conditions, and mitigation measures specified in the operational authorisation;
- keep and maintain an up-to-date record of:
 - all the relevant qualifications and training courses completed by the remote pilot and the other personnel in charge of duties essential to the UAS operation and by the maintenance staff, for at least 3 years after those persons have ceased employment with the organisation or have changed their position in the organisation;
 - the maintenance activities conducted on the UAS for a minimum of 3 years;
 - the information on UAS operations, including any unusual technical or operational occurrences and other data as required by the operational authorisation for a minimum of 3 years;
- ensure that any UAS used are, as a minimum, designed in such a manner that a possible failure will not lead the UAS to fly outside the operation volume or to cause a fatality. In addition, Human-Machine interfaces shall be such to minimise the risk of pilot error and shall not cause unreasonable fatigue;
- maintain the UAS in a suitable condition for safe operation by:
 - as a minimum, defining maintenance instructions and employing an adequately trained and qualified maintenance staff;
 - using an unmanned aircraft which is designed to minimise noise and other emissions, taking into account the type of the intended operations and geographical areas where the aircraft

noise and other emissions are of concern; and

- complying with point UAS.SPEC.100, if required (use of certified equipment or UA).
- establish and keep an up-to-date list of the designated remote pilots for each flight;
- establish and keep an up-to-date list of the maintenance staff employed by the operator to carry out maintenance activities;
- *From 2 Dec 21* - ensure that each individual unmanned aircraft is installed with:
 - at least one green flashing light for the purpose of visibility of the unmanned aircraft at night; and
 - an active and up-to-date remote identification system.

B3.1.5 Record keeping

Flight activities for each UAS should be recorded by the UAS operator within a logbook.

The logbook may be generated in either electronic or paper formats.

- If the paper format is used, it should contain, in a single volume, all the pages needed to log the holder's flight time. When one volume is completed, a new one will be started based on the cumulative data from the previous one.

Records should be stored for 2 years in a manner that ensures their protection from unauthorised access, damage, alteration, and theft.

The following information must be recorded:

- the identification of the UAS (manufacturer, model/variant, serial number);

Note: *if the UA holds a registration (e.g. G-xxxx) this should be included*

- the date, time, and location of the take-off and landing;
- the duration of each flight;
- the total number of flight hours/cycles;
- the name of the remote pilot responsible for the flight;
- the activity performed;

- any significant incident or accident that occurred during the operation;
- a completed pre-flight inspection;
- any defects and rectifications;
- any repairs and changes to the UAS configuration; and
- if a certified UA, or certified equipment is used, the operation or service time must be recorded in accordance with the applicable instructions and procedures.

B3.2 Remote pilot

B3.2.1 Minimum age

14 years of age.

B3.2.2 Competency Requirements

The 'specific' category covers a wide range of UAS operations, each with different levels of risk.

The UAS operator must identify the competency required for the remote pilot and all the personnel involved in duties essential to the UAS operation, within the risk assessment.

B3.2.3 Currency requirements

Operations manuals must include details of the minimum amount of recent flying experience that is required for each remote pilot on the relevant type of UA used in the operation.

Currency requirements must include:

- a requirement to practise all manoeuvres that are relevant to the operational authorisation;
- a requirement to practice responses to abnormal conditions and in-flight failures on a regular basis, such as:
 - the ability to identify a deteriorating situation and react accordingly;

- taking manual control after a failure of any automated system;
- practice flight in 'manual' modes;
- identification of the potential for GNSS and compass loss or degradation.

Due to the wide-ranging types of operation within the Specific category, it is not possible to list a full set of currency requirements here. However, as a minimum:

For VLOS Operations – Remote pilots will each be expected to have logged at least 2 hours total flight time within the last 3 calendar months on the type of UA applicable to the operational authorisation.

Note: *this flight time must be undertaken during 'live flight' and not on any form of UAS simulator.*

B3.2.4 Responsibilities

As set out in 4.2.2, plus the following:

- Ensure that the flight is conducted in accordance with the requirements and limitations of the operational authorisation.

B3.2.5 Alcohol and drug limitations

Remote pilots must not perform duties under the influence of psychoactive substances or alcohol.

B3.2.6 Medical limitations

Remote pilots must not perform duties when unfit to perform their tasks due to injury, fatigue, medication, sickness or other causes.

B3.2.7 Transition arrangements - remote pilot competency

B3.2.7.1 Remote pilots operating under OSC based permissions or exemptions issued prior to 31 December 2020

Remote pilots may continue to fly under the terms of the existing OSC based permission or exemption held by the UAS operator.

At the point when the OSC based permission or exemption is renewed, which must be on or before 30 December 2021, or when a new remote pilot joins the organisation (whichever is earlier), UAS operators must:

- Review the remote pilot competence elements of their OSC;
- Adjust the OSC as necessary to ensure the risks are appropriately mitigated;
- Ensure that all remote pilots used to fly under their operational authorisation meet the required levels of competence; and
- Ensure that all remote pilots are in possession of a valid 'flyer ID' that has been obtained on or after 15 December 2020.

Note: *This ensures that remote pilots have been tested against the requirements of the new UAS regulations (40 questions). The new Flyer ID test will be available from 15 December 2020).*

B3.2.7.2 Remote pilots operating under 'standard permission'/'PFCO' based permissions that were first issued prior to 31 December 2020

UAS operators are responsible for ensuring that all remote pilots flying under the terms of their permission are competent to do so, are kept in current flying practise and are kept fully aware of the applicable regulations.

Until 31 December 2023 remote pilots may be used by the UAS operator if they:

- hold a GVC; or,
- hold an NQE 'full recommendation' obtained prior to 31 December 2020 and a valid 'flyer ID' that has been obtained on or after 15 December 2020; or,
- comply with one of the previously accepted Alternative Means of Compliance categories detailed in Table 3 below, are in possession of a 'flyer ID' that has been obtained on or after 15 December 2020, and can demonstrate currency within the past 2 years.

From 1 January 2024 onwards, all remote pilots must be in possession of a GVC.

AMC	Existing Aviation Qualification	Initial Practical Flight Assessment requirement	Applicable until
1	Current EASA Fixed-Wing, Helicopter or Microlight licence	Remote pilot flight skills assessment verified prior to 31 December 2020 Full or Restricted Category NQE in at least one of the following two classes: a) SUA multicopter with a maximum take-off mass (MTOM) not exceeding 20 kg. b) SUA fixed wing with a MTOM not exceeding 20 kg.	31 December 2023
2	Current UK National Fixed-Wing, Helicopter or Microlight licence		
3	UK Military pilot / remote pilot or RPAS operator qualification (applicable where basic flight training has been carried out in non-segregated UK airspace) RAF VGS Instructor qualifications commencing at G1 Instructor level are also acceptable		
4	British Gliding Association (BGA) - Bronze 'C' and above (or EASA equivalent)		
5	BMFA 'A' or 'B' Certificates (or SAA/LMA equivalents)	Nil	
6	Other lapsed pilot licences or certificates	Licences that lapsed prior to 2010 are not deemed acceptable	

Table 3 – Remote pilot competency – 'PFCO/Standard Permission' issued before 31 December 2020 – Acceptable transition elements

ANNEX C | The Certified Category

Annex C – The Certified Category

Section C1 Operational Requirements

C1.1 Registration

UA whose design is subject to certification are required to be registered in accordance with Annex IX of the Basic Regulation (and articles 24 to 32 of ANO 2016 unless they are flying under an exemption).

Once the CAA has processed the application, the aircraft will be issued with a registration ID consisting of five characters starting 'G-' (e.g. G-ABCD) and the details will be entered into the aircraft register. The registration must be displayed permanently on the aircraft in accordance with article 32 of ANO 2016.

Compliance monitoring of the insurance regulation is carried out by the CAA Aircraft Registration Section. Details of the insurance requirements can be found on the CAA website under “Mandatory Insurance Requirements”.

C1.2 Insurance

All unmanned aircraft in the Certified category must be insured for third party risks in accordance with EU 785/2004.

Section C2 UAS Technical Requirements

C2.1 Certification

The UKs approach to the certification of unmanned aircraft is still under development. Further details will be provided when they become available.

Section C3 Personnel Requirements

C3.1 The UAS Operator

C3.1.1 Operator Certification

Air Operator's Certificate (AOC)/Remote Operator's Certificate (ROC) with appropriate Operations Specifications must be held.

C3.1.2 Operations manual

The full suite of documentation, as expected for an equivalent manned aircraft operation, is required.

C3.2 Remote Pilot

C3.2.1 Licensing

Remote pilots must be in possession of either:

- an appropriate manned aviation pilot's licence associated with the type of operation being conducted (with appropriate mitigation related to the operation of the particular unmanned aircraft); or,
- an RPL (when the RPL requirements are published and applicable).

Note: *The requirements for the licensing and training of United Kingdom civil remote pilots have not yet been fully developed. United Kingdom requirements will ultimately be determined by ICAO Standards and Recommended Practices (SARPs). ICAO has developed initial standards for a Remote Pilot's Licence (RPL), but these are part of a larger SARPS package that will not become applicable until 2024 at the earliest. Until formal licensing requirements are in place the CAA will determine the relevant requirements on a case-by-case basis, considering additional factors such as the type of operation being conducted, and the system being operated.*

C3.2.2 Currency requirements

The currency requirements related to the licence held must be complied with.

ANNEX D | Acceptable Means of Compliance (AMC) and Guidance Material (GM) to the UAS Implementing regulation

Annex D – Acceptable Means of Compliance (AMC) and Guidance Material (GM) to the UAS Implementing Regulation

This Annex provides details of guidance material and acceptable means of compliance for use in relation to the UAS Implementing Regulation, Regulation (EU) 2019/947 as amended and as ‘retained’ within UK domestic law.

It is arranged in the same order as the Articles and Annex appear within the UAS IR. Information is provided as either references within the remainder of CAP 722, or as separate text below.

It reflects or, where necessary, replaces the AMC and GM published by EASA to cover the EU UAS regulations and is to be used as the primary reference for the United Kingdom.

Section 1 – The ‘Cover Regulation’

D1.1 Article 1 – Subject matter

D1.1.1 AMC

Nil

D1.1.2 GM

AREAS OF APPLICABILITY OF THE UAS REGULATION

For the purposes of the UAS Regulation, the term ‘operation of unmanned aircraft systems’ does not include indoor UAS operations. Indoor operations are operations that occur in or into a house or a building (dictionary definition) or, more generally, in or into a closed space such as a fuel tank, a silo, a cave or a mine where the likelihood of a UA escaping into the outside airspace is very low

D1.2 Article 2 - Definitions

This Article defines sets out a number of terms that are used within the UAS IR. The

definitions appear in the order that they appear in the regulation, rather than being listed alphabetically. Where appropriate, these definitions are replicated within CAP 722D. The AMC and GM below provides additional advice on how the definition can be further interpreted.

D1.2.1 AMC

Para 11 - DEFINITION OF 'DANGEROUS GOODS'

Under the definition of dangerous goods, blood may be considered to be capable of posing a hazard to health when it is contaminated or unchecked (potentially contaminated). In consideration of Article 5(1)(b)(iii):

- (a) medical samples such as uncontaminated blood can be transported in the 'open', 'specific' or 'certified' categories;
- (b) unchecked or contaminated blood must be transported in the 'specific' or the 'certified' categories. If the transport may result in a high risk for third parties, the UAS operation belongs to the 'certified' category (see Article 6 1(b) (iii) of the UAS Regulation). If the blood is enclosed in a container such that in case of an accident, the blood will not be spilled, the UAS operation may belong to the 'specific' category, if there are no other causes of high risk for third parties.

D1.2.2 GM

Para 3 - DEFINITION OF 'ASSEMBLIES OF PEOPLE'

See 2.1.3.4

Para 17 – DEFINITION OF 'AUTONOMOUS OPERATION'

Flight phases during which the remote pilot has no ability to intervene in the course of the aircraft, either following the implementation of emergency procedures, or due to a loss of the command-and-control connection, are not considered autonomous operations.

An autonomous operation should not be confused with an automatic operation, which refers to an operation following pre-programmed instructions that the UAS executes while the remote pilot is able to intervene at any time.

Para 18 – DEFINITION OF 'UNINVOLVED PERSONS'

See 2.1.3.1

Para 22 - DEFINITION OF 'MAXIMUM TAKE-OFF MASS (MTOM)'

See also 2.2.1.4

The MTOM is the maximum mass defined by the manufacturer or the builder, in the case of privately built UAS, which ensures the controllability and mechanical resistance of the UA when flying within the operational limits.

The MTOM should include all the elements on board the UA:

- (a) all the structural elements of the UA;
- (b) the motors;
- (c) the propellers, if installed;
- (d) all the electronic equipment and antennas;
- (e) the batteries and the maximum capacity of fuel, oil and all fluids; and
- (f) the heaviest payload allowed by the manufacturer, including sensors and their ancillary equipment.

D1.3 Article 3 – categories of UAS operations

D1.3.1 AMC

Nil

D1.3.2 GM

BOUNDARIES BETWEEN THE CATEGORIES OF UAS OPERATIONS

Boundary between ‘Open’ and ‘Specific’

A UAS operation does not belong to the ‘Open’ category when at least one of the general criteria listed in Article 4 of the UAS Regulation is not met (e.g. when operating beyond visual line of sight (BVLOS)) or when the detailed criteria for a subcategory are not met (e.g. operating a 10 kg UA close to people when subcategory A2 is limited to 4 kg UA).

Boundary between ‘Specific’ and ‘Certified’

Article 6 of the IR and Article 40 of the DR [Regulation (EU) 2019/945] define the boundary between the ‘Specific’ and the ‘Certified’ category. The first article defines the boundary from an operational perspective, while the second one defines the technical characteristics of the UA, and they should be read together.

A UAS operation belongs to the 'Certified' category when, based on the risk assessment, the CAA considers that the risk cannot be mitigated adequately without the:

- certification of the airworthiness of the UAS;
- certification of the UAS operator; and
- licensing of the remote pilot, unless the UAS is fully autonomous.

UAS operations must be carried out within the 'Certified' category when they:

- are conducted over assemblies of people with a UA that has characteristic dimensions of 3 m or more; or
- involve the transport of people; or
- involve the carriage of dangerous goods that may result in a high risk for third parties in the event of an accident.

D1.4 Article 4 – 'Open' category of UAS operations

D1.4.1 AMC/GM

See 2.2.1 and Annex A

D1.5 Article 5 – 'Specific' category of UAS operations

D1.5.1 AMC/GM

See 2.2.2 and Annex B

D1.6 Article 6 – 'Certified' category of UAS operations

D1.6.1 AMC

See 2.2.3 and Annex C

D1.6.2 GM

See 2.2.3 and Annex C

Article 6 of the IR should be read together with Article 40 of the DR. Article 6 addresses UAS operations and Article 40 addresses the UAS itself. This construction was necessary to respect the legal order reflected in the BR, which foresees that the requirements for UAS operations and registration are in the IR, and that the technical requirements for UAS are in the DR. The reading of the two articles results in the following:

- (a) the transport of people is always in the 'Certified' category. Indeed, the UAS must be certified in accordance with Article 40 and the transport of people is one of the UAS operations identified in Article 6 as being in the 'Certified' category;
- (b) flying over assemblies of people with a UAS that has a characteristic dimension of less than 3 m may be in the 'specific' category unless the risk assessment concludes that it is in the 'Certified' category; and
- (c) the transport of dangerous goods is in the 'Certified' category if the payload is not in a crash-protected container, such that there is a high risk for third parties in the case of an accident.

D1.7 Article 7 – Rules and procedures for the operation of UAS

D1.7.1 AMC

See Chapter 2

Point 2 of Article 7, states that “*UAS operations in the ‘specific’ category shall be subject to the applicable operational requirements laid down in Commission Implementing Regulation (EU) No 923/2012*”. This text refers the Standardised European Rules of the Air (SERA), however for VLOS flights, such a requirement is impractical. Therefore, this requirement should normally only be applicable to BVLOS flights.

D1.7.2 GM

See Chapter 2

D1.8 Article 8 – Rules and procedures for competency of remote pilots

D1.8.1 AMC

See 4.2.3

D1.8.2 GM

See 4.2.3

D1.9 Article 9 – Minimum age for remote pilots

D1.9.1 AMC

See 4.2.1

SUPERVISOR

A person may act as a remote pilot even if he or she has not reached the minimum age defined in Article 9(1) of the UAS Regulation, provided that the person is supervised. The supervising remote pilot must be at least 16 years of age. The possibility to lower the minimum age applies only to remote pilots (and not to supervisors). Since the supervisor and the young remote pilot being supervised must both demonstrate competency to act as a remote pilot, no minimum age is defined to conduct the training and pass the 'flyer ID' test to demonstrate the minimum competency to act as a remote pilot in the 'Open' category.

D1.9.2 GM

See 4.2.1

D1.9A Article 9A – Regulations

No AMC/GM

D1.10 Rules and procedures for the airworthiness of UAS

D1.10.1 AMC

See Chapter 3

D1.10.2 GM

See Chapter 3

D1.11 Article 11 – Rules for conducting an operational risk assessment

D1.11.1 AMC

See CAP 722A

D1.11.2 GM

See CAP 722A

GENERAL

The operational risk assessment required by Article 11 of the UAS Regulation may be conducted using the methodology described in CAP 722A.

Aspects other than safety, such as security, privacy, environmental protection, the use of the radio frequency (RF) spectrum, etc. should be assessed in accordance with the applicable requirements established by the relevant UK organisations (such as The Information Commissioner's Office (ICO), Ofcom etc), or by other UK regulations.

For some UAS operations that are classified as being in the 'specific' category, alternatives to carrying out a full risk assessment are offered to UAS operators for UAS operations with lower intrinsic risks. In these cases, a request for authorisation may be submitted based on the mitigations and provisions described in the predefined risk assessment (PDRA) when the UAS operation meets the relevant operational characteristics of the PDRA. See 2.4.2 for further details.

In accordance with Article 11 of the IR, the applicant must collect and provide the relevant technical, operational and system information needed to assess the risk associated with the intended operation of the UAS.

D1.12 Article 12 – Authorising operations in the ‘Specific’ category

D1.12.1 AMC/GM

Nil

D1.13 Article 13 - Deleted

D1.14 Article 14 – Registration of UAS operators and certified UAS

D1.14.1 AMC

See 1.5, A3.1.2, B3.1.2 and C1.1

D1.14.2 GM

See 1.5, A3.1.2, B3.1.2 and C1.1

D1.15 Article 15 – Operational conditions for UAS geographical zones

D1.15.1 AMC

See CAP 722C

D1.15.2 GM

See CAP 722C

D1.16 Article 16 – UAS operations in the framework of model aircraft clubs and associations

D1.16.1 AMC

Nil

D1.16.2 GM

GENERAL

A model aircraft club or association may obtain an authorisation from the CAA that is valid for all their members to operate UA according to conditions and limitations tailored for the club or association.

The model aircraft club or association will submit the procedures that all members are required to follow to the CAA. When the CAA is satisfied with the procedures, organisational structure and management system of the model aircraft club or association, it may provide an authorisation that defines different limitations and conditions from those in the IR. The authorisation will be limited to the operations conducted within the authorised club or association and within the United Kingdom. The authorisation cannot exempt members of the club or association from registering themselves according to Article 14 of the UAS Regulation; however, the CAA may allow a model club or association to register their members on their behalf.

The authorisation may also include operations by persons who temporarily join in with the activities of the club or association (e.g. for leisure during holidays or for a contest), as long as the procedures provided by the club or association define conditions acceptable to the CAA.

OPTIONS TO OPERATE A MODEL AIRCRAFT

Model flyers have the following options to conduct their operations:

- (a) They may operate as members of a model club or association that has received an authorisation from the CAA, as defined in Article 16 of the IR. In this case, they should comply with the procedures of the model club or association in accordance with the authorisation.
- (b) In accordance with Article 15(2) of the IR, the UK may define zones where UAS are exempted from certain technical requirements, and/or where the operational limitations are extended, including mass or height

limitations.

(c) The UAS may be operated in Subcategory A3, in which the following categories of UAS are allowed to fly according to the limitations and conditions defined in UAS.OPEN.040:

- (1) UAS with a class C0, C1, C2, C3, C4 CE mark;
- (2) UAS that meet the requirements defined in Article 20(b) of the UAS Regulation; and
- (3) privately built UAS with flying weights of less than 25 kg.

ACTION IN CASES OF OPERATIONS/FLIGHTS THAT EXCEED THE CONDITIONS AND LIMITATIONS DEFINED IN THE OPERATIONAL AUTHORISATION

When a model club or association is informed that a member has exceeded the conditions and limitations defined in the operational authorisation, appropriate measures will be taken, proportionate to the risk posed. In any case, occurrences that cause an injury to persons or where the safety of other aircraft was compromised, as defined in Article 125 of Regulation (EU) 2018/113932, must be reported by the model club or association to the CAA. Considering the level of risk, the model club or association may determine whether or not the CAA should be informed.

D1.17 Article 17 – Deleted

D1.18 Article 18 - Responsibilities of the CAA

D1.18.1 AMC

DOCUMENTS, RECORDS AND REPORTS TO BE KEPT

The CAA should keep records of the following documentation for at least for three years after their validity date expires:

- (1) operational authorisations, in accordance with Article 12(2) of the IR:
 - (i) the initial application for an authorisation as defined in UAS.SPEC.030(3) of Part-B and the associated documents;
 - (ii) the application(s) for updated operational authorisations;
 - (iii) the final version of the risk assessment performed by the UAS operator, and the supporting material;

(iv) the UAS operator's statement confirming that the intended UAS operation complies with any applicable rules relating to it, in particular with regard to privacy, data protection, liability, insurance, security and environmental protection, in accordance with Article 12(2)(c) of the UAS Regulation;

(v) the procedures to ensure that all operations comply with Regulation (EU) 2016/679 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data;

(vi) when applicable, a procedure for coordination with the relevant service provider for the airspace if the entire operation, or part of it, is to be conducted in controlled airspace; and

(vii) up-to-date operational authorisation(s) with a table outlining successive changes;

(2) remote pilots' competency:

(i) proof of competency for remote pilots that have passed the 'flyer ID' online theoretical knowledge examination in accordance with UAS.SPEC.020(4)(b);

(ii) 'A2 CofC' certificates of remote pilot competency for remote pilots that have passed the examination in accordance with UAS.SPEC.030(2)(c) of Part-B, with the declaration of completion of the practical self-training provided by the remote pilot; and

(iii) proof of competency or other certificates for remote pilots, as required by the operational authorisations;

(3) Light UAS Operator Certificates:

(i) initial applications in accordance with UAS.LUC.010(2) of Part-C and associated documents;

(ii) applications for amendments to an existing LUC, and the associated documents; and

(iii) up-to-date terms of approval in accordance with UAS.LUC.050 of Part-C, with a table outlining the successive changes.

D1.18.2 GM

Nil

D1.19 Article 19 – Safety information

D1.19.1 AMC

See 2.9

D1.19.2 GM

OCCURRENCE REPORT

According to Regulation (EU) No 376/2014, occurrences shall be reported when they refer to a condition which endangers, or which, if not corrected or addressed, would endanger an aircraft, its occupants, any other person, equipment or installation affecting aircraft operations. Obligations to report apply in accordance with Regulation (EU) No 376/2014, namely its Article 3(2), which limits the reporting of events for operations with UA for which a certificate or declaration is not required, to occurrences and other safety-related information involving such UA if the event resulted in a fatal or serious injury to a person, or it involved aircraft other than UA.

D1.20 Article 20 – Particular provisions concerning the use of certain UAS in the Open category

D1.20.1 AMC

See 2.3.1.3 final paragraph, A2.1.1 and A2.3.1

D1.20.2 GM

Nil

D1.21 Article 21 – Adaptation of authorisations, declarations and certificates

D1.21.1 AMC/GM

Documents issued under national law remain valid only on the terms that they were issued under national law. Therefore, if a document has an expiry date that is prior to 1 January 2022, this expiry date remains to one to be observed; Article 21(1) does not extend its validity until 1 January 2022.

D1.22 Article 22 – Transitional provisions

D1.22.1 AMC

See 2.2.1.2 (Notes associated with A1 and A2 subcategories), A1 and A2 (for references to A1 Transitional and A2 Transitional)

D1.22.2 GM

Nil

Section 2 – The Annex to the ‘Cover Regulation’

D2A.1 UAS.OPEN.010 – General provisions

D2A.1.1 AMC

D2A.1.2 GM

MAXIMUM HEIGHT – See 2.1.1.1 and A1.1.3

OPERATIONS WITH UNMANNED SAILPLANES

This derogation in point 3 was included to allow model gliders to continue to operate along slopes. Strictly applying the 120-metre distance from the closest point of the surface of the earth would have had disproportionate consequences. Two measures have been put in place to reduce the risk:

- (a) A flying weight limited to 10 kg to reduce the consequences of an impact.

10 kg covers the vast majority of gliders in operation.

- (b) The maximum height above the remote pilot is limited to 120 m, which reduces the air risk

D2A.2 UAS.OPEN.020 – UAS operations in subcategory A1

D2A.2.1 AMC

OPERATIONAL LIMITATIONS IN SUBCATEGORY A1

As a principle, the rules prohibit overflying assemblies of people. Overflying isolated people is possible, but there is a distinction between class C1 and class C0 UAS or privately built UAS with MTOMs of less than 250 g.

- (a) Class C1 or 'A1 Transitional' UAS - Before starting the UAS operation, the remote pilot should assess the area and should reasonably expect that no uninvolved person will be overflowed. This evaluation should be made taking into account the configuration of the site of operation (e.g. the existence of roads, streets, pedestrian or bicycle paths), and the possibility to secure the site and the time of the day. In case of an unexpected overflight, the remote pilot should reduce as much as possible the duration of the overflight, for example, by flying the UAS in such a way that the distance between the UA and the uninvolved people increases, or by positioning the UAS over a place where there are no uninvolved people.
- (b) Class C0, or legacy and privately built UAS with flying weights less than 250g It is accepted that UAS in this class may fly over uninvolved people (but not over assemblies of people). Flight over uninvolved people should be avoided whenever possible however, and extreme caution should still be used.

MODIFICATION OF A UAS WITH A CLASS MARK

UAS operators should not allow any modifications to be made to a UAS in class C0, C1, C2, C3 or C4 that breach compliance with the product requirements. If the UAS operator allows such a modification on a UAS, that UAS is no longer considered to have a Class mark and it may only be operated in Subcategory A3, or in the Specific category.

Modifications to UAS that breach compliance with the requirements for the Class marking are those that affect the weight or performance so that they are outside the specifications or the instructions provided by the manufacturer in

the user manual.

The replacement of a part with another that has the same physical and functional characteristics is not considered to be a breach of the requirements for the Class marking (e.g. a replacement of a propeller with another of the same design). The UA user manual should define instructions for performing maintenance and applying changes that do not breach compliance with the Class marking requirements.

D2A.2.2 GM

Nil

D2A.3 UAS.OPEN.030 – UAS operations in subcategory A2

D2A.3.1 AMC

ADDITIONAL THEORETICAL KNOWLEDGE OF SUBJECTS FOR THE
EXAMINATION FOR SUBCATEGORY A2 – See CAP 722B

SAFE DISTANCE FROM UNINVOLVED PERSONS – see 2.1.3 and A1.3.2

MODIFICATION OF A UAS WITH A CLASS MARK

UAS operators should not allow any modifications to be made to a UAS in class C0, C1, C2, C3 or C4 that breach compliance with the product requirements. If the UAS operator allows such a modification on a UAS, that UAS is no longer considered to have a Class mark and it may only be operated in Subcategory A3, or in the Specific category.

Modifications to UAS that breach compliance with the requirements for the Class marking are those that affect the weight or performance so that they are outside the specifications or the instructions provided by the manufacturer in the user manual.

The replacement of a part with another that has the same physical and functional characteristics is not considered to be a breach of the requirements for the Class marking (e.g. a replacement of a propeller with another of the same design). The UA user manual should define instructions for performing maintenance and applying changes that do not breach compliance with the Class marking requirements.

D2A.3.2 GM

SAFE DISTANCE FROM UNINVOLVED PERSONS

The safe distance of the UA from uninvolved persons is variable and is heavily dependent on the performance and characteristics of the UAS involved, the weather conditions and the segregation of the overflown area. The remote pilot is ultimately responsible for the determination of this distance.

D2A.4 UAS.OPEN.040 – UAS operations in subcategory A3

D2A.4.1 AMC

SAFE DISTANCE FROM UNINVOLVED PERSONS – see 2.1.3 and A1.4.2

MODIFICATION OF A UAS WITH A CLASS MARK

UAS operators should not allow any modifications to be made to a UAS in class C0, C1, C2, C3 or C4 that breach compliance with the product requirements. If the UAS operator carries out such a modification on a UAS, that UAS is no longer considered to have a Class mark and it may only be operated in Subcategory A3, or in the Specific category.

Modifications to UAS that breach compliance with the requirements for the Class marking are those that affect the weight or performance so that they are outside the specifications or the instructions provided by the manufacturer in the user manual.

The replacement of a part with another that has the same physical and functional characteristics is not considered to be a breach of the requirements for the Class marking (e.g. a replacement of a propeller with another of the same design). The UA user manual should define instructions for performing maintenance and applying changes that do not breach compliance with the Class marking requirements.

D2A.4.2 GM

DIFFERENCE BETWEEN SUB-CATEGORIES A2 AND A3

Subcategory A2 addresses operations during which flying close to but not over people is intended for a significant portion of the flight.

Sub-category A3 addresses operations that are conducted in an area (hereafter referred to as 'the area') where the remote pilot reasonably expects that no uninvolved people will be endangered within the range of the unmanned aircraft where it is flown during the mission. In addition, the operation must be conducted at a safe horizontal distance of at least 150 m from residential, commercial, industrial or recreational areas.

SAFE DISTANCE FROM UNINVOLVED PERSONS

The safe distance of the UA from uninvolved persons is variable and is heavily dependent on the performance and characteristics of the UAS involved, the weather conditions and the segregation of the overflowed area. The remote pilot is ultimately responsible for the determination of this distance.

D2A.5 UAS.OPEN.050 – Responsibilities of the UAS operator

D2A.5.1 AMC/GM

See 4.1.2 and A3.1.4

D2A.6 UAS.OPEN.060 – Responsibilities of the remote pilot

D2A.6.1 AMC

See 4.2.2

OPERATING ENVIRONMENT

- (a) The remote pilot should observe the operating environment and check any conditions that might affect the UAS operation, such as the locations of people, property, vehicles, public roads, obstacles, aerodromes, critical infrastructure, and any other elements that may pose a risk to the safety of the UAS operation.
- (b) Familiarisation with the environment and obstacles should be conducted, when possible, by walking around the area where the operation is intended to be performed.
- (c) It should be verified that the weather conditions at the time when the operation starts and those that are expected for the entire period of the operation are compatible with those defined in the manufacturer's manual.

(d) The remote pilot should be familiar with the operating environment and the light conditions, and make a reasonable effort to identify potential sources of electromagnetic energy, which may cause undesirable effects, such as electromagnetic interference (EMI) or physical damage to the operational equipment of the UAS.

UAS IN A SAFE CONDITION TO COMPLETE THE INTENDED FLIGHT

The remote pilot should:

- (a) update the UAS with data for the geo-awareness function if it is available on the UA;
- (b) ensure that the UAS is fit to fly and complies with the instructions and limitations provided by the manufacturer, or the best practice in the case of a privately built UAS;
- (c) ensure that any payload carried is properly secured and installed and that it respects the limits for the mass and CG of the UA;
- (d) ensure that the charge of the battery of the UA, or the amount of fuel in the UA, is enough for the intended operation based on:
 - (1) the planned operation; and
 - (2) the need for extra endurance in case of unpredictable events; and
- (e) for UAS equipped with a loss-of-data-link recovery function, ensure that the recovery function allows a safe recovery of the UAS for the envisaged operation; for programmable loss-of-data-link recovery functions, the remote pilot may have to set up the parameters of this function to adapt it to the envisaged operation.

ABILITY TO MAINTAIN CONTROL OF THE UA

- (a) The remote pilot should:
 - (1) be focused on the operation of the UA, as appropriate;
 - (2) not operate a UA while operating a moving vehicle; and
 - (3) operate only one UA at a time.
- (b) If the remote pilot operates a UA from a moving ground vehicle or boat, the speed of the vehicle should be slow enough for the remote pilot to maintain the UA within VLOS, maintain control of the UA at all times and maintain situational awareness and orientation.
- (c) Autonomous operations are not allowed in the 'open' category. The remote pilot must be able to take control of the UA at any time.

D2A.6.2 GM

DISCONTINUATION OF THE FLIGHT IF THE OPERATION POSES A RISK TO OTHER AIRCRAFT

There is an obligation on the remote pilot to maintain a thorough visual scan of the airspace to avoid any risk of a collision with manned aircraft. This means that the remote pilot is primarily responsible for avoiding collisions because pilots of manned aircraft may not be able to see the UA due to its small size. Therefore, the remote pilot should make an evaluation of the risk of collision and take the appropriate action.

As soon as the remote pilot sees another aircraft or a parachute or any other airspace user, they must immediately keep the UA at a safe distance from it and land if the UA is on a trajectory towards the other object.

If the remote pilot cannot ensure suitable separation from the other aircraft, the UA should be safely landed immediately.

FREE-FLIGHT UA

‘Free flight’ means performing flights with no external control, taking advantage of the ascending currents, dynamic winds and the performance of the model. Outdoor free flights are carried out with gliders or with models equipped with means of propulsion that can raise them in altitude (e.g. rubber-bands, thermal engines), before they freely glide and follow the air masses.

EMERGENCY RESPONSE AND EMERGENCY RESPONSE EFFORT

‘Emergency response’ is an action taken in response to an unexpected and dangerous event in an attempt to mitigate its impact on people, property or the environment.

When there is an emergency response effort taking place in the operational area of a UAS, the UAS operation should be immediately discontinued unless it was explicitly authorised by the responsible emergency response services.

When an emergency response effort is taking place close to the operational area, a safe distance must be maintained between the UA and the emergency response site so that the UA does not interfere with, or endanger, the activities of the emergency response services. The UAS operator should take particular care to not hinder possible aerial support and to protect the privacy rights of persons involved in the emergency event.

ROLE OF THE UA OBSERVER AND FIRST-PERSON VIEW

The remote pilot may be assisted by a UA observer helping them to keep the

UA away from other aircraft and obstacles. The UA observer must be situated alongside the remote pilot and observers must not use aided vision (e.g. binoculars)

UA observers may also be used when the remote pilot conducts UAS operations in first-person view (FPV), which is a method used to control the UA with the aid of a visual system connected to the camera of the UA.

In all cases, the remote pilot is still responsible for the safety of the flight.

The UA observer's purpose is not to extend the range of the UA beyond the VLOS distance from the remote pilot. However, in emergency situations, such as the need to perform an emergency landing away from the remote pilot's position, binoculars may be used to assist the pilot in safely performing the landing.

D2A.7 UAS.OPEN.070 – Duration and validity of the remote pilot online theoretical competency and certificates of remote pilot competency

D2A.7.1 AMC/GM

Nil

D2B.1 UAS.SPEC.010 – General provisions

D2B.1.1 AMC/GM

See 2.2.2

D2B.2 UAS.SPEC.020 – Operational declaration - Deleted

D2B.3 UAS.SPEC.030 – Application for an operational authorisation

D2B.3.1 AMC/GM

See 2.3.1

D2B.4 UAS.SPEC.040 – Issuing of an operational authorisation

D2B.4.1 AMC/GM

Nil

D2B.5 UAS.SPEC.050 – Responsibilities of the UAS operator

D2B.5.1 AMC/GM

See 4.1.2 and B3.1.4

D2B.6 UAS.SPEC.060 – responsibilities of the remote pilot

D2B.6.1 AMC

See 4.2.2 and B3.2.4

OPERATING ENVIRONMENT

- (a) The remote pilot, or the UAS operator in the case of an autonomous operation, should check any conditions that might affect the UAS operation, such as the locations of people, property, vehicles, public roads, obstacles, aerodromes, critical infrastructure, and any other elements that may pose a risk to the safety of the UAS operation.
- (b) Familiarisation with the environment and obstacles should be conducted through a survey of the area where the operation is intended to be performed.
- (c) It should be verified that the weather conditions at the time when the operation starts and those that are expected for the entire period of the operation are compatible with those defined in the manufacturer's manual, as well as with the operational authorisation.
- (d) The remote pilot should be familiar with the light conditions and make a reasonable effort to identify potential sources of electromagnetic energy, which may cause undesirable effects, such as EMI or physical damage to the

operational equipment of the UAS.

THE UAS IS IN A SAFE CONDITION TO COMPLETE THE INTENDED FLIGHT

The remote pilot, or the operator in the case of an autonomous operation, should:

- (a) update the UAS with data for the geo-awareness function if one is available on the UA;
- (b) ensure that the UAS is fit to fly and complies with the instructions and limitations provided by the manufacturer;
- (c) ensure that any payload carried is properly secured and installed, respecting the limits for the mass and CG of the UA;
- (d) ensure that the UA has enough propulsion energy for the intended operation based on:
 - (i) the planned operation; and
 - (ii) the need for extra energy in case of unpredictable events; and
- (e) for a UAS equipped with a loss-of-data-link recovery function, ensure that the recovery function allows a safe recovery of the UAS for the envisaged operation; for programmable loss-of-data-link recovery functions, the remote pilot may have to set up the parameters of this function to adapt it to the envisaged operation.

D2B.6.2 GM

Nil

D2B.7 UAS.SPEC.070 – Transferability of an operational authorisation

D2B.7.1 AMC/GM

Nil

D2B.8 UAS.SPEC.080 – Duration and validity of an operational authorisation

D2B.8.1 AMC/GM

Nil

D2B.9 UAS.SPEC.090 – Access

D2B.9.1 AMC/GM

Nil

D2B.10 UAS.SPEC.100 – Use of certified equipment and certified unmanned aircraft

D2B.10.1 AMC/GM

Nil

D2C.1 UAS.LUC.010 – General requirements for an LUC

D2C.1.1 AMC/GM

GENERAL

An LUC holder is considered to be a UAS operator; therefore, they must register according to Article 14 and can do it in parallel to the LUC application.

Prior to making an application for an LUC, UAS operators should first discuss the matter and their intended operation with the CAA in order to ascertain that an LUC is the most suitable solution.

APPLICATION FOR AN LUC

The application should include at least the following information:

- (a) Name and address of the applicant's principal place of business.
- (b) Statement that the application serves as a formal application for a LUC.

- (c) Statement that all the documentation submitted to the competent authority has been verified by the applicant and found to comply with the applicable requirements.
- (d) Desired date for the operation to commence.
- (e) Signature of the applicant's accountable manager.
- (f) List of attachments that accompany the formal application (the following is not an exhaustive list):
 - (i) name(s) of the responsible UAS operator's personnel, including the accountable manager, operations, maintenance and training managers, the safety manager and security manager, the person responsible for authorising operations with UASs;
 - (ii) list of UASs to be operated;
 - (iii) details of the method of control and supervision of operations to be used;
 - (iv) identification of the operation specifications sought;
 - (v) OM and safety management manual (SMM). (Note: the OM and SMM may be combined under the LUC Manual);
 - (vi) schedule of events in the process to gain the LUC certificate with appropriate events addressed and target dates;
 - (vii) documents of purchase, leases, contracts or letters of intent;
 - (viii) arrangements for the facilities and equipment required and available; and
 - (ix) arrangements for crew and ground personnel training and qualification.

D2C.2 UAS.LUC.020 – Responsibilities of the LUC holder

D2C.2.1 AMC

OPERATIONAL CONTROL

The organisation and methods established by the LUC holder to exercise operational control within its organisation should be included in the OM as an additional chapter in relation to the template provided in GM1 UAS.SPEC.030(3)(e).

RECORD-KEEPING — GENERAL

The record-keeping system should ensure that all records are stored in a manner that ensures their protection from damage, alteration and theft. They should be accessible on request of the NAA, whenever needed within a reasonable time. These records should be organised in a way that ensures traceability, availability and retrievability throughout the required retention period. The retention period starts when the record was created or last amended. Adequate backups should be ensured.

D2C.2.2 GM

OPERATIONAL CONTROL

‘Operational control’ should be understood as the responsibility for the initiation, continuation, termination or diversion of a flight in the interest of safety.

‘System’ in relation to operational control should be understood as the organisation, methods, documentation, personnel and training of those personnel for the initiation, continuation, termination or diversion of a flight in the interest of safety.

D2C.3 UAS.LUC.030 – Safety management system

D2C.3.1 AMC

PERSONNEL REQUIREMENTS — GENERAL

- (a) The accountable manager should have the authority to ensure that all activities are carried out in accordance with the requirements of the UAS Regulation.
- (b) The safety manager should:
 - (1) facilitate hazard identification, risk analysis, and risk management;
 - (2) monitor the implementation of risk mitigation measures;
 - (3) provide periodic reports on safety performance;
 - (4) ensure maintenance of the safety management documentation;
 - (5) ensure that there is safety management training available and that it meets acceptable standards;

- (6) provide all the personnel involved with advice on safety matters; and
 - (7) ensure the initiation and follow-up of internal occurrence investigations.
- (c) Management and other personnel of the LUC holder should be qualified for the planned operations in order to meet the relevant requirements of the UAS IR.
- (d) The LUC holder should ensure that its personnel receive appropriate training to remain in compliance with the relevant requirements of the UAS IR.

SAFETY POLICY

- (a) The safety policy should:
- (1) be endorsed by the accountable manager;
 - (2) reflect organisational commitments regarding safety, and its proactive and systematic management;
 - (3) be communicated, with visible endorsement, throughout the organisation;
 - (4) include internal reporting principles, and encourage personnel to report errors related to UAS operations, incidents and hazards; and
 - (5) recognise the need for all personnel to cooperate with compliance monitoring and safety investigations.
- (b) The safety policy should include a commitment to:
- (1) improve towards the highest safety standards;
 - (2) comply with all applicable legislation, meet all applicable standards, and consider best practices;
 - (3) provide appropriate resources;
 - (4) apply the human factors principles;
 - (5) enforce safety as a primary responsibility of all managers; and
 - (6) apply 'just culture' principles and, in particular, not to make available or use the information on occurrences:
 - (i) to attribute blame or liability to someone for reporting something which would not have been otherwise detected; or
 - (ii) for any purpose other than the improvement of safety.
- (c) The senior management of the UAS operator should:
- (1) continually promote the UAS operator's safety policy to all personnel,

- and demonstrate their commitment to it;
- (2) provide the necessary human and financial resources for the implementation of the safety policy; and
- (3) establish safety objectives and associated performance standards.

DOCUMENTATION

The safety management system documentation of the LUC holder should be included in an SMM or in the LUC manual. If that documentation is contained in more than one operator's manual and is not duplicated, cross references should be provided.

COMPLIANCE MONITORING

- (a) The accountable manager should designate a manager to monitor the compliance of the LUC holder with:
 - (1) the terms of approval, the privileges, the risk assessment and the resulting mitigation measures;
 - (2) all operator's manuals and procedures; and
 - (3) training standards.
- (b) The compliance monitoring manager should:
 - (1) have knowledge of, and experience in, compliance monitoring;
 - (2) have direct access to the accountable manager to ensure that findings are addressed, as necessary; and
 - (3) not be one of the other persons referred to in UAS.LUC.030(2)(c).
- (c) The tasks of the compliance monitoring manager may be performed by the safety manager, provided that the latter has knowledge of, and experience in, compliance monitoring.
- (d) The compliance monitoring function should include audits and inspections of the LUC holder. The audits and inspections should be carried out by personnel who are not responsible for the function, procedure or products being audited.
- (e) An organisation should establish an audit plan to show when and how often the activities as required by the UAS IR will be audited.
- (f) The independent audit should ensure that all aspects of compliance, including all the subcontracted activities, are checked within a period defined in the scheduled plan, and agreed by the competent authority.
- (g) Where the organisation has more than one approved location, the

compliance monitoring function should describe how these locations are integrated into the system and include a plan to audit each location in a risk-based programme as agreed by the competent authority.

(h) A report should be raised each time an audit is carried out, describing what was checked and the resulting findings against applicable requirements and procedures.

(i) The feedback part of the compliance monitoring function should address who is required to rectify any non-compliance in each particular case, and the procedure to be followed if rectification is not completed within appropriate timescales. The procedure should lead to the accountable manager.

(j) The LUC holder should be responsible for the effectiveness of the compliance monitoring function, in particular for the effective implementation and follow-up of all corrective measures.

SAFETY RISK MANAGEMENT

The LUC holder should have a safety management system that is able to perform at least the following:

(a) identify hazards through reactive, proactive, and predictive methodologies, using various data sources, including safety reporting and internal investigations;

(b) collect, record, analyse, act on and generate feedback about hazards and the associated risks that affect the safety of the operational activities of the UAS operator;

(c) develop an operational risk assessment as required by Article 11;

(d) carry out internal safety investigations;

(e) monitor and measure safety performance through safety reports, safety reviews, in particular during the introduction and deployment of new technologies, safety audits, including periodically assessing the status of safety risk controls, and safety surveys;

(f) manage the safety risks related to a change, using a documented process to identify any external and internal change that may have an adverse effect on safety; the management of change should make use of the UAS operator's existing hazard identification, risk assessment, and mitigation processes;

(g) manage the safety risks that stem from products or services delivered through subcontractors, by using its existing hazard identification, risk assessment, and mitigation processes, or by requiring that the subcontractors have an equivalent process for hazard identification and risk management; and

(h) respond to emergencies using an ERP that reflects the size, nature, and complexity of the activities performed by the organisation. The ERP should:

- (1) contain the action to be taken by the UAS operator or specified individuals in an emergency;
- (2) provide for a safe transition from normal to emergency operations and vice versa;
- (3) ensure coordination with the ERPs of other organisations, where appropriate; and
- (4) describe emergency training/drills, as appropriate.

USE OF SUBCONTRACTORS

- (a) When an LUC holder uses products or services delivered through a subcontractor that is not itself approved in accordance with this Subpart, the subcontractor should work under the terms of the LUC.
- (b) Regardless of the certification status of the subcontractor, the LUC holder is responsible for ensuring that all subcontracted products or services are subject to the hazard identification, risk management, and compliance monitoring of the LUC holder.

D2C.3.2 GM

See section 5.3 for general information

ACCOUNTABLE MANAGER

The accountable manager is a single, identifiable person who has the responsibility for the effective and efficient performance of the LUC holder's safety management system.

SAFETY POLICY

The safety policy is the means whereby an organisation states its intention to maintain and, where practicable, improve safety levels in all its activities and to minimise its contribution to the risk of an accident or serious incident as far as is reasonably practicable. It reflects the management's commitment to safety, and should reflect the organisation's philosophy of safety management, as well as be the foundation on which the organisation's safety management system is built. It serves as a reminder of 'how we do business here'. The creation of a positive safety culture begins with the issuance of a clear, unequivocal direction.

The commitment to apply 'just culture' principles forms the basis for the

organisation's internal rules that describe how 'just culture' principles are guaranteed and implemented.

Regulation (EU) No 376/2014 defines the 'just culture' principles to be applied (refer in particular to Article 16(11) thereof).

SAFETY MANAGER REQUIREMENTS

The functions of the safety manager may be fulfilled by the accountable manager or another person charged by the UAS operator with the responsibility of ensuring that the UAS operator remains in compliance with the requirements of the UAS Regulation.

Where the safety manager already fulfils the functions of the compliance monitoring manager, the accountable manager cannot be the safety manager.

Depending on the size of the organisation and the nature and complexity of its activities, the safety manager may be assisted by additional safety personnel for the performance of all the safety management tasks.

Regardless of the organisational set-up, it is important that the safety manager remains the unique focal point as regards the development, administration, and maintenance of the organisation's management system.

SAFETY COMMITTEE/SAFETY ACTION GROUP REQUIREMENTS

A UAS operator may include a safety committee in the organisational structure of its safety management system and, if needed, one or more safety action groups.

(a) Safety committee - A safety committee may be established to support the accountable manager in their safety responsibilities. The safety committee should monitor:

- (1) the UAS operator's performance against safety objectives and performance standards;
- (2) whether safety action is taken in a timely manner; and
- (3) the effectiveness of the UAS operator's safety management processes.

(b) Safety action group

- (1) Depending on the scope of the task and the specific expertise required, one or more safety action groups should be established to assist the safety manager in their functions.
- (2) The safety action group should be comprised of managers, supervisors and personnel from operational areas, depending on the scope of the task and the specific expertise required.

(3) The safety action group should at least perform the following:

- (i) monitor operational safety and assess the impact of operational changes on safety;
- (ii) define actions to mitigate the identified safety risks; and
- (iii) ensure that safety measures are implemented within agreed timescales.

KEY SAFETY PERSONNEL

The UAS operator should appoint personnel to manage key fields of activity such as operations, maintenance, training, etc.

SAFETY REPORTING AND INTERNAL INVESTIGATIONS

The purpose of safety reporting and internal investigations is to use reported information to improve the level of safety performance of the UAS operator. The purpose is not to attribute blame or liability.

The specific objectives of safety reporting and internal investigations are to:

- (a) enable assessments of the safety implications of each relevant incident and accident, including previous similar occurrences, so that any necessary action can be initiated; and
- (b) ensure that knowledge of relevant incidents and accidents is disseminated so that other persons and UAS operators may learn from them.

All occurrence reports that are considered to be reportable by the person who submits the report should be retained, as the significance of such reports may only become obvious at a later date.

TRAINING AND SAFETY PROMOTION

Training, combined with safety communication and information sharing form part of safety promotion and supplement the organisation's policies, encouraging a positive safety culture and creating an environment that is favourable to the achievement of the organisation's safety objectives.

Safety promotion can also be the instrument for the development of a just culture.

Depending on the particular risk, safety promotion may constitute or complement a risk mitigation action and an effective reporting system.

COMPLIANCE MONITORING

The primary objective of the compliance monitoring function is to enable the

UAS operator to ensure a safe operation and to remain in compliance with the UAS Regulation.

An external organisation may be contracted to perform compliance monitoring functions. In such cases, that organisation should designate the compliance monitoring manager.

The compliance monitoring manager may use one or more auditors to carry out compliance audits and inspections of the LUC holder under their own responsibility.

SAFETY RISK MANAGEMENT

In very broad terms, the objective of safety risk management is to eliminate risk, where practical, or reduce the risk (likelihood/severity) to acceptable levels, and to manage the remaining risk to avoid or mitigate any possible undesirable outcome. Safety risk management is, therefore, integral to the development and application of effective safety management.

Safety risk management can be applied at many levels in an organisation. It can be applied at the strategic level and at operational levels. The potential for human error, its influences and sources, should be identified and managed through the safety risk management process. Human factors risk management should allow the organisation to determine where it is vulnerable to human performance limitations.

MANAGEMENT OF CHANGE

Unless properly managed, changes in organisational structures, facilities, the scope of work, personnel, documentation, policies and procedures, etc. can result in the inadvertent introduction of new hazards, which expose the organisation to new, or increased risk. Effective organisations seek to improve their processes, with conscious recognition that changes can expose the organisations to potentially latent hazards and risks if the changes are not properly and effectively managed.

Regardless of the magnitude of a change, large or small, proactive consideration should always be given to the safety implications. This is primarily the responsibility of the team that proposes and/or implements the change. However, change can only be successful if all the personnel affected by the change are engaged and involved, and they participate in the process. The magnitude of a change, its safety criticality, and its potential impact on human performance should be assessed in any change management process.

The process for the management of change typically provides principles and a structured framework for managing all aspects of the change. Disciplined application of change management can maximise the effectiveness of the

change, engage staff, and minimise the risks inherent in change.

Change is the catalyst for an organisation to perform the hazard identification and risk management processes.

Some examples of change include, but are not limited to:

- (a) changes to the organisational structure;
- (b) a new type of UAS being employed;
- (c) additional UASs of the same or similar type being acquired;
- (d) significant changes in personnel (affecting key personnel and/or large numbers of personnel, high turn-over);
- (e) new or amended regulations;
- (f) changes in financial status;
- (g) new location(s), equipment, and/or operational procedures; and
- (h) new subcontractors.

A change may have the potential to introduce new human factors issues or exacerbate pre-existing issues. For example, changes in computer systems, equipment, technology, personnel (including the management), procedures, the work organisation, or work processes are likely to affect performance.

The purpose of integrating human factors into the management of change is to minimise potential risks by specifically considering the impact of the change on the people within a system.

Special consideration, including any human factors issues, should be given to the 'transition period'. In addition, the activities utilised to manage these issues should be integrated into the change management plan.

Effective management of change should be supported by the following:

- (a) implementation of a process for formal hazard analyses/risk assessment for major operational changes, major organisational changes, changes in key personnel, and changes that may affect the way a UAS operation is carried out;
- (b) identification of changes likely to occur in business which would have a noticeable impact on:
 - (1) resources — material and human;
 - (2) management guidance — processes, procedures, training; and
 - (3) management control;

- (c) safety case/risk assessments that are focused on aviation safety; and
- (d) involvement of key stakeholders in the change management process as appropriate.

During the change management process, previous risk assessments and existing hazards are reviewed for possible effects.

SAFETY RISK MANAGEMENT — INTERFACES BETWEEN ORGANISATIONS

Safety risk management processes should specifically address the planned implementation of, or participation in, any complex arrangements (such as when multiple organisations are contracted, or when multiple levels of contracting/subcontracting are included).

Hazard identification and risk assessment start with the identification of all parties involved in the arrangement, including independent experts and non-approved organisations. This extends to the overall control structure, and assesses in particular the following elements across all subcontract levels and all parties within such arrangements:

- (a) coordination and interfaces between the different parties;
- (b) applicable procedures;
- (c) communication between all the parties involved, including reporting and feedback channels;
- (d) task allocation, responsibilities and authorities; and
- (e) the qualifications and competency of key personnel.

Safety risk management should focus on the following aspects:

- (a) clear assignment of accountability and allocation of responsibilities;
- (b) only one party is responsible for a specific aspect of the arrangement — there should be no overlapping or conflicting responsibilities, in order to eliminate coordination errors;
- (c) the existence of clear reporting lines, both for occurrence reporting and progress reporting; and
- (d) the possibility for staff to directly notify the organisation of any hazard by suggesting an obviously unacceptable safety risk as a result of the potential consequences of this hazard.

Regular communication between all parties to discuss work progress, risk mitigation actions, changes to the arrangement, as well as any other significant issues, should be ensured.

D2C.4 UAS.LUC.040 – LUC manual

D2C.4.1 AMC

GENERAL

The LUC manual may contain references to the OM, where an OM is compiled in accordance with GM1 UAS.SPEC.030(3)(e).

The LUC manual should contain at least the following information, customised according to the complexity of the UAS operator.

LUC MANUAL TEMPLATE

Operator's name

Table of contents

1. Introduction (the information under Chapter O, points 1-6 of the OM may be duplicated here or simply referenced to the OM)

2. SMM

2.1. Safety policy (provide details of the UAS operator's safety policy, safety targets)

2.2. Organisational structure (include the organogram and brief description thereof)

2.3. Duties and responsibilities of the accountable manager and key management personnel; (in addition, clearly identify the person who authorises operations)

2.4. Safety management system (provide a description of the safety management system, including the lines of responsibilities with regard to safety matters)

2.5. Operational control system (provide a description of the procedures and responsibilities necessary to exercise operational control with respect to flight safety)

2.6. Compliance monitoring (provide a description of the compliance monitoring function)

2.7. Safety risk management (the information about hazard identification, safety risk assessment and mitigation under Chapter A of the OM may be duplicated here or simply referenced to the OM)

2.8. Management of change (description of the process to identify safety-critical changes within the organisation and its operation and to eliminate or modify safety risk controls that are no longer needed or effective due to such changes)

2.9. Development and approval of an operational scenario (provide a description of the process)

2.10. Interface with subcontractors and partners (describe the relationship with any subcontractor delivering products or services to the UAS operator as well as with partners, if available)

2.11. Documentation of key management system processes

3. OM (the information under Chapters 2-11 of the OM may be duplicated here or references to the OM may be provided)

4. Handling, notifying and reporting accidents, incidents and occurrences

5. Handling of dangerous goods (specify the relevant regulations and instructions to crew members concerning the transport of dangerous goods such as pesticides and chemicals, etc. and the use of dangerous goods during operations such as batteries and fuel cells, engines, magnetising materials, pyrotechnics, flares and firearms)

PROCEDURES FOR SUBCONTRACTORS

If any activity is carried out by partner organisations or subcontractors, the LUC manual should include a relevant statement of how the LUC holder is able to ensure compliance with UAS.LUC.30(2)(i), and should contain, directly or by cross reference, descriptions of, and information on, the activities of those organisations or subcontractors, as necessary to substantiate this statement.

D2C.4.2 GM

Nil

D2C.5 UAS.LUC.050 – Terms of approval of the LUC holder

D2C.5.1 AMC/GM

Nil

D2C.6 UAS.LUC.060 – Privileges of the LUC holder

D2C.6.1 AMC/GM

GENERAL

The privileges granted to the LUC holder will be specified in the certificate that is issued. It should be noted that these privileges will be unique to each LUC and dependent on the content and quality of the application; there is no 'standard list' of privileges that are automatically granted with any LUC.

For the purpose of granting privileges to LUC applicants, the CAA may apply a gradual approach. Depending on the UAS operator's past safety performance and safety record over a defined period of time (e.g. the previous 6 months), the CAA may then consider expanding the scope of the UAS operator's privileges.

The gradual approach does not prevent the CAA from granting privileges with a greater scope to a first-time LUC applicant who has an adequate structure and competent personnel, an effective safety management system and has demonstrated a good compliance disposition.

D2C.6.2 GM

Nil

D2C.7 UAS.LUC.070 – Changes in the LUC management system

D2C.7.1 AMC

CHANGES REQUIRING PRIOR APPROVAL

A change of the accountable manager is considered a significant change that requires a prior approval.

D2C.7.2 GM

Nil

D2C.8 UAS.LUC.080 – Duration and validity of an LUC

D2C.8.1 AMC/GM

Nil

D2C.9 UAS.LUC.090 - Access

D2C.9.1 AMC/GM

Nil
