Safety and Airspace Regulation Group

UK Civil Aviation Authority

Unmanned Aircraft System Operations in UK Airspace – Operating Safety Cases

CAP 722A | Second Edition

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RH6 0YR

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The latest version of this document is available in electronic format at www.caa.co.uk/CAP722A

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Revision History

First Edition July 2019

Initial issue. Information has been extracted from Appendices B, C and D of CAP 722 Sixth Edition March 2015 and updated where appropriate to reflect the evolving best practice concerning risk assessment processes, and to capture the regulatory changes within ANO 2016 and its subsequent amendments.

Second Edition December 2022

This second edition of CAP 722A is to reflect regulatory changes introduced with the UAS Implementing Regulation (EU) 2019/947 as retained (and amended in UK domestic law) Under the European Union (Withdrawal) Act 2018, hereafter referred to as 'UK Regulation (EU) 2019/947'. This regulation can be found on the CAA website.

This update coincides with the publication of the Acceptable Means of Compliance (AMC) and Guidance Material (GM) for UK Regulation (EU) 2019/947. Within the AMC and GM, the previously published version of the risk assessment methodology has been removed, and instead Applicants should use CAP 722A.

This second edition also contains updated guidance to the risk assessment process.

Abbreviations and glossary of terms

The abbreviations and glossary of terms for the entire CAP 722 ‘series’ of documents are centralised within the CAP 722D “Abbreviations and Master Glossary”.

Foreword

Aim

CAP 722A “Unmanned Aircraft System Operations in UK Airspace - Operating Safety Case” is intended to assist Applicants who are involved in the production of an Operational Risk Assessment (ORA) per Article 11 of UK Regulation (EU) 2019/947, which will be used as supporting evidence to an application to the CAA for operation of an Unmanned Aircraft System (UAS) in the Specific Category. The Operating Safety Case (OSC) described in this document is the ORA.

The intent of CAP 722A is to ensure that the required operational safety objectives and proposed target levels of safety have been met by the Applicant. This ensures regulatory compliance and that standard aviation safety practices are adopted by UAS operators before a UAS is authorised to operate in the UK.

The aim of the OSC is to present sufficient evidence that all relevant hazards and resultant Safety risks have been identified for the proposed operation and have been suitably mitigated to a tolerable and As Low As Reasonably Practicable (ALARP) level. This ensures an acceptable level of safety for the proposed operation.

CAP 722A **is not the regulation** and does not replace existing civil aviation regulations. It provides templates and guidance for the preparation of a risk assessment as part of an application to the CAA for an operational authorisation in the ‘specific’ category only.

This document does not explain the application process to Applicants. For information on the application process for an operational authorisation, please refer to the CAA website “Flying in the Specific category”.

In advance of further changes to this document, updated information is contained in the CAA website “Remotely piloted aircraft and drones”.

Content

This document consists of three main sections and one appendix:

- UAS OSC Volume 1 – Operations Manual
- UAS OSC Volume 2 – UAS Description
- UAS Volume 3 – Safety Risk Assessment
- Appendix A: OSC Compliance Checklist Template

How to use this document

The templates in this document provide section headings detailing the minimum subject areas that need to be addressed when producing an OSC for the purpose of demonstrating that a UAS operation can be conducted safely. The template layouts and guidance material provided are not prescriptive nor exhaustive, but the subject areas detailed should be included in the OSC documentation if applicable to the intended operation, in order to provide the minimum required information.

The Applicant should also complete a compliance checklist, for which a template is provided in Appendix A. The compliance checklist should be included in the document set provided to the CAA.

Instructions in **bold** are indicated by the terms: '**describe'** / '**detail'** / '**explain'**, etc. These indicate the information that should be included in the OSC.

All text in *italics* is guidance material only and should not be included in the OSC. This chapter also contains tables and templates that may assist Applicants in preparing this section of their OSC.

'Should' indicates a strong recommendation (in other words, a person would need to provide clear justification for not following the recommendation).

'May' indicates discretion.

Where references to other documents are provided, it is the Applicant's responsibility to ensure that the latest revision is being used.

Policy and scope

The application for an operational authorisation shall be based on the risk assessment referred to in Article 11 of UK Regulation (EU) 2019/947. CAP 722A provides the Applicant with a methodology to complete an OSC to ensure compliance to the relevant regulations.

Applicants should take responsibility for their own OSC, whether the material originates from the templates proposed throughout this document or otherwise.

The Applicant shall submit an application for an updated operational authorisation if there are any significant changes to the operation or changes to the mitigation measures listed in the operational authorisation. Any significant changes to the Applicant's OSC will require further assessment by the CAA or approved organisation prior to further operations being conducted, and will necessitate application to the CAA for a variation. Examples of this could include change to the type of operations, or use of a different UAS to conduct operations (refer to AMC1 to UK Regulation (EU) 2019/947, UAS.SPEC.030(2)).

Each application for an operational authorisation should be accompanied by an OSC, unless otherwise stated within a pre-defined risk assessment (PDRA).

The CAA uses the OSC provided by the Applicant to assess the application and ensure compliance to the relevant UAS regulations.

This methodology contained in this document applies to the operation of a UAS in the specific category only. This methodology does not apply to:

- Operations to be conducted in the certified category.
- The Light UAS operator Certificate (LUC) (refer to UK Regulation (EU) 2019/947 AMC and GM Annex Part C).
- Standalone equipment / product approvals such as Detect And Avoid (DAA), Electronic Conspicuity (EC) equipment etc.
- Air Traffic Management (ATM) and UAS Traffic Management (UTM) ground-based solutions such as mobile network navigation solutions.
- Vertiports or other ground based supporting infrastructure.

Availability

The AMC and GM to UK Regulation (EU) 2019/947 and the latest versions of the CAP 722 series documents are available on the CAA website Publications section.

The CAA has a system for publishing further information and guidance, which can be found on the CAA website under the Skywise section, which can be filtered for information and subject matter relevant to UAS.

Point of contact

Unless otherwise stated, all enquiries relating to this CAP should be made to:

GA & RPAS Unit
Civil Aviation Authority
Safety and Airspace Regulation Group
Aviation House
Beehive Ring Road
West Sussex
RH6 0YR

E-mail: uavenquiries@caa.co.uk

1. UAS OSC Volume 1 – Operations Manual

1.1. Introduction

The aim of the OSC Volume 1 is to provide a description of the intended operations of the UAS, with the purpose of providing evidence to the CAA that the operational means to mitigate the Safety risks claimed in Volume 3 have been correctly implemented.

This section provides a template that can be used by the Applicant to draft their OSC Volume 1 document.

The tables and bullet points included in this section are non-exhaustive lists, aimed at providing prompts to the Applicant for developing the contents of their document; items in the lists or in other guidance may not be included in the document if they are not applicable.

1.2. Section 1 – Initial information

1.2.1. Front page

Include the following items on the front cover of the Volume 1 document:

Description	Guidance
Operator ID	*Uniquely identifies the Applicant.*
UAS Operating Safety Case Volume 1 – Operations Manual	*To be included in the document title.*
Document reference number	*A reference number generated by the Applicant which uniquely identifies the document.*
Document version and date	*E.g. Version X, dated DD/MM/YYYY*

Table 1: Volume 1 front cover

1.2.3. Amendment record

Include an amendment record at the beginning of the document per Table 2, which records changes made to the document.

An amendment record provides traceability of changes made to the document and ensures appropriate document control.

Amendment/ Revision/ Issue Number	Date	Amended by	Details of changes
(a, b, c or 1, 2, 3 etc.)	*DD/MM/YYYY*	*Name of person*	*List of main changes made to the document, including section/paragraph numbers where those changes were made.*

Table 2: Volume 1 amendment record

When submitting a new revision of the document, it is also highly recommended that the Applicant use revision bars or highlight the sections changed. This will assist the CAA when assessing the application.

1.2.4. Acronyms and abbreviations

List all acronyms or abbreviations used throughout the document.

There is no need to further expand any acronym or abbreviation within the document body. Refer to CAP 722D for information on commonly used abbreviations and acronyms.

1.2.5. Table of contents

Include a table of contents listing all numbered sections/paragraphs in the document, including the following sections: Title Page, Amendment Record, Acronyms and Abbreviations.

1.3. Section 2 – The organisation

1.3.1. Introduction

Provide an introduction.

This section should be used to outline the scope of the document, its intent and the overarching operating strategy of the Company.

1.3.2. Safety statement

Provide a safety statement.

The person responsible for the safe conduct of all the Company's operations should sign this statement, e.g. Accountable Manager, CEO, Company Director, etc.

The statement should include as a minimum:

- *Statement that the Company is safe to operate in the proposed environment, that the systems to be employed can be operated safely, and a commitment to operate within the bounds of this UAS OSC and any CAA authorisation issued.*
- *Statement confirming that the intended operation complies with any applicable rules relating to it, in particular with regard to privacy, data protection, liability, insurance, security and environmental protection.*
- *Commitment to conduct further mitigation actions detailed within the UAS OSC. A commitment to safety, as a priority, should be detailed.*

The safety statement should be signed and dated by the accountable person in this regard. Failure to sign and date the safety statement will result in the application being returned and will delay its processing.

1.3.3. Safety policy

Detail the Company's safety policy, safety management system, safety targets, etc.

Refer to CAP 795 for guidance on establishing a safety management system for an organisation.

1.3.4. Organisation

Provide details of the organisation that is the subject of the application.

All areas detailed below should be covered as a minimum. The examples provided are not exhaustive.

1.3.4.1. Structure of organisation and management lines

Provide an organisational diagram and a brief description of the organisation and its activities.

Include accreditations or approvals held that might be considered relevant.

An example of organisational diagram is shown below:

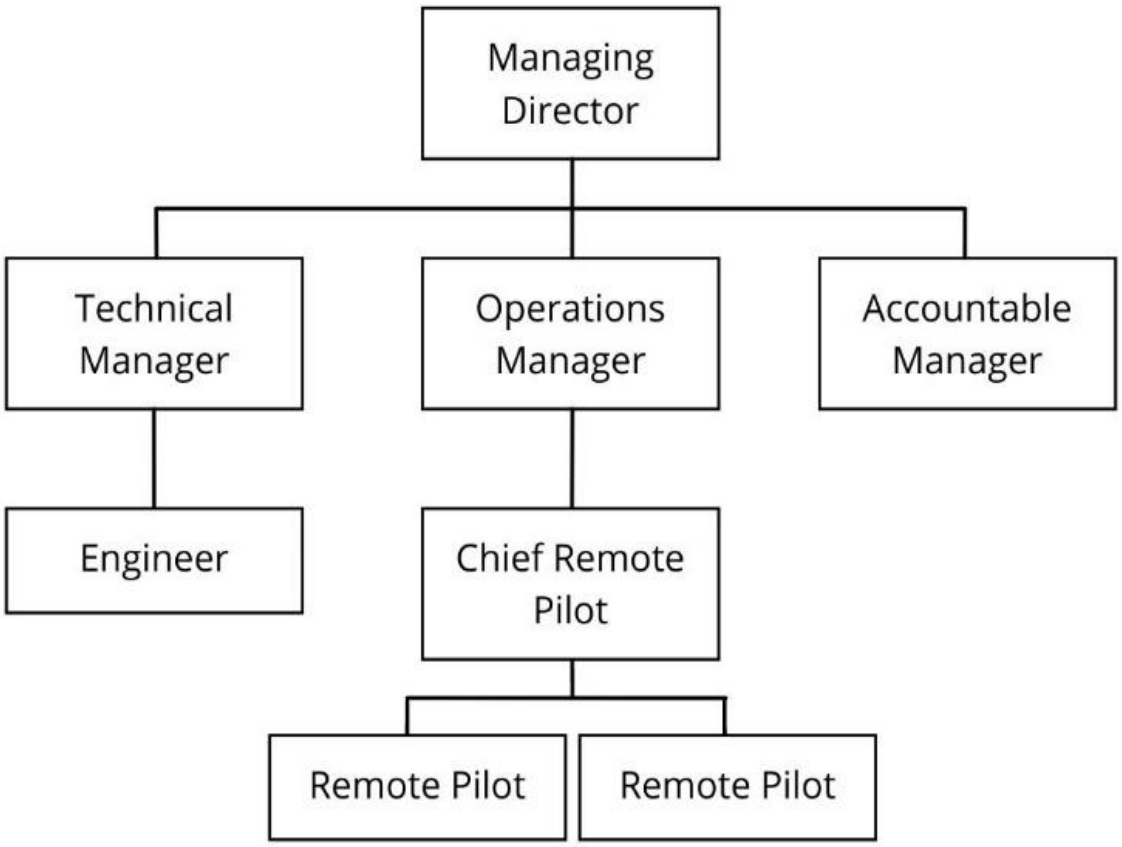

Figure 1: Organisational diagram.

1.3.4.2. Nominated personnel

Explain the roles of nominated personnel by including the following information:

- The role titles
- A brief description of the role.
- The name of the individuals holding any nominated role may be required to be included by the Competent Authority.

Examples of nominated personnel / post holders are:

- *Accountable Manager*
- *Operations Manager*
- *Technical Manager*
- *Chief Pilot*
- *Quality / Safety Manager*

This section should be scaled to the size of the organisation and its structure. Each role should be covered with a brief description. Multiple roles may be filled by the same person. However in complex organisations and/or complex operations, internal audit / quality roles should be carried out by a person uninvolved in operation delivery.

1.3.5. Responsibilities and duties of the UAS operator, remote pilot and support Personnel

Explain the composition of the remote crew and associated support staff, their respective responsibilities and duties, and how the UAS Operator intends to meet the Remote Pilot responsibilities.

Examples of remote crew roles:

- *Remote Pilot*
- *Safety officer*
- *Support personnel*

Examples of support staff roles:

- *Visual observer*
- *Launch / recovery crew*
- *Radio operators*
- *Maintenance (if directly involved in flight operations)*

It is not necessary to include the names of the individuals who hold these roles.

The Applicant should refer to UK Regulation (EU) 2019/947, UAS.SPEC.050 and UAS.SPEC.060.

1.3.6. Flight safety programme

1.3.6.1. Emergency Response Plan (ERP)

Describe the Emergency Response Plan (ERP).

An ERP limits the escalating effect of a loss of control of the operation. It is an action taken in response to an unexpected and dangerous event to reduce the impact of its consequence. The ERP is different from the emergency procedures, which deal with the handling of the UA.

The ERP should reflect the size, nature and complexity of activities performed by the organisation. The ERP should:

- *Contain the action to be taken by the operator or specified individuals in an emergency.*
- *Provide for a safe transition from normal to emergency operations and vice-versa.*
- *Ensure coordination with the ERPs of other organisations, where appropriate.*
- *Describe emergency training / drills as appropriate.*

Further guidance is provided below:

- *Describe roles and clear delineation of responsibilities.*
- *Describe the necessary checklists and procedures that must be followed by UAS operator personnel, that form the ERP.*
- *Detail any necessary 'quick reference guides' and contact information that may assist personnel in the implementation of the ERP.*
- *Describe how the UAS operator will interact with other agencies and organisations during implementation of the ERP, including local air traffic service units and the emergency services.*
- *Identify what the triggers are for implementing the ERP, and what actions must be carried out for each situation. Include how the emergency is immediately promulgated to other aviation related agencies, particularly in cases of a fly-away loss of control.*
- *Include reference to the mandatory reporting requirements.*
- *Explain what strategic mitigations are in place to assist the ERP. For example, clear labelling of hazardous substances on board the UA, including batteries, to inform any first responders or members of the public who may come across the crashed UA.*
- *Describe what equipment is required for the ERP.*

1.3.6.2. Incident reporting

Describe the incident reporting process.

Include details of how occurrence reporting requirements are complied with. For example, the organisation's accident and incident investigation and reporting policy including their Emergency Response Plan (ERP). This includes reporting of accidents to the CAA and the AAIB as well as the process for incorporating their recommendations as necessary.

Refer to AMC1 Article 19(2) and GM1 Article 19(2) for further information.

Refer to EU 376/2014 for reporting, analysis, and follow-up of occurrences in civil aviation.

Reportable occurrences involving a UAS should be reported in accordance with EU 376/2014 and IR 2015/1018. In addition to those occurrences listed in IR 2015/1018, consideration should be given to reportable occurrences that can be considered as UAS specific, such as those resulting in events that potentially prejudice the safety of other airspace users or third parties as a result of, but not limited to, any of the following causes:

- *Loss of control of the unmanned aircraft due to:*
  - *Loss of the C2 link.*
  - *Loss of navigation function.*
  - *GCS configuration changes / errors.*
  - *Loss of communication between remote pilot stations.*
- *Error during transfer to / from launch control / mission control stations.*
- *Display failures.*
- *Functional failures of the UAS which led to loss of situational awareness.*
- *Structural failures during any phase of flight that led to control difficulties or loss of the aircraft.*
- *Mishandling by the pilot in command including mis-selection of flight parameters via the Command Unit (CU).*
- *Loss of propulsion.*
- *Crew resource management failures / confusion.*
- *Human errors.*
- *Any incident that caused injury to a third party.*

Details of potential Safety risks identified by the operator should be submitted via the European ECCAIRS2 portal homepage within 30 days of the initial date of notification of the occurrence. This update should include preliminary analysis and the actions to be taken as a result of that analysis. When conducting analysis of events operators may choose to use CAP1760 when conducting root cause analysis.

Furthermore, the UAS operator should submit the final results of their internal investigation no later than three months from the date of initial notification of the occurrence to the CAA.

1.3.7. Competency and qualification requirements including role training and currency

Provide details of any certificates of competency, qualifications, experience or training necessary for the pilot or support crew for the types of UAS and the roles employed by the operator.

Describe the use of any Flight Simulation Training Devices (FSTD) used for acquiring and maintaining the skills of the remote pilots (if applicable).

Describe the conditions and restrictions in connection with such training (if applicable).

Include any training undertaken, beyond basic Recognised Assessment Entity (RAE) competency assessment or other suitable qualification that prepares the pilot for flying in a particular environment, for example, urban or densely populated areas, segregated airspace, etc.

Provide details of the minimum experience and currency requirements, skills tests or manufacturer courses required by the organisation that support the case for an appropriate level of competency and knowledge for the proposed operations. These may include in-house or outsourced training.

Include the training and assessment requirements and methods for pilots and support crew as determined by the operator to cover:

- *Initial syllabus*
- *Refresher syllabus*
- *Conversion syllabus*

Include any independent assessment of pilot competency and currency requirements. These requirements should include task specific flight and emergency procedure competency checks. Some elements could be specific to the operator. This should also cover the use of new pilots and how they are assessed as competent prior to operating.

The description of any FSTD should be provided, including the purpose of such training and the technical details of the device. The fidelity of the FSTD should also be described, including under what circumstances it may be used (e.g. BVLOS only) and what phase of training the FSTD may be used for.

Any FSTD should be fit for purpose and be developed to a sufficient level of fidelity to be an accurate replica of flight of the UA. The acquisition, maintenance, use of an FSTD and associated procedures should be described.

Include the processes and procedures that will be implemented to ensure that remote pilots and other operational support staff acquire and maintain the necessary currency to execute their duties.

The Applicant should refer to UK Regulation (EU) 2019/947, UAS SPEC.060 and AMC 1 for Article 8.

1.3.8. Logs and records

Describe the organisation's requirements for the completion and retention of aircraft and remote pilot flying logs and records and any other data considered useful for the tracking and monitoring of the flight activities.

For logs and records of the remote pilot, refer to AMC1 to UK Regulation (EU) 2019/947, UAS.SPEC.050(1)(d).

For logs and records of the Aircraft, refer to AMC1 to UK Regulation (EU) 2019/947, UAS.SPEC.050(1)(g).

Copies of any onsite assessments or particular risk assessments carried out by the crew prior to conducting the operations should be included in the records for the flight.

Additional information to be recorded by the operator should include:

- *Relevant qualifications, experience and/or training completed by the remote crew.*
- *Relevant qualifications, experience and/or training completed by the maintenance staff.*
- *Maintenance activities conducted on the UAS.*

These records should be stored for a minimum of 3 years and available for inspection by the competent authority or any statutory body whenever required. Records should be stored in a safe and secure manner and can be electronic or hard copy. The Applicant should refer to UK Regulation (EU) 2019/947, UAS.SPEC.090.

1.3.9. Crew health

Detail the organisation's policy on crew health requirements including any procedures, guidance or references to ensure that the flight team are appropriately fit, capable and able to conduct the planned operations.

The Applicant should refer to GM1 to UK Regulation (EU) 2019/947, UAS.SPEC.060(1)(a).

There are currently no mandatory aeromedical examination requirements for remote pilots or support staff in the specific category.

1.3.10. Security and privacy

Detail the operator's security and privacy policy and how this is implemented.

Both physical and cyber security aspects are required to address potential weaknesses to UAS such as employees, location, accessibility, technology, management structure and governance.

The following two points should be addressed:

- *Physical security of system elements and assets, e.g. ensuring adequate physical protection is afforded to system assets.*
- *Security governance to ensure the secure and safe operation of the system, e.g. Security Operating Procedures are drafted, applied, reviewed and maintained. This should include cyber security considerations.*

Applicants should refer to GM1 to UK Regulation (EU) 2019/947, UAS.SPEC.050(1)(a)(iv) to describe how they will comply with privacy requirements within the OSC.

For further information on cyber security, please refer to the CAA website.

1.3.11. Other documents

Detail any other relevant documents.

An operator may include in an annex additional related documents considered necessary to provide sufficient information and clarity on the planned activities. These documents may include copies of insurance documents, evidence of remote pilot competency, CAA authorisations, forms and templates used for site assessments, flight logs, etc. The Operator Registration Certificate should also be included, when applicable.

Applicants should ensure any additional related documents are appropriately referenced where applicable.

1.4. Section 3 – Flight operations

The purpose of this section is to provide details of the operating environment and procedures associated with the subject application. All subject areas detailed below should be covered as a minimum. Where examples are given, they do not necessarily represent all the information to be detailed for that requirement.

Operations that are distinct from one another should be addressed separately in the Safety Risk Assessment Process (SRAP).

1.4.1. Areas of operation

Refer to GM1 to UK Regulation (EU) 2019/947, UAS.SPEC.050(1)(h) for guidance on the procedures to describe the areas of operation.

Emergency buffer areas, as described in the GM above, should be established where necessary to protect uninvolved people on ground or other airspace users from the consequence of a loss of control. The emergency buffer should be large enough to enable activation of the emergency procedures, based on the handling characteristics of the UA, the failure modes identified and the environmental conditions.

For example, if the risk assessment identifies that there may be no uninvolved people within the operational volume and emergency buffer, and the emergency procedures set out that a flight termination device will be used, then the emergency buffer must be large enough to allow the UA to safely impact the ground before it leaves the emergency buffer.

1.4.2. Type of operation

State whether the flights are VLOS or BVLOS operation.

EVLOS is no longer considered a type of operation. An operation that was previously considered as EVLOS would now be considered as BVLOS.

1.4.3. Characteristics of the operation

Provide details of the intended operation.

Refer to the following non-exhaustive list of examples:

- *The classification of the airspace the flight will be conducted in (Class A, C, D, E, or G), or within another airspace restriction such as a TDA or FRZ.*
- *Whether the flights will be performed during day or night.*
- *Whether the flights are planned to be conducted in congested areas (Urban-high density population).*
- *The height above the surface for which the flights are planned.*
- *Whether goods will be carried (for carriage of dangerous goods please refer to the CAA website) or articles will be dropped/ dispensed.*
- *The type of operation being conducted, for example, filming, infrastructure inspections, agriculture, aerial spraying, swarming, surveillance, test and development etc.*
- *If the flights involve operation in close proximity to uninvolved persons, vehicles, vessels or structures.*
- *Whether the flights involve flying over assemblies of people.*

The description should contain all relevant information that demonstrates a detailed understanding of how and where the operation is to be undertaken and the limitations or conditions associated with it. Any other information helpful in explaining the intended operation, such as diagrams or illustrations, should be included in this section.

1.4.4. Operation of multiple types of UAS

Detail the different types of UAS that may be operated.

Include any limitations considered appropriate to the types of UAS that a remote pilot may operate, e.g. class, mass, manufacturer and model, etc.

1.4.5. Radio licensing requirements

Detail any radio licences.

It is the responsibility of the UAS operator to ensure that the radio spectrum used for the command-and-control link and for any airborne equipment and 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 UAS 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, e.g. EC devices / transponders.

Any radio licences required for the operation should be included as evidence in the application and appropriately referenced.

1.4.6. Methods to determine the feasibility of the intended operation

Describe the process undertaken to determine the feasibility of each aspect of the intended operation, including the operating site planning and assessment.

Describe how the relevant aspects associated with the operation are assessed and prioritised. Factors to be considered include:

- *Airspace classification, i.e. class of airspace.*
- *Intended operating environment, necessary notification procedures to ATC or aerodromes, considerations when operating in close proximity to aerodromes or other aircraft.*
- *Operations near industrial sites or activities such as live firing, gas venting, high-intensity radio transmissions, etc. Considerations for local byelaws and physical obstructions (wires, masts, buildings, etc).*
- *Airspace restrictions such as prohibited airspace around prisons, nuclear establishments, habitation, recreational activities, public access, permission from landowners, likely operating sites and alternative sites, weather considerations, etc.*
- *Site permission.*

Include templates of checklists used to document operation and operating site assessments and describe how these are evaluated, by whom and how it is determined that the operation is considered feasible. Describe how these records are held and retrieved when necessary.

1.4.7. Pre-notification to third parties

Describe the process for obtaining relevant airspace permission and/or notification of the activity to relevant third parties.

If a flight is to be undertaken within an aerodrome's flight restriction zone or within another zone that restricts the flight of the UAS, the appropriate parties should be contacted and permission obtained.

Some operations such as those above 400ft within controlled airspace may need to be notified to the ANSP. Further information can be found in AMC1 to UK Regulation (EU) 2019/947, UAS.SPEC.040(1)(b).

Notification of a flight to other airspace users may require issuance of a NOTAM. Reference should be made to NOTAM policy.

In some cases, promulgation of airspace changes necessary for the operation may be required. This will be arranged as part of any necessary airspace change and may include changes to the AIP, AICs and NOTAMs.

All efforts should be made to inform third parties within the flight volume that may be in close proximity to the UA, and to obtain the necessary agreements. A 'letter drop' is not sufficient to assume all third parties are 'involved persons'.

It may be necessary to inform the local police of the intended operation to avoid interruption to or concerns from the public.

1.4.8. Communications

Describe the communication methods between airspace users, aircraft operators, air traffic service providers and any other relevant agencies or emergency services where necessary.

Consider the methods used to achieve this such as two-way radio, telephone, flight notification apps or other suitable methods.

Communication methods should be suitably robust, depending on the nature of the communication.

The site survey section should consider any communication requirements detailed in this section. For example, a site with no mobile network coverage is clearly not suitable for an operation where a mobile telephone has been provided as a mitigation means or is a communication requirement. Similarly, if two-way radio communication is a requirement, then this should be range tested in the operational environment at any proposed location.

Any range test should be representative of the operational environment; for example, a test early on a Sunday morning may result in a different outcome to a test on a weekday, where a nearby source of interference may be present only at certain times.

Any specific phraseology used by the operator for communication between flight crew should be detailed and included as part of any training for the remote crew.

This should also include communications between the operator's personnel involved with the support of the UAS operation, and any back-up communications to be used in the event of failure of the primary communication system.

The Applicant should refer to GM1 to UK Regulation (EU) 2019/947, UAS.SPEC.060(2)(d).

1.4.9. Assessment of the environmental conditions

Describe the methods of obtaining weather forecasts and conditions prior to operation, to ensure UAS operating limitations are not exceeded.

Weather conditions could be a contributory factor to increased Safety risks when operating an UAS. Weather could impact different aspects of operations, the UAS itself, sensors on the UAS, or critical communications between UAS and operator.

Consideration should be given to potential weather impacts in the event that the flight cannot be completed as planned, and contingency plans should be established as appropriate. For example, in the event of the loss of control of a UAS in strong winds, the UAS could be blown into areas likely to cause third party damage and injury. Before commencing flight, operators of the UAS should satisfy themselves that the flight can be made safely, taking into account the latest information available as to the weather reports and forecast available.

Operators should consider the use of appropriate weather products and assess the level of their personnel's skills in using weather products to make effective weather-related decisions. To establish that weather products are appropriate, users should consider the level of accuracy and validity of the information and whether personnel will know how to use the information effectively.

Depending on the category and method of operation, CAA Regulated Aviation Meteorological Products, Services and Guidance may be deemed appropriate information and whilst primarily intended for use by the manned aviation sector, the Regulated Products include weather reports and forecasts for "low level" airspace users (such as balloon operators), which could also provide valuable information to UAS operators.

When using weather information, consideration should be given as to its applicability to the time and area of operation. For example, aerodrome observations (METAR) and forecasts (TAF) represent conditions at an aerodrome and may not accurately represent conditions even a short distance away from the aerodrome.

All regulated products are available free of charge via the Met Office Aviation Briefing Service. The Aviation Briefing Service also includes additional UK and European information such as synoptic charts, weather map viewer, observed and forecast map layers (satellite imagery, lightning, thunderstorm layers), rainfall radar and Aerodrome Warning email alert service.

Use of other information such as public weather forecasts, rainfall and radar imagery, synoptic charts and weather "apps" (aviation and non-aviation) can be beneficial when used in conjunction with regulated products. However, users need to recognise the limitations and possible risks of using unregulated sources of weather information and should consider relevant factors such as:

- *Is the information provided complete?*
- *Is information managed effectively within the app – is only valid information displayed, and is expired information removed promptly?*
- *What level of data validation and verification does the provider employ?*
- *Does the provider identify and manage any errors effectively (e.g. notification to users, correction of errors and facility for reporting issues)?*
- *What measures are taken to ensure that information taken from regulated products (or other authoritative sources) is not lost, altered or misrepresented?*

1.4.10. Site procedures

Detail the procedures associated with operating from the main and alternate sites, including the site survey assessment and other site related procedures.

The site survey assessment should include methods of surveying the operating areas, identifying hazards and conducting any additional risk assessments, as show in Table 3.

Checks to be completed	*Guidance*	Completed – Y/ N
Operating Area	*The use of non-established sites for flying UA requires an assessment of the suitability of that site to be made prior to commencing operations. Such an assessment should be made using a site visit and available information from at least the aeronautical charts, as well as other sources of information such as the UK Aeronautical Information Service (www.ais.org.uk), digital imagery (Online Maps etc.), Ordnance Survey maps, etc.* *Typical elements of an assessment that could affect the safety of the flight include:* ▪ *Hazards associated with industrial sites or such activities as live firing, gas venting, high-intensity radio transmissions, etc.* ▪ *Local by-laws.* ▪ *Obstructions (wires, masts, buildings, etc.).* ▪ *Extraordinary restrictions such as segregated airspace around prisons, nuclear establishments, etc. (suitable permission may be needed). Also habitation and recreational activities.* ▪ *Public access.* ▪ *Likely operating site and alternative sites.* ▪ *Weather conditions for the planned flight.* *Selection of main and alternate operating sites: include methods of identifying and selecting the operating areas, including the operational volume and emergency buffer. The size, shape, surroundings, surface, slope and suitability of the landing zone and how this will be kept clear.*	

Checks to be completed	*Guidance*	Completed – Y/ N
Site permissions	*Detail the procedures describing how the landowner's permission to conduct the intended operation are obtained.* *Operators should be aware of their responsibilities regarding operations from private land and any requirements to obtain the appropriate permission before operating from a particular site. In particular, operators should ensure that they observe the relevant trespass laws and do not unwittingly commit a trespass whilst conducting a flight.*	
Airspace	*Class / type of airspace and specific provisions (e.g. Controlled Airspace, Flight Restriction Zones, etc).* *Other aircraft operations (local aerodromes or operating sites).*	
Operational restrictions	*Minimum separation distances from persons, vessels, vehicles and structures not under control of the remote pilot.* *Segregate the UAS operation from the general public by placing physical barriers and cordons around the area of activity, or using other built / natural features.* *Crowd control – Marshalling or other active crowd control measures that restrict access to the area within which the UAS is operating.* *These minimum distances and crowd lines should take into account the operational volume and emergency buffer described in section 1.4.1.*	
RF wireless site survey procedures to ensure reliable connectivity	*Surveys for frequency coverage throughout the potential operating area. Surveys for frequency capacity to ensure sufficient bandwidth to support all predicted operations.* *The use of a spectrum analyser is recommended to assist in assessing the level of local electromagnetic and RF congestion in the appropriate frequency ranges used by critical systems that are reliant on the transmission and reception of radio signals. Further guidance can be found in GM1 to UK Regulation (EU) 2019/947, UAS.SPEC.050(1)(c).*	

Table 3: Site survey assessment.

Site survey assessments may be carried out utilising check lists / templates or other means the operator deems appropriate. These assessments will form part of the operator's record keeping in accordance with conditions imposed within any authorisation issued by the CAA.

1.4.11. Pre-flight procedures: assembly and functional checks

Detail the checks that need to be conducted following completion of assembly of the UAS.

Detail the pre-flight procedures that need to be conducted, prior to the operation commencing.

These may include, but are not limited to:

Checks to be completed	*Guidance*	*Completed – Y/ N*
Unmanned Aircraft	*Conduct a visual inspection of the platform and its structure to ensure security of objects such as access panels, engines / motors, propellers / rotors, landing gear and external loads.*	
Fuel	*Batteries are correctly installed and charged.* *Correct fuel amount and type for the mission.*	
Electrical and avionics equipment	*Ensure they are serviceable and functioning, include built-in tests, etc.*	
C2 Link	*Ensure correct functioning of the C2 link.*	
GNSS	*Ensure that the GNSS is receiving sufficient satellites before commencing the flight.* *Verify that the weather conditions and GNSS coverage will be suitable for the flight.*	
Navigation system	*Check that the navigation system or CU are programmed with correct route information.*	
Flight / engine controls	*Verify correct operation of flight controls and engines / motors.* *Check for freedom of movement.*	
Payload	*Verify security of attached payload and correct operation of payload release mechanisms.*	

Checks to be completed	*Guidance*	*Completed – Y/ N*
Flight Termination System	*Verify that any flight termination system used is functioning.*	
Airspace	*Verify that there are no airspace restrictions in place using a flight notification app or similar method.*	
Additional checks	*As required by the manufacturer or operator procedures.*	

Table 4: Pre-flight assembly and functional checks.

Examples of pre-flight procedures that need to be carried out prior to the operation commencing, are:

- *Crew briefing: the procedures for briefing the flight and ground crew in connection with the task, responsibilities, duties, handling of emergencies, etc.*
- *Communications: outline the procedures for maintaining contact between flight and ground crew members and adjacent air operations if applicable.*
- *Refuelling: include the procedures and precautions associated with changing and / or charging of batteries, replenishment of liquid fuels, etc.; consider the handling of high energy storage devices.*
- *Loading of equipment: describe the precautions to be taken to ensure the security of loaded equipment.*

1.4.12. In-flight procedures

Detail the normal procedures to be performed by the crew associated with engine / motor starting, take-off, in-flight, landing and shutdown.

Detail the specific operating limitations.

Examples of in-flight procedures are:

- *Deconfliction procedures, actions to be taken in the event an aircraft approaches and enters the operational volume.*
- *Regular in-flight checks, such as fuel / power, C2 link status, temperatures, on board systems status, satellite coverage / GNSS functionality, and position.*
- *Pre-landing checks, such as airspace lookout, ground lookout for uninvolved people, check the landing area is clear, ensure the aircraft configuration is set up for landing (e.g. gear down).*
- *Procedure to determine the required fuel quantity for the intended operation including for contingency.*
- *Procedures for safe handling by any person who may come into contact with the hazardous substances (e.g. payload handlers/loaders, ground staff, remote pilot).*
- *Procedures to ensure relevant Rules of the Air requirements from SERA are met (see AMC1 to Article 7(2) of UK Regulation (EU) 2019/947). This AMC sets out which requirements need to be met. The procedures to ensure these are met should be detailed in this section of the OSC.*

Examples of operational limitations:

- *Operating heights, lateral distances, conditions and limitations for operating within the applicable class(es) of airspace etc. This Information can also be portrayed graphically, detailing any applicable boundaries intended for safety, based on the operational volume and emergency buffer described in section 1.4.1.*
- *Maximum cruising speed (maximum speed typically used during operation; this may be the maximum airspeed).*
- *Environmental conditions, such as minimum visibility conditions.*

These could be contained in a separate remote crew manual and include information such as flight crew reference cards. This should be referenced in this section.

1.4.13. Post-flight and between flight checks

Detail the checks or inspections to be conducted both after flight and between consecutive flights.

Describe the process for reporting defects and maintenance actions.

Examples of after-landing checks and procedures that may be necessary:

- *System checks*
- *Avionics shutdown*
- *Motor / engine shutdown checks*
- *Battery / fuel isolation*

Logging requirements should include any actions necessary to log the flight hours of the aircraft (e.g. in the aircraft tech log).

Debrief the flight crew on the safety standards of the operations and take note if procedures can be improved for future operations with a background of collaboration and Crew Resource Management principles.

1.4.14. Emergency procedures

Detail the emergency procedures to be carried out after an event leading to a loss of control of the operation. This should include appropriate checklists as required.

Explain under what conditions the ERP is activated.

Emergency procedures are carried out when a loss of control of the operation has occurred and deal primarily with the handling of the UA, in order to reduce the impact of the consequence of the loss of control.

Examples of events that lead to a loss of control of the operation are listed below, but are not limited to:

- *Aircraft exiting the operational volume*
- *Complete loss of flight control*
- *Complete loss of propulsion*
- *Abnormal environmental conditions*
- *Air or ground incursions*

The ERP is a separate set of procedures that may or may not be activated after the event that leads to a loss of control of the operation.

Include any applicable normal and failure indications provided to the remote pilot and include appropriate checklists. Applicable preventative measures should also be detailed. The emergency procedures should be a component of the ERP.

2. UAS OSC Volume 2 – UAS Description

2.1. Introduction

The aim of the OSC Volume 2 is to provide a description of the UAS architecture, components, installation, functions, safety features and Human-Machine Interface (HMI), with the purpose of providing evidence to the CAA that the technical means to mitigate the Safety risks claimed in Volume 3 have been correctly implemented.

This section provides a template that can be used by the Applicant to draft their OSC Volume 2 document.

The tables included in this section are non-exhaustive lists, aimed at providing prompts to the Applicant for developing the contents of their document; items in the lists or in other guidance may not be included in the document if they are not applicable or not available. The tables may also serve as checklists to the Applicant.

2.2. Section 1 – Initial information

2.2.1. Front page

Include the following items on the front cover of the Volume 2 document:

Description	Guidance
Operator ID	*Uniquely identifies the Applicant.*
UAS Operating Safety Case Volume 2 – UAS Description	*To be included in the document title.*
Document reference number	*A reference number generated by the Applicant which uniquely identifies the document.*
Document version and date	*E.g. Version X. Dated DD MMM YYYY*

Table 5: Volume 2 front cover

2.2.2. Amendment record

Include an amendment record at the beginning of the document per Table 6, which records changes made to the document.

An amendment record provides traceability of changes made to the document and ensures appropriate document control.

Amendment Number	Date	Amended by	Details of changes
(a, b, c or 1, 2, 3 etc.)	*DD/MM/YYYY*	*Name of Person*	*List of main changes made to the document, including section/paragraph numbers where those changes were made.*

Table 6: Volume 2 amendment record

When submitting a new revision of the document, it is also highly recommended that the Applicant use revision bars or highlight the sections changed. This will assist the CAA when assessing the application.

2.2.3. Acronyms and abbreviations

List all acronyms or abbreviations used throughout the document and provide their meaning.

There is no need to further expand any acronym or abbreviation within the document body.

2.2.4. Table of contents

Include a table of contents listing all numbered sections/paragraphs in the document, including the following sections: Title Page, Amendment Record, Acronyms and Abbreviations.

2.3. Section 2 – Aircraft and systems description

The purpose of this section is to provide a detailed technical description of the airframe and systems used in the UAS. The description will provide, amongst other things, the evidence that risk mitigation means claimed in the OSC Volume 3 are correctly implemented in the UAS. All sections detailed below should be covered as a minimum. Where examples and tables are provided, the lists are non-exhaustive.

2.3.1. UAS model

Provide the UAS name and model.

2.3.2. Details of design and manufacturing organisations

Provide details of the designer and manufacturer of the UAS and associated equipment.

Details of manufacturer Quality Management System (QMS) accreditations such as ISO9001:2015 may also be included as evidence.

2.3.3. UA physical characteristics

Describe the physical characteristics and design features of the UA, including:

Description	Guidance
Empty mass	*No fuel / battery, no payload*
Maximum Take-Off Mass (MTOM)	
Aircraft type	*fixed wing, rotorcraft, etc.*
Dimensions for a fixed-wing aircraft:	
Wingspan	
Fuselage length	
Fuselage diameter	
Dimensions for a rotorcraft/multirotor:	
Length of aircraft body	
Width of aircraft body	
Height of aircraft body	

Propeller configuration	*Number of rotors, number of blades, etc.*
Propeller dimensions	
Sound power level	
Any other relevant information	

Table 7: UA physical characteristics description

The description may include photographs.

2.3.4. UA performance characteristics

Describe the performance characteristics (design flight envelope) of the UA, including:

Description	Guidance
Maximum airspeed	
Minimum airspeed to maintain safe flight	*Manoeuvring or stall speed as applicable; in the case of a rotorcraft / multirotor UAS, it may be zero.*
Normal/typical operating height	*Specify AGL or AMSL.*
Maximum operating height	*Specify AGL or AMSL.*
Maximum flight time during normal operation	*This is the maximum flight time expected by the operator to carry out the operation. This is not the maximum flight time the UAS is capable of.*
Maximum flight time on an ISA day at cruising speed at normal/typical operating height.	*This is the maximum flight time the UAS is capable of with a fully charged battery, in (as close as) normal environmental conditions (15°C OAT at sea level, no wind, no precipitations)*

Maximum flight range on an ISA day (normal and emergency conditions)	*Maximum distance covered with a fully charged battery, in the following conditions:* *- Cruising speed, normal operating height.* *- Emergency condition, defined by the Applicant.*
Glide distances	*Glide profile, ground distance covered.*
Maximum radio range of the C2 Link	
Any other relevant information	

Table 8: UA performance characteristics description

2.3.5. UAS environmental limitations

Describe the environmental limitations of the UAS, including:

Description	Guidance
Wind speed limits	*Headwind, crosswind, tailwind, including gusts.*
Turbulence restrictions	
Precipitation limits	*Resistance to water ingress, hail, snow, ash, etc.* *Examples of water ingress: rain, moisture. Include IP ratings, etc.*
OAT limits	
In-flight icing condition limits	
Any other relevant information	

Table 9: UAS environmental limitations description

2.3.6. Construction

Describe the method of construction of the UA, including:

Description	Guidance
Type of material	*Composite, metallic, combination of materials, etc.*
Material characteristics or properties	*Frangibility, etc.*
Any other relevant information	

Table 10: UA construction description

2.3.7. Electrical power system

Describe the electrical power generation, distribution, system control and installation, and safety provisions, including:

Description	Guidance
Batteries:	
Type, model and manufacturer	
Quantity	
Arrangement	
Generator:	
Type, model and manufacturer	
Specification	
Electrical loads	*This may be voltage, current and power values of the various components in different configurations of the electrical power system: power on / standby, engines on, cruise, emergency, etc.*
Electrical load shedding functionality	*When a failure occurs, certain systems / functions may automatically be turned off to provide sufficient and reliable power to more critical systems or functions.*

Power supply redundancy	
Procedures to charge and discharge batteries.	
Safety provisions with regards to hazards inherent to high-voltage storage devices:	*E.g. batteries.*
Procedures in place for safe handling by any person who may come into contact with high-voltage storage devices	*E.g. payload handlers / loaders, ground staff, remote pilot.*
Means of identifying high-voltage storage devices.	*Labels on the UA, etc.*
Safety provisions for any person discovering the UA following an accident.	*Labels on the UA, etc.*
Procedures and safety provisions to mitigate the risk of battery thermal runaway.	*Include means to protect personnel from potential harm.*
Procedures for monitoring high-voltage storage devices.	
HMI:	
Information indicated to the remote pilot.	
Alert messages indicated to the remote pilot.	*Advisory, caution, warning, etc.*
Any other relevant information	

Table 11: UA Electrical power system description

The description may include drawings, bill of materials, test data, photographs, etc.

Inclusion of Electrical system diagrams is recommended to help describe the system layout, its components and the electrical load distribution.

An electrical load analysis is recommended to describe the system and electrical load distribution. With the help of system diagrams, the analysis would show the power drawn by the various components in different flight phases (e.g. take-off, cruise, landing, emergency, etc.) for all possible UAS configurations (e.g. with added payload).

Include in an annex to the OSC any manufacturer supplied data relating to equipment and components such as data sheets, specification sheets and performance data. Evidence of QMS certification or accreditation for applicable engineering processes may also be provided.

2.3.8. Propulsion system

Describe the propulsion system and installation, including its ability to provide reliable and sufficient power for take-off, climb and maintaining flight at the expected mission altitudes. The description should include:

Description	Guidance
Propulsion type	*Hybrid, eVTOL, thrust vectoring, etc.*
Engines:	
Type, model and manufacturer	
Propeller type, model and manufacturer	
Quantity	
Arrangement	
Power output	
Propeller guards	
In-flight restart functionality	
Performance monitoring	
Health monitoring	*Engine temperature, etc.*
Safety features and redundancy in the system that allow maintaining flight after a failure or degradation has occurred in the propulsion system.	
Fuel-powered propulsion system – Safety features to mitigate the risk of engine loss when the following hazards occur:	
Fuel starvation	
Fuel contamination	*By water, fungi, etc.*
Failed signal input from the control station	
Engine controller failure	
Indication to the remote pilot	
Electric-powered propulsion system:	

Power source and supply management with regards to other systems in the UA	
Redundant power sources	
Maximum continuous power output of the motor	
Maximum peak power output of the motor	
Electrical distribution architecture	
Electrical load shedding functionality	
HMI:	
Information indicated to the remote pilot.	
Alert messages indicated to the remote pilot.	*Advisory, caution, warning, etc.*
Any other relevant information	

Table 12: UA Propulsion system description

The description may include drawings, bill of materials, test data, photographs, etc.

Inclusion of system diagrams is recommended to help describe the system layout.

Include in an annex to the OSC any manufacturer supplied data relating to equipment and components such as data sheets, specification sheets and performance data. Evidence of QMS certification or accreditation for applicable engineering processes may also be provided.

2.3.9. Fuel system

Describe the fuel storage, distribution, system control and installation, and safety provisions, including:

Description	Guidance
Fuel type	*Electrical, gasoline, hybrid, solar, hydrogen, etc.*
Safety provisions with regards to hazardous substances within the fuel system:	
List of hazardous substances and their characteristics.	*Flammability, corrosiveness, etc.*
Procedures in place for safe handling of the UA by any person who may come into contact with the hazardous substances.	*E.g. payload handlers / loaders, ground staff, remote pilot.*
Means of identifying the hazardous substances.	*Labels on the UA, etc.*
Safety provisions for any person discovering the UA following an accident.	*Labels on the UA, etc.*
HMI:	
Information indicated to the remote pilot.	
Alert messages indicated to the remote pilot.	*Advisory, caution, warning, etc.*
Any other relevant information	

Table 13: UA Fuel system description

The description may include drawings, bill of materials, test data, photographs, etc.

Inclusion of system diagrams is recommended to help describe the system layout.

Include in an annex to the OSC any manufacturer supplied data relating to equipment and components such as data sheets, specification sheets and performance data. Evidence of QMS certification or accreditation for applicable engineering processes may also be provided.

2.3.10. Flight Controls system

Describe how the UA is controlled, the system design and operation, the various functions, including:

Description	Guidance
Design and operation of flight control units, surfaces, actuators, control linkages, etc.	
Flight controller:	
Type, model and manufacturer	
Functions	
Flight modes available	*Include basic functions, means of activation, limitations, flight mode selection dependant on phase of flight or emergency scenario, etc.*
Automatic functions:	
Take-off and landing	
Stabilisation	
Autopilot	
Return to home	
If functions are provided by COTS equipment, provide type, model and manufacturer.	
Safety features and redundancy in the system which allow maintaining flight after a failure or degradation of the flight control system, including indication to the remote pilot.	*E.g. when one engine fails, the remaining engines increase thrust, or the flight controller adjusts the UAS attitude to maintain flight.*
HMI:	
Information indicated to the remote pilot.	
Alert messages indicated to the remote pilot.	*Advisory, caution, warning, etc.*
Any other relevant information	

Table 14: UA Flight Controls system description

The description may include drawings, bill of materials, test data, photographs, etc.

Inclusion of system diagrams is recommended to help describe the system layout and how it is constructed.

Include in an annex to the OSC any manufacturer supplied data relating to equipment and components such as data sheets, specification sheets and performance data. Evidence of QMS certification or accreditation for applicable engineering processes may also be provided.

2.3.11. Navigation

Describe the systems and methods used for positioning, navigation and guidance, including:

Description	Guidance
Sensors	
Type, model and manufacturer	
Quantity	
Telemetry links	*Data transmitted from the UA to the CU, etc.*
Method to determine current position.	*Longitude, latitude, altitude, heading.*
Method to navigate to intended destination.	*Waypoint, vectoring, flight track.*
Automatic/automated navigation functions	
Geo-awareness functions	*For the purpose of supporting avoidance of specific areas or confinement to a given area.*
Containment functions	*Within the operational volume.*
Safety features and redundancy in the system which allow maintaining flight after a failure or degradation has occurred in the navigation system:	
Backup means of navigation	
Detection of and response to loss of primary means and secondary means of navigation.	
Indication to the remote pilot	

HMI:	
Information indicated to the remote pilot.	
Alert messages indicated to the remote pilot.	*Advisory, caution, warning, etc.*
Any other relevant information	

Table 15: UA Navigation system description

2.3.12. Detect and Avoid (DAA) systems

Describe any DAA system for such use as terrain and obstacle avoidance, adverse weather avoidance, mid-air traffic deconfliction and collision avoidance, etc. The description should include:

Description	Guidance
DAA system functions	
Devices used	*ADS-B, FLARM, EC devices, etc.* *Apply for the 24-bit address of the EC device to the CAA Infrastructure Section.*
Technology used	*Light detection and ranging (LIDAR), electro-optical sensors, laser ranging, radar altimeter, etc.*
Interface between the DAA system and the flight control computer	
Limitations of the DAA system	
Evidence of equipment qualification and approval.	*E.g. TSO, ETSO, etc.*
DAA event sequence:	
Level of automation	
Actions required by the remote pilot	
Means to verify normal system operation.	*Built-in test, procedure, etc.*
HMI:	
Information indicated to the remote pilot.	

Alert messages indicated to the remote pilot.	*Advisory, caution, warning, etc.*
Any other relevant information	

Table 16: DAA system description

2.3.13. Other avionics systems

Describe any other avionics fitted to the UA, following the guidance provided in the previous paragraphs. Include details of any equipment approval.

2.3.14. Command Unit (CU)

Describe the CU elements (e.g. fixed or mobile installation, laptop computer, tablet, etc.), architecture, functions, interfaces, installation, operating system, and any relevant specifications, including:

Description	Guidance
Power sources, supply management and redundancy.	
Radio signal:	
Determination of the signal strength and health value.	
Threshold values which represent a critically degraded signal.	
Control handover between two CUs	
Safety features to mitigate the risk of inadvertent command activation:	
List of critical commands	
Mitigation means	*Kill switch, switch guard, activation key, two-step process, etc.*
Safety features to mitigate the risk of display or HMI lock-up.	

Safety features to maintain flight-critical processing when multiple programs are running concurrently.	*E.g. consider processing capability if critical flight controls software is run on a laptop concurrently with software processing the payload data or other programs.*
HMI:	
Information indicated to the remote pilot.	
Radio signal strength and/or health indication to the remote pilot.	
Alert messages indicated to the remote pilot.	*Advisory, caution, warning, etc.*
Any other relevant information	

Table 17: CU description

The description may include drawings, bill of materials, test data, photographs, etc.

Inclusion of system and functional diagrams is recommended to help describe the system layout and features.

Include in an annex to the OSC any manufacturer supplied data relating to equipment and components such as data sheets, specification sheets and performance data. Evidence of QMS certification or accreditation for applicable engineering processes may also be provided.

2.3.15. Command and Control (C2) link

Describe how control instructions and telemetry data are relayed between the CU and the UA, including:

Description	Guidance
RLOS	
BRLOS	
Antennas:	
Type, model and manufacturer	
Locations on the UAS	
Transceivers / Modems:	
Power levels	
Transmission schemes	
Operating frequencies	
Details of frequency spectrum approvals	*Ofcom approvals, etc.*
Maximum power output/range	
Type of signal processing	
Datalink margin in terms of the overall link bandwidth at the maximum anticipated distance from the CU.	
Operational C2 link management:	
Frequency switchovers	
Contingency situations	
Third party link service provider	
Radio signal:	*Include mobile network coverage and signal strength for appropriate locations.*
Determination of the signal strength and health value	
Threshold values which represent a critically degraded signal.	

Minimum and average assured data rates	
Minimum and average assured latencies	
Design features and procedures to maintain availability, continuity, and integrity of the datalink:	
RF or other interference	
Flight beyond communications range	
Antenna masking	*During turns, at high attitude angles, etc.*
Loss of CU functionality	
Loss of UA functionality	
Atmospheric attenuation	*Including during precipitations.*
Safety features to mitigate the risk of loss of C2 link:	
C2 links redundancy	
Automatic triggering of an emergency recovery function	
Automatic return to home	
Safety features to mitigate the risk of harmful interference.	*Pairing, encryption, back-up link, etc.* *Consider in particular electro-magnetic compatibility and interference.*
HMI:	
Information indicated to the remote pilot.	
Radio signal strength and/or health indication to the remote pilot.	
Alert messages indicated to the remote pilot.	*Advisory, caution, warning, etc.*
Any other relevant information	

Table 18: C2 Link description

The description may include drawings, bill of materials, test data, photographs, etc.

It is recommended to use licensed spectrum for BVLOS operations to minimise the chances of external interference and to improve latency.

2.3.16. Communications

Describe the communication system and installation which provides the means to communicate with air traffic service providers, emergency services, the UAS flight crew and any other personnel, agencies or organisations relevant to the UAS operation. The description should include:

Description	Guidance
Antennas:	
Type, model and manufacturer	
Locations on the UAS	
Communication method:	
VHF	
GSM network	
Satellite	
Safety features to mitigate the loss of communication function:	
Primary communication means	
Secondary / back-up communication means	
HMI:	
Information indicated to the remote pilot.	
Radio signal strength and/or health indication to the remote pilot.	
Alert messages indicated to the remote pilot.	*Advisory, caution, warning, etc.*
Any other relevant information	

Table 19: Communications description

The description may include drawings, bill of materials, test data, photographs, etc.

2.3.17. Take-off and landing mechanisms

Describe the take-off and landing mechanisms fitted to the UA, including:

Description	Guidance
Wheels, skids, rails, launchers, etc.	
If various mechanisms can be fitted:	
Primary mechanism	
Secondary mechanisms	
Operational conditions/requirements for each mechanism.	
Any other relevant information	

Table 20: Take-off and landing mechanisms description

The description may include drawings, bill of materials, test data, photographs, etc.

2.3.18. Emergency recovery and safety systems

Describe the systems installed on the UAS that contribute to the safe handling or recovery of the UA in the event of loss of control or situational awareness.

These are typically a flight termination system (aims to immediately end the flight) or an automatic recovery system (pre-programmed course of action to reach a predefined landing area); some examples are ballistic parachutes, propeller guards, return to home function, tethering system, geo-fencing, geo-caging, airbags, etc.

The description should include:

Description	Guidance
Mode of operation	
Safety features which mitigate the risk of loss of control or situational awareness.	*E.g. a tether system should have a tensile mechanical strength that is no less than:* *- for heavier-than-air aircraft, 10 times the mass of the aerodyne at maximum take-off mass.* *- for lighter-than-air aircraft, 4 times the force exerted by the combination of the maximum static thrust and the aerodynamic force of the maximum allowed wind speed in flight.*
Means to verify normal system operation.	*Built-in test, crew procedures, etc.*
HMI:	
Information indicated to the remote pilot.	
Alert messages indicated to the remote pilot.	*Advisory, caution, warning, etc.*
Any other relevant information	

Table 21: Emergency recovery and safety systems description

The description may include drawings, bill of materials, test data, photographs, etc.

Inclusion of system diagrams is recommended to help describe the system layout and how it is constructed.

Include in an annex to the OSC any manufacturer supplied data relating to equipment and components such as data sheets, specification sheets and performance data. Evidence of QMS certification or accreditation for applicable engineering processes may also be provided.

2.3.19. External lighting

Describe any external lights installed on the UA, including:

Description	Guidance
Type, model and manufacturer	
Locations on the UA	
Colour	
Operation	*Always on, automatically activated, manually activated, etc.*
Operating modes	*Continuous lighting, flashing, etc.*
Purpose	*Conspicuity, etc.*
HMI:	
Information indicated to the remote pilot.	
Alert messages indicated to the remote pilot.	*Advisory, caution, warning, etc.*
Any other relevant information	

Table 22: External lighting description

The description may include drawings, bill of materials, test data, photographs, etc.

2.3.20. Payload

Describe the payloads that may be carried by the UA and their installation, e.g. deployable, crop spraying canisters, surface mapping hardware, cargo, data acquisition equipment (camera, infra-red scanners, LIDAR), etc. The description should include:

Description	Guidance
Types	*If cargo is being transported, also describe the storage means, e.g. crash resistant container.*
Mass	
Interfaces with the UA:	
Mechanical interface	*Means to attach the payloads to the UA, safety harness, etc.*
Electrical interface	*Power supply, etc.*
Data interface	
Release mechanism	*Describe the mechanical and electrical interfaces with the UA.*
Any other interface	
Procedures to install the payload onto the UA.	
Effects of the payload on the UA	*MTOM, centre of gravity (CG), flight envelope, manoeuvrability, etc.*
Sensors	
Safety features to mitigate the risk of the payload affecting the flight of the UA:	
Effects on aerodynamics	
Effects of electro-magnetic interference.	
Effects of electrical power and / or data connection failures on the UAS.	
Effects of complete detachment of the payload from the UA (either caused by a failure or through intentional lowering / dropping of the payload).	*In particular, consider the resulting dynamic loads on the UA and effects on its attitude caused by a sudden mass variation.*

Effects of partial detachment of the payload from the UA.	*In particular, consider the resulting effects on the UA's attitude and possible physical impact on the airframe from a sudden shift in CG or swinging of the payload.*
Distraction of the remote pilot generated by the payload during flight.	
Procedures to verify the attachment points to the UA.	
Procedures to verify the UA MTOM and CG location.	
Procedures to detect and mitigate any failure of the payload in flight.	*Including internal payload failures, failures at the interfaces and attachment points, etc.*
Safety provisions with regards to hazards inherent to the payload	*E.g. heat generated by the payload, camera lasers, etc.*
Procedures in place for safe handling of the payload.	*E.g. payload handlers / loaders, ground staff, remote pilot.*
Means of identifying hazards.	*Labels on the UA, etc.*
HMI:	
Information indicated to the remote pilot.	
Alert messages indicated to the remote pilot.	*Advisory, caution, warning, etc.*
Any other relevant information	

Table 23: Payload description

The description may include drawings, bill of materials, test data, photographs, etc.

2.3.21. Ground support equipment

Describe the ground support equipment, including:

Description	Guidance
UAS launch and recovery systems	
Power sources	
Transportation equipment	*Case, etc.*
Backup or emergency equipment	
Procedures to transport UA, CU, battery/fuel, and other equipment between operation sites and from the loading/off-loading area to the take-off/landing area.	
Storage of ground support equipment.	
Suitability of the ground support equipment and transportation method with regards to the UAS components' fragility, sensitivity or inherent hazards.	*Sensitivity to water ingress, dust, etc.* *Fire hazard posed by the batteries, etc.*
Ground support equipment standards	*Standards which the equipment was built to.*
Ground support equipment manufacturer's recommendations.	
Any other relevant information	

Table 24: Ground support equipment description

The description may include drawings, bill of materials, test data, photographs, etc.

2.3.22. Maintenance

Describe the maintenance programme of the UAS, including:

Description	Guidance
Maintenance manual:	
Structure	*Describe how the maintenance manual is structured.*
Maintenance procedures:	
Inspections	
Overhaul	
Repairs	
Assurance of repair procedures	*Describe how the integrity of the repair is assessed as meeting or exceeding the requirements of the original design data.*
Batteries maintenance during storage periods	
Origin of each procedure	*Manufacturer, operational experience, etc.*
Maintenance schedules	*Include maintenance intervals / frequencies.*
Procedures to record maintenance that has been carried out.	
Storage of maintenance records	
Staff qualification and levels of approval.	
Procedures to use the manual by the Maintenance staff	
Configuration control	*Describe the process through which the Maintenance manual gets revised.*
Any other relevant information	

Table 25: Maintenance description

If the maintenance manual is a sizeable stand-alone document, parts of it may be referred to in this section without the need to import it into Volume 2.

2.3.23. Spare parts procurement

Describe the spare parts procurement, including:

Description	Guidance
Sources of procurement	*Specify if parts are manufacturer-sourced or locally produced.*
Process to confirm the suitability of the part.	
Any other relevant information	

Table 26: Spare parts procurement description

The description may include drawings, bill of materials, test data, photographs, etc.

2.3.24. Change Management and modifications to the system

Describe the process through which the organisation/operator manages and records any change, addition or removal of any hardware, software or firmware post initial design of the UAS (UA or CU).

Hardware, software and firmware may be:

- *Hardware – Physical components such as propulsion units, batteries, fasteners, payload configuration changes, additional equipment such as hook-on devices, etc.*
- *Software – Programmes and operating information used by the UA such as auto-stabilisation, hover mode, low speed mode, etc.*
- *Firmware – Software specifically designed for a piece of hardware such as a controller, battery, propulsion unit, etc.*

The description should include:

Description	Guidance
Hardware, software, and firmware version control	
Modification standards	
Modification records storage	
Safety assessment associated with the modification	*Assess impacts of any changes on the current safety claims and the potential for introduction of new hazards.*
Any other relevant information	

Table 27: Change Management and modifications to the system description

2.4. Section 3 – Safety features of the UAS

Identify the hazards and failure modes within the UAS that may lead to mid-air collision or harm to uninvolved people on the ground, and identify the technical (e.g. redundant system) and / or operational (e.g. crew action) means to mitigate the Safety risk created by these hazards.

A 10-step method is provided in Figure 2 and Table 28, derived from the Functional Hazard Assessment technique used in CS-25 Aircraft certification, to help the Applicant identify functional hazards, associated failure modes and the means to mitigate them. This method however has its limitations and cannot identify non-functional hazards, e.g. hazards caused by materials used in the UAS. It is the responsibility of the Applicant to ensure that all hazards, both functional and non-functional, have been investigated.

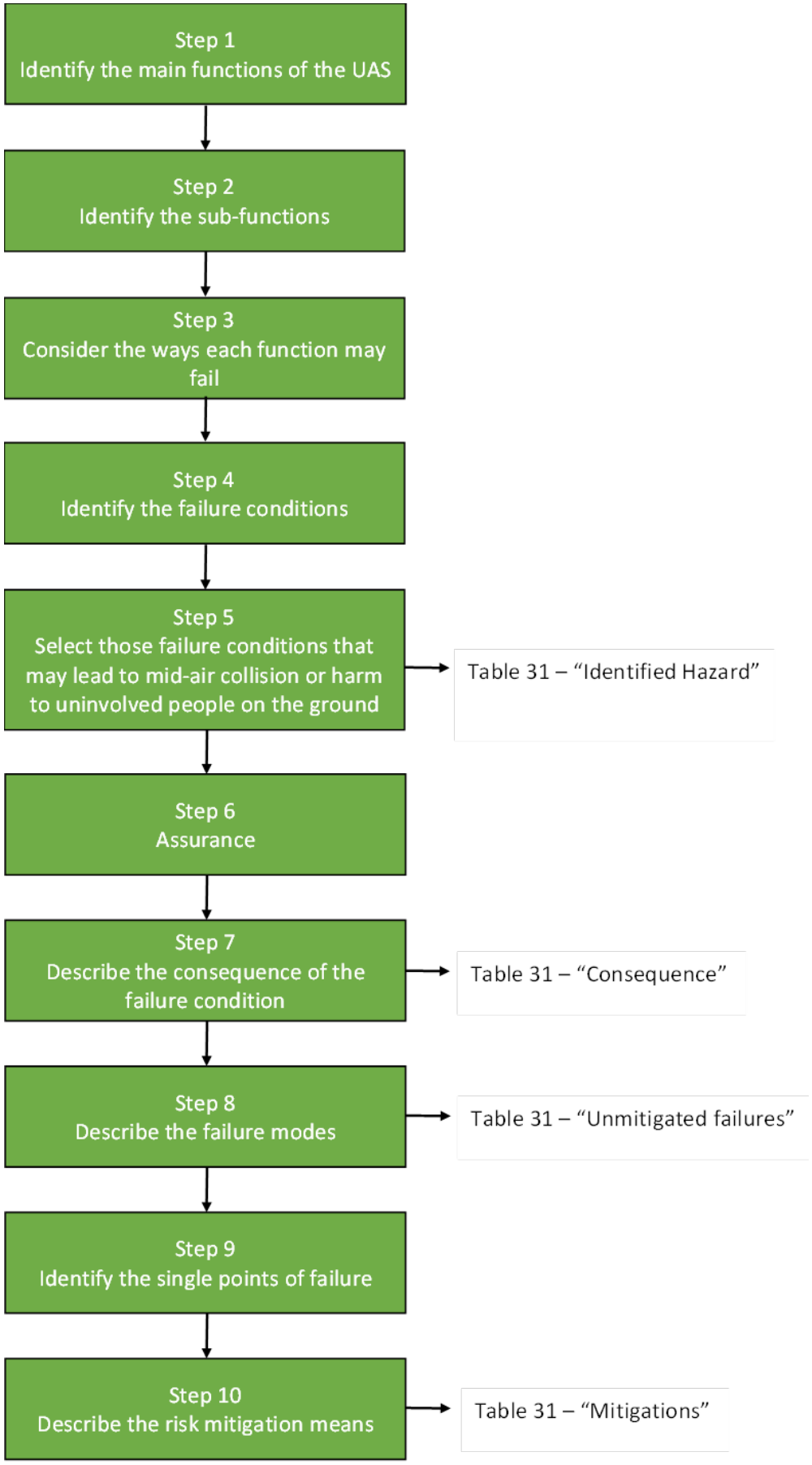

Figure 2: 10-step method to identify functional hazards, failure modes and mitigation means.

Method	Guidance
Step 1 – Identify the main functions of the UAS.	*E.g.:* - *To provide thrust* - *To control the UA* - *To provide power sources* - *To provide Communications* - *etc.*

Step 2 – Identify the sub-functions.	*E.g.:*
	- *To provide thrust:*
	  - *To start the engine*
	  - *To control engine thrust*
	  - *To shut down the engine*
	  - *etc.*
	- *To control the UA:*
	  - *To provide pitch control*
	  - *To provide roll control*
	  - *To provide yaw control*
	  - *etc.*
	- *To provide power sources:*
	  - *To provide electrical power to the propulsion system*
	  - *To provide electrical power to the flight control system*
	  - *To provide electrical power to the command and communication system*
	  - *To store electrical power*
	  - *etc.*

Step 3 – Consider the ways each function may fail.	*Only consider the following:* *a. Complete loss of function* *b. Partial loss of function* *c. Uncommanded function (i.e. the function is activated when not commanded)*

Method	Guidance
Step 4 – Identify the failure conditions.	*A failure condition is a condition having an effect on the UAS, both direct and consequential, which is caused or contributed to by one or more failures. A failure condition is therefore also considered a (functional) hazard, i.e. a condition of the platform (UAS) that, unless mitigated, can lead to an incident or accident.* *For each individual sub-function identified in step 2 (if no sub-function was identified for a given function, do this exercise for the function), identify all associated failure conditions using step 3, e.g.:* - *Total loss of engine thrust control* - *Partial loss of engine thrust control (e.g. loss of one or several but not all engines)* - *Uncommanded high engine speed* - *Loss of roll* - *Uncommanded yaw* - *Loss of electrical power to the control and communication system* - *Loss of command and control* - *etc.*
Step 5 – Select those failure conditions that may lead to mid-air collision or harm to uninvolved people on the ground. (Identified Hazard)	*The retained list of failure conditions will be included in the "Identified Hazard" column of the Hazard and Safety Risk Log in Volume 3.*
Step 6 – Assurance	*For each failure condition that has been excluded in Step 5, provide a brief explanation as to the reason for excluding it (one sentence may suffice). This is for traceability and to provide evidence of completeness to the CAA.*

Method	Guidance
Step 7 – Describe the consequence of the failure condition.	*For each failure condition selected in Step 5, describe the consequence on other aircraft and uninvolved people on the ground. When determining the consequence of a failure condition, only consider the worst case yet realistic/likely scenario.* *Specify whether the failure condition poses a ground risk or air risk. If the consequence of a failure condition can lead to both air and ground risk, the failure condition should be duplicated in the Hazard and Safety Risk Log in Volume 3, such that ground and air risk are assessed separately.* *Understanding the consequence of the failure condition will help determine the severity of the Safety risk when determining the "Initial Safety Risk Level" in Volume 3.* *The Applicant should consider each flight phase (Taxi, Take-off, en-route, approach, landing), as well as adverse operational conditions, adverse environmental conditions, or other external events, as they may have an impact on the severity or likelihood of the Safety risk.* *The description of the consequence will be included in the "Consequence" column of the Hazard and Safety Risk Log in Volume 3.*

Method	Guidance
Step 8 – Describe the failure modes. (Unmitigated Failures)	*For each failure condition selected in step 5, describe the failure modes which may contribute to it. The description will be included in the "Unmitigated Failures" column of the Hazard and Safety Risk Log in Volume 3.* *A failure is an event which affects the operation of an item such that it can no longer function as intended (e.g. an electrical connection comes apart within the engine).* *A failure mode is the way the item fails to perform its intended function, i.e. the externally observable manifestation of the failure (e.g. the engine stops running).* *Include known or recurrent failure modes from operational experience, in-service occurrence data, etc.* *Understanding the failures and failure modes (i.e. the causes) leading to the failure condition will help determine the likelihood of the Safety risk when determining the "Initial Safety Risk Level" in Volume 3.*
Step 9 – Identify the single points of failure	*Amongst the failure modes identified in step 8, identify single failures which may alone lead to the failure conditions identified in step 5. The means to mitigate single points of failure are critical to the safety of the UAS operation and will be of particular interest to the CAA in Volume 3.*
Step 10 – Describe the risk mitigation means. (Mitigations)	*For each failure mode identified in step 8, describe the technical and/or operational means to mitigate it. The description will be included in the "Mitigations" column of the Hazard and Safety Risk Log in Volume 3 and will provide the evidence that the failure condition has been mitigated to an acceptable level.* *The Applicant should ensure that Volume 2 Section 2 describes the systems / components / functions used by the mitigation and should make reference to it when describing the mitigation (e.g. "ref. Volume 2 Section 2 para. x.x.x"). This will provide the evidence that the mitigation is correctly implemented in the UAS.*

Table 28: 10-step method to identify functional hazards, failure modes and mitigation means.

3. UAS Volume 3 – Safety Risk Assessment

3.1. Introduction

The aim of the OSC Volume 3 is to provide instruction and guidance on how the Applicant should conduct their Safety risk assessment. This section provides a template that can be used by the Applicant to draft their OSC Volume 3 document.

The tables included in this section are non-exhaustive lists, aimed at providing prompts to the Applicant for developing the contents of their document; items in the list or in other guidance may not be included in the document if they are not applicable. The tables may also serve as checklists to the Applicant.

3.2. Safety Risk Management (SRM) guidance

SRM should be known and understood by the Applicant before tackling the Safety risk assessment. Applicants should provide clear evidence that the Safety risks have been suitably mitigated. The CAA will only accept an OSC when it has been evidenced that the Safety risks are both tolerable and ALARP.

There is no transfer of ownership of the Safety risk when the CAA accepts an OSC. Accountable persons within the UAS operation will retain ownership and accountability should a Safety risk lead to an incident or accident. Those accountable for the management of Safety risks should regard the SRM as an ongoing task.

3.3. Section 1 – Initial information

3.3.1. Front page

Include the following items on the front cover of the Volume 3 document:

Description	Guidance
Operator ID	*Uniquely identifies the Applicant.*
UAS Operating Safety Case Volume 3 – Safety Risk Assessment	*To be included in the document title.*
Document reference number	*A reference number generated by the Applicant which uniquely identifies the document.*
Document version and date	*E.g. Version X. Dated DD MMM YYYY*

Table 29: Volume 3 front cover

3.3.2. Amendment record

Include an amendment record at the beginning of the document per Table 30, which records changes made to the document.

An amendment record provides traceability of changes made to the document and ensures appropriate document control.

Amendment or Issue Number	Date	Amended by	Details of Change
(a, b, c or 1, 2, 3 etc.)	*DD/MM/YYYY*	*Name of Person*	*List of main changes made to the document, including section/paragraph numbers where those changes were made.*

Table 30: Volume 3 amendment record

When submitting a new revision of the document, it is also highly recommended that the Applicant use revision bars or highlight the sections changed. This will assist the CAA when assessing the application.

3.3.3. Acronyms and abbreviations

List all acronyms or abbreviations used throughout the document and provide their meaning.

There is no need to further expand any acronym or abbreviation within the document body.

3.3.4. Table of contents

Include a table of contents listing all numbered sections/paragraphs in the document, including the following sections: Title Page, Amendment Record, Acronyms and Abbreviations.

3.4. Section 2 – Safety Risk Assessment Process (SRAP)

The Applicant should take responsibility for their own safety case and risk assessment. Any changes to the operator's UAS OSC will require further assessment by the CAA, prior to further operations being conducted and will necessitate application to the CAA for a variation in this regard.

A careful and systematic approach should be taken when following any risk assessment process. OSC Volumes 1 and 2 should be used to support the assumptions and results of the analysis carried out in this document. For example, the technical details of the UAS, how it functions and the systems that provide technical mitigations against the identified risks will be detailed in Volume 2. The concept of operations, operational requirements, and the environment the UAS will be flying in will be detailed in Volume 1 along with any operational mitigations that contribute to the safety arguments for the identified risks.

The SRAP is used to identify, assess, manage and record Safety risks associated with an operation. The SRAP is divided into seven steps, each of which are described in more detail in the following sections with reference to Figure 3.

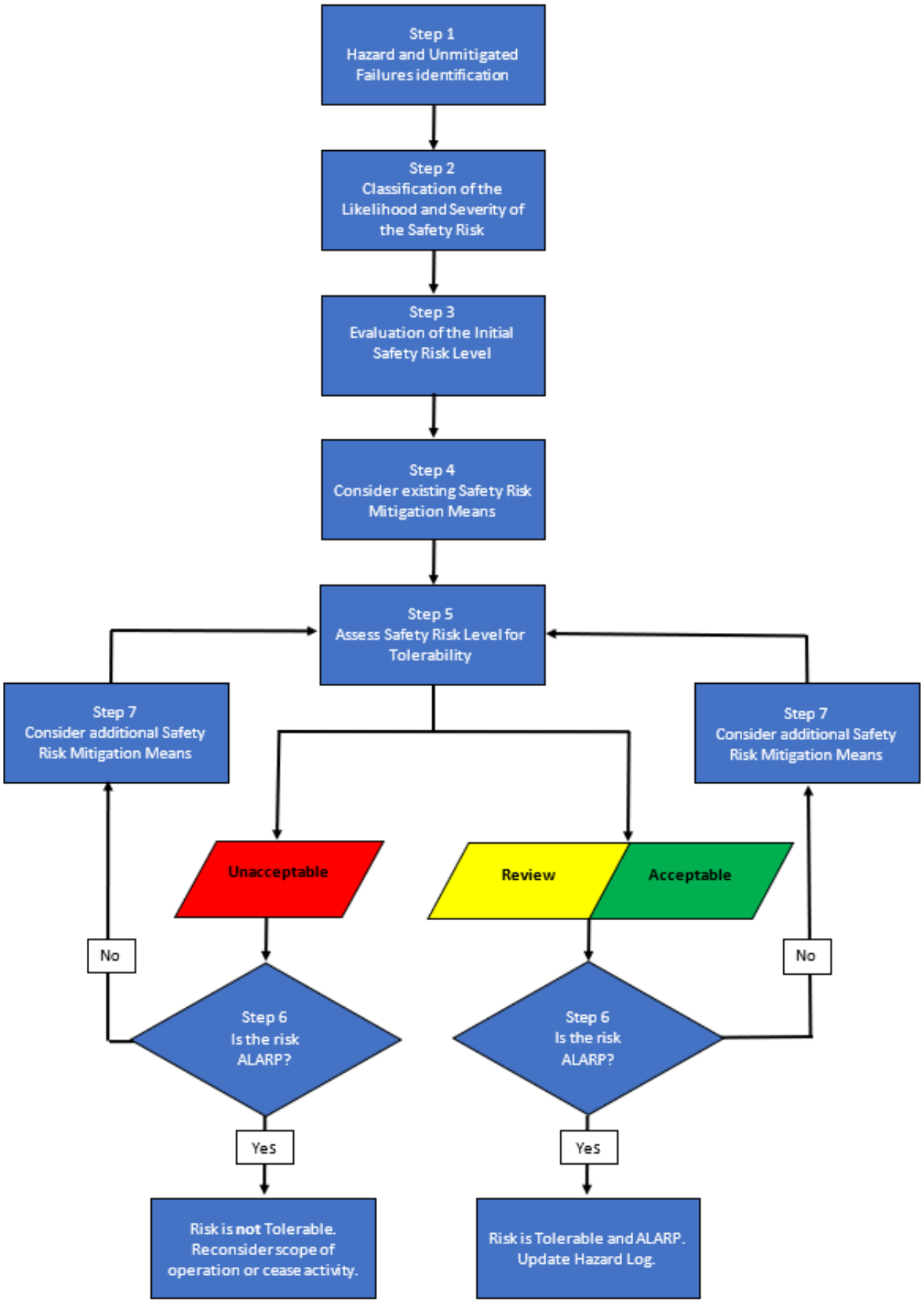

Figure 3: Safety Risk Assessment Process

Step 1- Hazard and unmitigated failures identification

a) **Provide** a Hazard and Safety Risk Log, an example of which can be found at Table 31. This log has 9 columns and a single row for each hazard.

Unique No	Identified Hazard	Unmitigated Failures	Consequence	Initial Safety Risk Level	Mitigations	Tolerable Y/N	ALARP Y/N	Final Safety Risk Level
1	2	3	4	5	6	7	8	9

Table 31: Hazard and Safety Risk Log

b) **Identify** the hazards associated with the operations, specifying whether the hazard poses a ground risk, air risk or both, and allocate a unique number for each. Hazard identification includes consideration of ground and air environments; examples are shown in Table 32.

Ground	*Obstacles, i.e., buildings, infrastructure etc.*
	Types of terrain.
	Uninvolved people.
	Assemblies of people.
	Ground impact of UA.
	Type of operation i.e. VLOS, BVLOS etc.
Air	*Airspace class.*
	Airspace volume.
	Aerodrome boundaries / Flight Restriction Zones.
	Airspace incursion or excursion.
	Other airspace users (altitude, urban or rural environments, deconfliction, separation).
UAS failure conditions identified in Volume 2.	

Table 32: Hazard Identification Examples

The Applicant should consider each flight phase (Taxi, Take-off, en-route, approach, landing), as well as adverse operational conditions, adverse environmental conditions, or

other external events, as they may have an impact on the severity or likelihood of the Safety risk.

Only Aviation Safety risks are to be included in the SRAP. Health & Safety, financial or project completion risks are not in the scope of the OSC process and should not be submitted to the CAA as part of the OSC process.

c) **Identify** any unmitigated failures associated with the identified hazard.

An unmitigated failure is a failure without any mitigation means considered.

d) **Describe** the consequence of the identified hazard on other aircraft and uninvolved people on the ground.

When determining the consequence of a hazard, only consider the realistic worst case scenario.

Specify whether the identified hazard poses a ground risk or air risk. If the consequence of the identified hazard can lead to both air and ground risk, the identified hazard should be duplicated in the Hazard and Safety Risk Log, such that the ground and air risk can be assessed separately.

The Applicant should consider each flight phase (Taxi, Take-off, en-route, approach, landing), as well as adverse operational conditions, adverse environmental conditions, or other external events, as they may have an impact on the severity or likelihood of the Safety risk.

e) **Update** Hazard and Safety Risk Log columns (1) to (4) accordingly.

f) Assurance - **Explain** the methodology used to ensure that all relevant hazards and Safety risks have been identified for the intended operation.

Step 2- Classification of the likelihood and severity of the Safety Risk

The Initial Safety Risk Level is a combination of the likelihood of a Safety risk occurring and the severity of harm to people and other airspace users.

a) **Assess** the likelihood of the Initial Safety risk occurring (refer to the Safety risk likelihood classification in Table 33).

Understanding the unmitigated failures leading to the hazard (refer to Step 1 c)) will help determine the likelihood of the Safety risk.

Likelihood of Safety risk occurring		
Definition	**Meaning**	**Value**
Frequent	Likely to occur many times	5
Occasional	Likely to occur sometimes	4
Remote	Unlikely to occur but possible	3
Improbable	Very unlikely to occur	2
Extremely Improbable	Almost inconceivable that the event will occur	1

Table 33: Safety risk likelihood classification

b) **Assess** the severity of the Safety risk (refer to the Safety risk severity classifications in Table 34.

Understanding the consequence of the hazard (refer to Step 1 d)) will help determine the severity of the Safety risk.

Severity of Safety risk occurring		
Definition	**Meaning**	**Value**
Catastrophic	Results in fatality of one or more people	5
Hazardous	Very serious injury or serious injuries to multiple people	4
Major	Serious injury or minor injuries to multiple people	3
Minor	Results in minor injury to an individual	2
Negligible	Nuisance of little consequence	1

Table 34: Safety risk severity classification

Step 3 - Evaluation of the Initial Safety Risk Level

a) **Apply** the results of the assessment of Step 2 (likelihood and severity classification) into Table 35 and determine the Safety Risk Level.

	Severity of Safety Risk				
Likelihood of Safety Risk Occurring	Catastrophic 5	Hazardous 4	Major 3	Minor 2	Negligible 1
Frequent 5	Unacceptable (5,5)	Unacceptable (4,5)	Unacceptable (3,5)	Review (2,5)	Review (1,5)
Occasional 4	Unacceptable (5,4)	Unacceptable (4,4)	Review (3,4)	Review (2,4)	Acceptable (1,4)
Remote 3	Unacceptable (5,3)	Review (4,3)	Review (3,3)	Acceptable (2,3)	Acceptable (1,3)
Improbable 2	Review (5,2)	Review (4,2)	Acceptable (3,2)	Acceptable (2,2)	Acceptable (1,2)
Extremely Improbable 1	Review (5,1)	Acceptable (4,1)	Acceptable (3,1)	Acceptable (2,1)	Acceptable (1,1)

Table 35: Safety Risk Level matrix

The purpose of this matrix is to establish if a Safety risk is tolerable or not. The Safety Risk Levels are defined as follows:

Unacceptable – The Safety risk is not tolerable and mitigation measures are required to reduce the Safety risk to a tolerable level.

Review – The Safety risk may be considered tolerable. The risk should be reviewed with appropriate frequency to ensure that it remains so.

Acceptable – The safety Risk is tolerable and should be reviewed with appropriate frequency to ensure that it remains so.

The use of numbering in Table 35 assists the Applicant in demonstrating the effects of Safety risk mitigation means. For example, a Safety risk is assessed as being Review (4,3) with a severity of hazardous (4) and a likelihood of remote (3). The Safety risk is tolerable, but not ALARP. Additional mitigation means are then considered which reduce the Safety risk level score to Review (4,2). In this example, the Safety risk severity remains at hazardous (4), but the likelihood has been reduced to improbable (2). The use of numbering allows the Applicant to clearly demonstrate reductions in the Safety risk level even if the level itself does not change (Review (4,3) to Review (4,2)).

b) **Update** the Hazard and Safety Risk Log column (5) with the Initial Safety Risk Level and include the score in the format (severity, likelihood).

Step 4 – Consideration of Safety risk mitigation means

a) **Describe** the mitigation means to reduce the level of the Safety risk in the Hazard and Safety Risk Log column (6), specifying whether the mitigation means is technical or operational.

Mitigations are measures to reduce the Safety Risk Level. These mitigations are needed when a Safety risk is either not TOLERABLE or not ALARP. Mitigations may be operational or technical in nature. OSC Volumes 1 and 2 should detail the Safety risk mitigations used.

Mitigation means should be listed in order of effectiveness.

Mitigation means may include:

- *Technical features (parachute, electronic conspicuity, etc.)*
- *Operational procedures.*
- *Emergency procedures.*
- *Crew composition.*
- *Training and competence of personnel.*

b) Assurance - **Explain** how mitigations means are:

- Appropriate
- Implemented
- Measured
- Sufficiently robust

Step 5 – Assess Safety risks for Tolerability

a) **Assess** if the Safety Risk Level is TOLERABLE.

If the Safety Risk Level is in the Review or Acceptable region of the matrix, it is TOLERABLE.

If the Safety Risk Level is in the Unacceptable region of the matrix, it is not TOLERABLE.

Step 6 – Assess Safety risks for ALARP

a) **Assess** if the Safety Risk Level is ALARP.

A Safety risk is ALARP when it is considered that any further reduction in either likelihood or severity is not possible without expending a disproportionate amount of resource. Sufficient evidence and rationale should be presented for this assertion to be acceptable to the CAA.

b) **Proceed** to Step 6 c) if the Safety risk has been assessed as both TOLERABLE and ALARP or **Proceed** to Step 7 if the Safety risk has been assessed as not ALARP.

When a Safety risk is assessed as Unacceptable, then the risk is not TOLERABLE. If it is considered ALARP, then the scope of the operation should be reconsidered, or activity ceased. At this point the Applicant should refer to Article 6 of UAS IR 2019/947.

c) **Provide** evidence that demonstrates the Safety risk is both TOLERABLE and ALARP. This should be presented in a Claim, Argument, Evidence format below:

- Claim – Safety risk is both Tolerable and ALARP.
- Argument – Why the Applicant considers the claim to be true. A suitable supporting statement for the claim, for example, the remote pilot holds a 'xxxx' remote pilot certificate, has been independently assessed in all modes of flight by 'xxxx' association, which may be an RAE, or another suitably competent organisation. Alternatively, the remote pilot may be the holder of another acceptable pilot licence/qualification and has 'xxx' hours experience on this system, 'xxx' hours of which have been in the intended operating environment. Suitable operational and/or technical mitigations may be described here.
- Evidence – To support the argument. This may be the operator's logbook and copies of certificates or licences held. It is important that any referenced evidence is already embedded in the UAS OSC Volume 1 and Volume 2.

When a Safety risk has been assessed and evidenced as both TOLERABLE and ALARP, a 'Y' may be inserted into columns (7) and (8) of the Hazard and Safety Risk Log. The Final Safety Risk Level can then be added to column (9). When a risk is considered both TOLERABLE and ALARP, the SRAP is considered complete.

Step 7 – Consideration of Additional Safety risk Mitigation Means

Step 7 should be followed when the Safety risk is not ALARP. Step 7 feeds back into Step 5 to reassess the Safety risk for tolerability after additional Safety risk mitigation means have been considered.

a) **Describe** additional mitigation means in the Hazard and Safety Risk Log column (6).

Additional mitigation means may include:

- *System design change.*
- *Additional technical features (parachute, electronic conspicuity, etc.)*
- *Amendment/development of operational procedures.*
- *Amendment/development of emergency procedures.*
- *Changes to crew composition.*
- *Additional training of personnel.*

b) Assurance - **Explain** how mitigations means are:

- Appropriate
- Implemented
- Measured
- Sufficiently robust

c) **Continue** process at Step 5.

Appendix A: OSC Compliance Checklist Template

INTRODUCTION

The aim of the OSC compliance checklist is to support the Applicant as they develop the OSC and to increase the efficiency of the evaluation conducted by the CAA.

The compliance checklist has two parts, which are explained below:

- Part 1 is for information only, which will be used by the CAA to complete an initial evaluation of the application and draft the Operational Authorisation if the operations can be authorised under UK Regulation (EU) 2019/947, Articles 12 and 18.
- Part 2 is a compliance checklist which ensures the Applicant has included the required information in the OSC and indicates where the CAA can find that information (UK Regulation (EU) 2019/947, Article 11 and relevant articles and annexes).

The Applicant should fill in all tables in Part 1 and Part 2. Detailed, extensive information is not required as it will be included in the OSC Volumes; the Applicant should only provide brief details in response to each line of required information.

COMPLIANCE CHECKLIST PART 1

GENERAL INFORMATION	
Required information	**Applicant response**
UAS operator ID	
UAS operator name	
Accountable Manager name	
Accountable Manager telephone number	
Accountable Manager email address	

UAS	
Completing this table: Copy this table and complete the information for each UAS to be used.	
Required information	**Applicant response**
Manufacturer	
Model	
MTOM	

UAS	
Completing this table: Copy this table and complete the information for each UAS to be used.	
Required information	**Applicant response**
Classification (fixed wing, multirotor, hybrid)	
Control frequency or frequencies	
Electronic conspicuity devices	
Other modifications	

SAFETY RISK ASSESSMENT	
Required information	**Applicant response**
Has the Safety risk assessment been completed in accordance with the SRAP detailed in CAP 722A? (Answer yes or no).	
If not, detail the risk assessment methodology that has been used (a separate document may be referred to which contains the full demonstration).	
If not, demonstrate how the risk assessment methodology used complies with UK Regulation (EU) 2019/947, Article 11 (a separate document may be referred to which contains the full demonstration).	

PROPOSED OPERATIONS		
Required information	**Guidance**	**Applicant response**
Type of operation	*VLOS or BVLOS*	
Operating times	*Day, night or 24 hours*	
Location of operations	*Provide brief details of geographical areas and overflown population.*	
Airspace	*What class of airspace will the flights be conducted in?*	
Operating height above surface level	*Operating heights, altitudes, etc.*	
Operating range	*What are the operating distances for the proposed operations?*	
Separation from uninvolved people	*What separation from uninvolved people is being proposed?*	
Flights over assemblies of people	*Will flights be conducted over assemblies of people?* *Note: UK Regulation (EU) 2019/947, Article 2 paragraph (3) – assemblies of people means*	

PROPOSED OPERATIONS		
Required information	**Guidance**	**Applicant response**
	gatherings where individuals are unable to move away due to the density of the people present.	
Dangerous goods	*Will dangerous goods be carried?*	
Dropping of articles	*Does the operation include dropping of articles?* *If so, provide brief details of why articles will be dropped and the location of further information in the OSC.*	

COMPLIANCE CHECKLIST PART 2

VOLUME 1 COMPLIANCE CHECKLIST Section 1 Initial information		
Information	**OSC location – page and paragraph numbers**	**Additional information as required**
Amendment record		
Acronyms and abbreviations		
Table of contents		

VOLUME 1 COMPLIANCE CHECKLIST Section 2 The organisation		
Information	**OSC location – page and paragraph numbers**	**Additional information as required**
Introduction		
Safety statement		
Safety policy		
Organisation – structure and management lines		
Organisation – nominated personnel		
Responsibility and duties of the UAS operator, remote pilot, and support Personnel		
Flight safety programme – Emergency Response Plan (ERP)		
Flight safety programme – incident reporting		

VOLUME 1 COMPLIANCE CHECKLIST **Section 2 The organisation**		
Information	**OSC location – page and paragraph numbers**	**Additional information as required**
Competency and qualification requirements including role training and currency		
Logs and records		
Crew health		
Security and privacy		

VOLUME 1 COMPLIANCE CHECKLIST **Section 3 Flight operations**		
Information	**OSC location – page and paragraph numbers**	**Additional information as required**
Areas of operation		
Type of operation		
Characteristics of the operation		
Operation of multiple types of UAS		
Radio licencing requirements		
Methods to determine the feasibility of the intended operation		
Pre-notification to third parties		
Communications		
Assessment of the environmental conditions		
Site procedures		
Pre-flight procedures: assembly and functional checks		
In-flight procedures		
Post-flight and between flight checks		
Emergency procedures		

VOLUME 2 COMPLIANCE CHECKLIST **Section 1 Initial information**		
Information	**OSC location – page and paragraph numbers**	**Additional information as required**
Amendment record		
Acronyms and abbreviations		
Table of contents		

VOLUME 2 COMPLIANCE CHECKLIST **Section 2 Aircraft and systems description**		
Information	**OSC location – page, paragraph or table numbers**	**Additional information as required**
UAS model		
Details of design and manufacturing organisations		
UA physical characteristics		
UA performance characteristics		
UAS environmental limitations		
Construction		
Electrical power system		
Propulsion system		
Fuel system		
Flight Controls system		
Navigation		
Detect and Avoid (DAA) systems		
Other avionics systems		
Command Unit (CU)		
Command and Control (C2) link		
Communications		
Take-off and landing mechanisms		
Emergency recovery and safety systems		
External lighting		
Payload		
Ground support equipment		
Maintenance		
Spare parts procurement		
Change Management and modifications to the system		

VOLUME 2 COMPLIANCE CHECKLIST **Section 3 Safety features of the UAS**		
Information	**Answer yes or no**	**Additional information as required**
Have the hazards, failure modes and mitigation means been identified and evidenced in Volume 3?		

VOLUME 3 COMPLIANCE CHECKLIST		
Information	**OSC location – page and paragraph numbers**	**Additional information as required**
State the location of the Hazard and Safety Risk Log location in Volume 3		