United Kingdom

Civil Aviation Authority

Official Record Series 9

CAA Decision to amend Acceptable Means of Compliance and Guidance Material pursuant to Article 76(3) UK Reg (EU) 2018/1139

DECISION No. 46

Publication date: 3 March 2025

Decision adopting Acceptable Means of Compliance (AMC) and Guidance Material (GM) for UK Regulation (EU) 2019/947

Background

1. The CAA has developed the UK Specific Operation Risk Assessment (UK SORA) methodology to enable UAS operators to comply with the requirements for conducting an operational risk assessment set out in the UAS Regulation (UK Regulation (EU) 2019/947).

2. UK SORA is published as new Acceptable Means of Compliance (AMC) and Guidance Material (GM) to Article 11 of UK Reg (EU) 2019/947.

3. The existing guidance material to Article 11 is amended to account for the UK SORA AMC/GM, with consequential amendments to:

   (a) GM1 to Article 16;
   (b) AMC and GM contained within Part B, UAS Operations in the 'Specific' category.

4. In addition, new expanded AMC to Article 8(2) on remote pilot competence has been developed to support remote pilot training and progression for increasingly complex UAS operations.

Decision:

5. The CAA, under Article 76(3) of UK Regulation (EU) 2018/1139, has decided to adopt the AMC and GM as set out in Schedule 1.

6. This Decision will remain in force unless revoked or amended by the CAA.

Definitions

7. All references to Regulations are to assimilated law pursuant to the Retained EU Law (Revocation and Reform) Act 2023.

Rob Bishton
For the Civil Aviation Authority

Date of Decision: 03 March 2025

Date of Decision Coming into force:

- GM1 Article 8 and AMC/GM in Annex A to Article 8 – 03 March 2025
- All other AMC/GM – 23 April 2025

Schedule 1

Includes the Guidance Material (GM) referenced below.

The text of the amendment is arranged to show deleted text, new or amended text as shown below:

(a) ~~Text to be deleted is shown struck through~~;

(b) New text is highlighted in grey;

(c) ~~Text to be deleted is shown struck through~~ followed by the replacement text which is highlighted in grey.

(d) (…) indicates text in this section remains unchanged and is not shown for brevity.

UK Regulation (EU) 2019/947, UAS Regulation

~~AMC1 Article 8 Remote Pilot Competence~~

[Editorial note – the existing AMC1 Article 8 Remote Pilot Competence is deleted and replaced by new Remote Pilot Competence AMC in Annex A to Article 8.]

GM1 Article 8 Remote Pilot Competence

AMC for Article 8 can be found in Annex A to Article 8.

AMC1 to Article 11 Conducting a UK Specific Operation Risk Assessment (UK SORA)

UK UAS regulatory requirements

1. Introduction

1.1 The UK SORA methodology has been adapted from the Joint Authorities for Rulemaking on Unmanned Systems (JARUS) SORA version 2.5 to enable UAS operators to comply with the requirements for conducting an operational risk assessment, as set out in Article 11 of Assimilated Regulation (EU) 2019/947. A full list of JARUS publications can be found here.

The UK SORA methodology is one acceptable means of compliance with Article 11 of Assimilated Regulation (EU) 2019/947. This may include describing the technical features of the UAS by relying on a UAS configuration that has been granted a SAIL Mark certificate by the CAA, or by reference to the UK SORA requirements in so far as they apply to a specific UAS.

An Operational Authorisation is granted by the CAA on the basis of its evaluation of the OA Applicant's risk assessment.

Operations out of scope for UK SORA

1.2 UK SORA may not be used for the following types of operation:

(a) Operations outside the **regulatory** limitations of the Specific Category, such as;

(1) Conducted over assemblies of people with a UA that has a characteristic dimension of 3m or more;

(2) carrying people;

(3) carrying dangerous goods that may result in high risk for third parties in the event of an accident

(b) Operations outside the **policy** limits of the UK SORA, such as;

(1) operating unmanned aircraft with a dimension larger than 40 metres;

(2) operating unmanned aircraft with a maximum cruise speed above 200 metres per second;

(3) Operations above Flight Level 660;

(4) using unmanned aircraft with a maximum dimension of more than 3 metres or maximum speed over 35 metres per second, where the population density is greater than 50,000 people per km^2.

(c) Some operations require additional applications, outside the SORA, or may require the use of policy that has not yet been released. Please contact the CAA via uksora@caa.co.uk before starting an application, if this applies to your operation. This includes;

(1) Multiple Simultaneous Operations;

(2) Operations that require an airspace change;

(3) Operations involving the carriage of Dangerous Goods (where this can be achieved in the Specific Category).

1.3 Before starting the UK SORA process the applicant should consider if any of the above criteria apply to the proposed operation. If the answer is yes, then the UK SORA process may not be used for the application.

1.4 If UK SORA may not be used, the applicant should contact the CAA regarding alternative options via uksora@caa.co.uk.

Multiple location applications

1.5 For operations conducted under **Visual Line of Sight** (VLOS), UK SORA may be used to conduct a risk assessment for operations conducted at multiple locations. The applicant **must** demonstrate that the UK SORA requirements will be met for all flights performed under the operational authorisation. If an applicant can demonstrate they have sufficient procedures in place to correctly identify operational volumes, buffers, adjacent areas, and characterise airspace, a generic location authorisation may be issued by the CAA.

1.6 For operations conducted under **Beyond Visual Line of Sight** (BVLOS), UK SORA may be used to conduct a risk assessment for operations conducted at multiple locations. The applicant **must** demonstrate that the UK SORA requirements will be met for all flights performed under the operational authorisation. The operational authorisation will detail the **specific** operational volumes and buffers authorised, which **must** be included in the operation details during the application. The operator **must not** define their own operational volumes, buffers, adjacent areas, or characterise airspace without approval from the CAA.

1.7 The CAA may limit the number of locations or specific locations when assessing an application for the purpose of effective safety management, impact on air traffic, or excessive application time or cost.

The UK SORA process

Managing risk using SORA

1.8 The categories of harm considered in UK SORA are the potential for:

(i) fatal injuries to third parties on the ground;

(ii) fatal injuries to first parties in the air.

1.9 As the UK SORA only addresses safety risk, it is acknowledged that the CAA, when appropriate, may also consider additional categories of harm (e.g. privacy, disruption of a community, environmental damage, financial loss, etc.). Other regulations account for the additional categories.

Target level of safety (TLOS)

1.10 The UK SORA uses a holistic safety risk management process to evaluate the risks related to a given operation and then provide proportionate requirements that an operation should meet to ensure a Target Level of Safety (TLOS) is met.

1.11 This TLOS is defined for people and aircraft uninvolved in the operation and is commensurate with existing manned aviation levels of safety to these same stakeholders. These values were chosen by JARUS to ensure that UAS operations would not pose more risk to third parties than manned aviation which are seen as socially acceptable rates (see Section 5(f) in the Scoping Paper to AMC RPAS 1309 Issue 2 and Section 1.2.1 in JARUS SORA Annex F version 2.5). The specific TLOS figures are also summarised in the JARUS SORA Main Body 2.5.

1.12 The UK CAA is working with JARUS to provide updated accident data and to validate the underlying assumptions contained within Scoping Paper to AMC RPAS 1309 Issue 2. In addition, the CAA is conducting a broader analysis of quantitative methods for risk assessments including the future publication of TLOS figures for UAS operations.

1.13 At the time of publication, an application using the UK SORA methodology shall be assumed to meet the JARUS SORA 2.5 TLOS and therefore compliant with UK Regulation (EU) 2019/947 on rules and procedures for the operation of unmanned aircraft article 11 Rules for conducting an operational risk assessment (3). The assessment shall propose a target level of safety, which shall be equivalent to the safety level in manned aviation, in view of the specific characteristics of UAS operation.

Semantic model in the context of UK SORA

1.14 UK SORA uses a semantic model with standardised terminology for phases of operation, procedures, and operational volumes.

Figure 1 – UK SORA Semantic Model

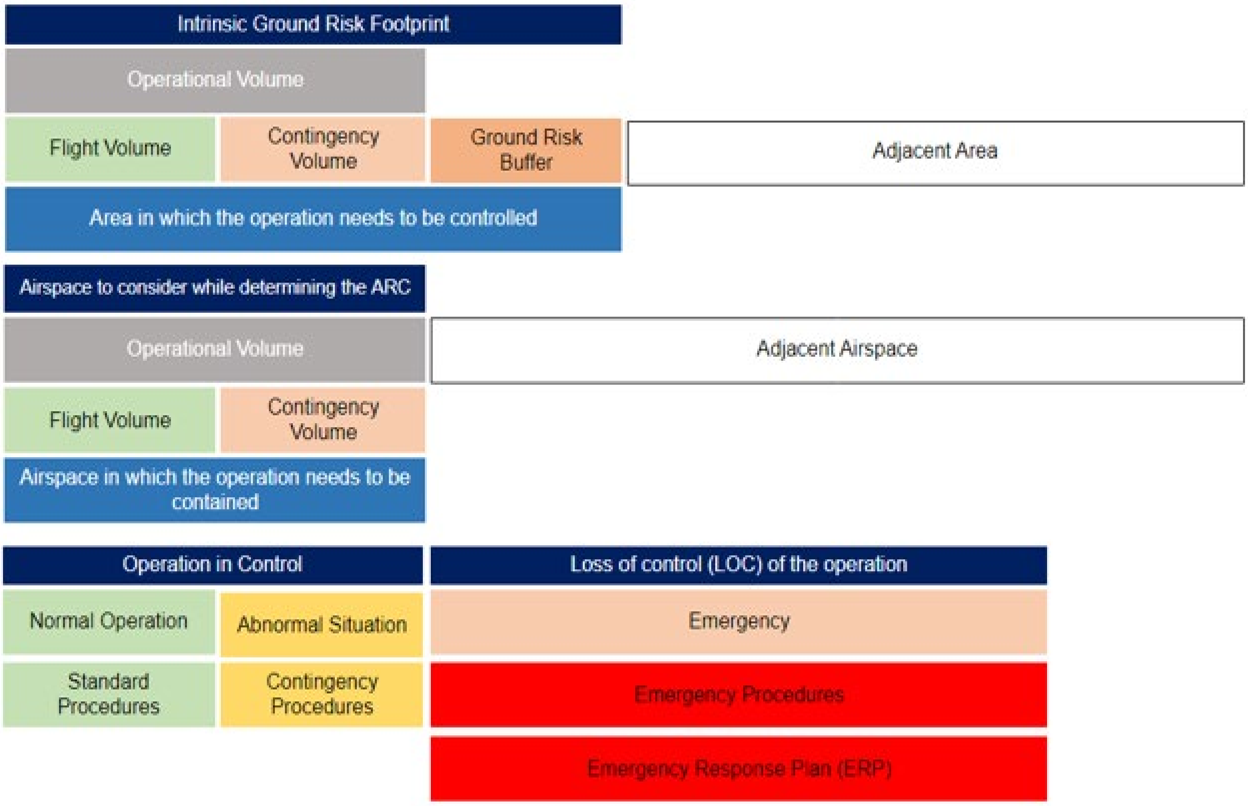
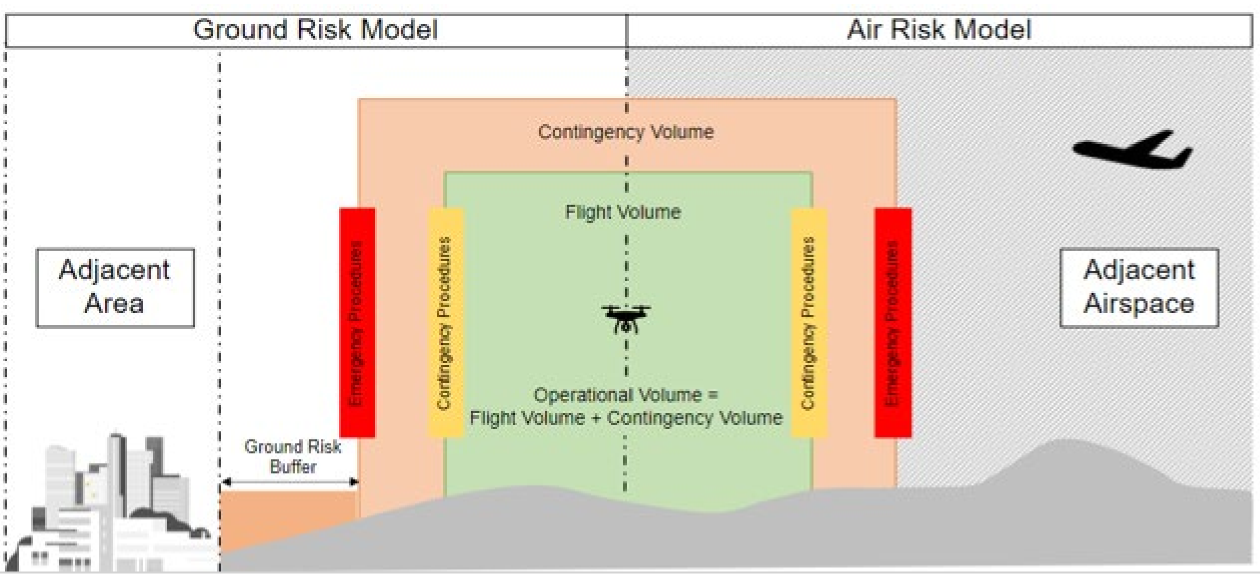


Figure 2 - The Operational Volume



Operation Control States

1.15 The UK SORA considers an operation to be in either a state of control, or a state of loss of control.

The operational volume

1.16 The operational volume is made up of the flight volume and the contingency volume and should be provided in latitude and longitude as either a centre point with radius, or multi point polygon. Vertical extent should be given in height above ground or altitude above sea level.

The flight volume

1.17 For normal operations, the UA **must** only operate inside the flight volume using standard operating procedures.

1.18 Depending on the type of operation, the flight volume may be defined as a flight corridor for each planned trajectory, a larger volume to allow for a multitude of similar flights with changing flight paths, or a set of different flight volumes fulfilling specific conditions.

1.19 The flight volume should be sufficiently large for the planned operation. Whenever a particular flight requires the UA to traverse or loiter/hold at a specific point of interest, this point **must** be included inside the flight volume.

The contingency volume

1.20 The contingency volume surrounds the flight volume. The outer limit of the contingency volume is equivalent to the outer limit of the operational volume.

1.21 Entry into the contingency volume is always considered an abnormal situation and requires the execution of appropriate contingency procedures to return the UA to the flight volume.

1.22 An abnormal situation may also occur inside the flight volume.

The ground risk buffer

1.23 The ground risk buffer is an area on the ground that surrounds the footprint of the contingency volume.

1.24 If the UA exits the contingency volume during a loss of control of the operation, it should end its flight within the ground risk buffer.

1.25 The size of the ground risk buffer is based on the individual risk of an operation and is driven by the flight characteristics of the UA and the containment requirements. Refer to JARUS SORA 2.5 Annex A for further guidance.

The adjacent area

1.26 The adjacent area represents the ground area where it is reasonably expected a UA may crash after a loss of control situation.

1.27 The adjacent area is calculated starting from the outer limit of the operational volume.

1.28 The size of the adjacent area depends on the UA performance.

The adjacent airspace

1.29 The adjacent airspace is the airspace where it is reasonably expected that an unmanned aircraft may fly after a loss of control.

States of operation

Operation in control

1.30 An operation is considered in control when the remote crew can continue the management of the current flight situation, such that no persons on the ground or in the air are endangered. This remains true for both normal and abnormal situations. However, the safety margins in the abnormal situation are reduced.

1.31 There are two states of operation in control:

(i) **Normal operation** utilise standard operating procedures (SOP), which are a set of operating instructions covering policies, procedures, and responsibilities set out by the applicant.

(ii) **Abnormal situation** is an undesired state where it is no longer possible to continue the flight using SOPs. However, third parties on the ground or in the air are not in immediate danger. In this case contingency procedures **must** be applied to prevent a loss of control or excursion from the operational volume.

1.32 In an abnormal situation, the remote crew **must** attempt to return the operation back into the controlled state by executing contingency procedures as soon as practicable.

Figure 3 - States of operation

Operation in Control		Loss of control (LOC) of the operation
Normal Operation	Abnormal Situation	Emergency
Standard Procedures	Contingency Procedures	Emergency Procedures
		Emergency Response Plan (ERP)

Abnormal Situation

Contingency procedures

1.33 Contingency procedures are designed to prevent a loss of control that has an increased likelihood of occurring due to the current abnormal situation. These procedures should return the operation to a controlled state and the use of SOP's or allow the safe termination of the flight.

1.34 Contingency procedures **must** be activated as soon as the UA deviates from its intended flight path, or behaves abnormally, to prevent it leaving the operational volume.

1.35 If contingency procedures cannot rectify the abnormal situation, or the UA approaches the outer edge of the contingency volume, emergency procedures **must** be applied to safely terminate the flight.

Loss of control (LOC) of the operation

1.36 A Loss of Control (LOC) typically has the following characteristics:

(i) It could not be handled by a contingency procedure; or

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

1.37 This includes situations where a UA has exited the operational volume and is potentially operating over or in an area of ground or air risk for which the UAS operator is not authorised.

1.38 The LOC state is also entered if a UA does not follow the authorised route and the remote pilot is unable to control it, an automatic failsafe is initiated, or the Flight Termination System (FTS) is activated, even if this happens inside the operational volume.

Emergency procedures

1.39 Emergency procedures **must** be executed whenever a LOC state is entered, even if it is within the operating volume. They **must** be executed by the remote crew and may be supported by automated features of the UAS (or vice versa) and are intended to mitigate the effect of failures that cause or could lead to an unsafe outcome.

1.40 Regardless of other actions and responses by the flight crew, the emergency procedures **must** always be executed before crossing the outer edge of the contingency volume, which would otherwise result in an operational volume excursion.

Emergency Response Plan (ERP)

1.41 The ERP is used for coordinating all activities needed to respond to incidents and accidents. It is different from emergency procedures, as it does not deal with LOC but actions to be taken afterwards.

Containment

1.42 Containment consists of technical and operational mitigations that are intended to contain the flight of the UA within the defined operational volume and ground risk buffer to reduce the likelihood of a LOC resulting in an operational volume excursion.

Robustness

1.43 Robustness is the term used to describe the combination of two key characteristics of a risk mitigation or operational safety objective:

(i) the level of integrity (LOI) i.e., how good the mitigation/objective is at reducing risk.

(ii) the level of assurance (LOA) i.e., the degree of certainty with which the level of integrity is ensured.

1.44 The compliance evidence used to substantiate the level of integrity and assurance of an application are detailed in the Annexes B, C, D, and E. These annexes contain AMC, GM, or reference to industry standards and practices, where accepted by the CAA.

1.45 Table 1 provides guidance to determine the level of robustness based on the level of integrity and the level of assurance.

Table 1 - Robustness Levels

Integrity	Low Assurance	Medium Assurance	High Assurance
Low integrity	Low robustness	Low robustness	Low robustness
Medium integrity	Low robustness	Medium robustness	Medium robustness
High integrity	Low robustness	Medium robustness	High robustness

1.46 The applicant **must** provide a compliance approach and compliance evidence for mitigations and OSOs based on the SAIL level.

1.47 The CAA will assess the approach and evidence. For some requirements, the CAA may decide that a declaration of compliance is acceptable.

1.48 Applicants should refer to Annex A for a description of the difference between compliance approach and compliance evidence.

Roles, responsibilities, and definitions

General definitions relating to the UK SORA can be found in CAP 722D. Some specific definitions are included below.

The use of the word 'must' in the context of AMC/GM to Article 11, indicates a condition that an applicant or operator is required to comply with in order carry out an Article 11 risk assessment using the UK SORA methodology.

'Should' indicates a strong recommendation: while the applicant or operator is not required to comply with the recommendation to rely on UK SORA, the CAA would expect it to have regard to the recommendation and provide clear and rational justification for not following it.

'May' indicates discretion.

'Must not' indicates prohibition

Applicant

1.49 The applicant is the individual or organisation applying for an operational authorisation. The applicant **must** substantiate the safety of the operation by completing the UK SORA. Compliance evidence for the assessment may be provided by third parties (e.g., the designer of the UAS or equipment, UTM service providers, etc.).

Operator

1.50 The operator is an applicant that has obtained an operational authorisation from the CAA. The authorisation allows the operator to perform a series of flights, if they are performed in accordance with the scope and limitations of the operational authorisation, based on the UK SORA compliance demonstration. The responsibilities of the operator are described in UK Reg (EU) 947/2019 UAS.SPEC.050 - Responsibilities of the UAS operator.

Designer

1.51 The legal person or design and production organisation responsible for the development and manufacture of a UAS.

Air navigation service provider (ANSP)

1.52 The ANSP is the designated provider of air traffic service in a specific area of operation (airspace). The ANSP assesses and/or should be consulted whether the proposed operation may be safely conducted in the particular airspace that they cover. Whether an ANSP approval would be required may depend on whether the particular operation may be considered as being compliant with the rules of the air or should be managed as a contained hazard.

UTM service provider

1.53 UTM service providers are entities that provide services to support safe and efficient use of airspace.

Airspace managers

1.54 The Special Use Airspace (SUA) Authority is responsible for ensuring that appropriate processes and procedures exist to ensure the safe and efficient management and operation of the SUA it is responsible for. Where SUA affects IFR flight planning it should be managed by an Airspace Management Cell (AMC) and referred to as an AMC Managed Area (AMA).

Remote pilot in command and flight crew

1.55 The responsibilities of a remote pilot and crew are defined in UK Regulation (EU) 2019/947, UAS.SPEC.060 Responsibilities of the remote pilot. The definition of Remote Pilot can be found in UK Regulation (EU) 2018/1139 (*The Basic Regulation)* Article 3(31).

Maintenance staff

1.56 Ground personnel in charge of maintaining the UAS before and after flight in accordance with UAS maintenance instructions.

UK SORA application phases

1.57 The UK SORA application process is divided into two broad phases: the final SAIL assessment phase 1, and the compliance evidence assessment phase 2. The table below describes the individual steps per phase of the application process.

Table 2 - UK SORA Application Phases

Phase Number	Step Number	Step Description
1	1	Login to the UK SORA application service
1	2	Determine the intrinsic Ground Risk Class (iGRC)
1	3	Apply strategic ground risk mitigations (Optional)
1	4	Determine the initial air risk class (ARC)
1	5	Apply strategic air risk mitigations (Optional)
1	6	Initial SAIL determination
1	7	Complete the operation details and provide compliance approach and evidence for mitigations
1	8	Phase 1 payment and CAA assessment
1	9	Final SAIL decision
2	10	Provide OSO compliance evidence
2	11	Provide containment compliance evidence
2	12	Provide Tactical mitigation performance requirement (TMPR) compliance evidence
2	13	Phase 2 payment and CAA assessment
2	14	Operational authorisation decision

Step 1 Login to the UK SORA application service

1.58 In Step 1, applicants **must** login to the UK SORA application service using their operator ID.

Step 2 Determination of the intrinsic Ground Risk Class (iGRC)

1.59 The applicant **must** determine the intrinsic ground risk class (iGRC). The applicant **must** consider the following when determining the information to be entered into the application:

(i) Determine the maximum characteristic dimension and the maximum possible speed of the UA in accordance with the manufacturer data.

(ii) Identify the iGRC footprint by completing the following 3 tasks:

(1) Identify the flight volume.

(2) Calculate the contingency volume.

(3) Calculate the initial ground risk buffer.

(iii) Identify the maximum population density within the iGRC footprint.

(iv) Identify the iGRC of the footprint using Table 3 for the UA.

1.60 The final ground risk buffer calculation will be completed as part of the Containment step.

Determining the UA characteristics

1.61 To establish the characteristics of the UA, the applicant **must** consider the following:

(i) **Dimension**: Define the maximum size of the UA by its wingspan for fixed-wing aircraft, or maximum distance between blade tips for rotorcraft.

(ii) **Maximum Speed**: This is defined as the maximum possible airspeed the UA may achieve, as specified by its Designer. It is important to note that this refers to the potential maximum speed, not the maximum speed of the proposed operation. Mitigations that reduce speed during an impact are detailed separately in Annex B.

Determination of the iGRC

1.62 Table 3 shows how the iGRC is determined.

Table 3 - iGRC Determination

Maximum population density	Maximum UA characteristic dimension or maximum speed				
	1 meter or 25m/s	**3 meters or 35m/s**	**8 meters or 75m/s**	**20 meters or 120m/s**	**40 meters or 200m/s**
Controlled Ground Area	iGRC 1	iGRC 1	iGRC 2	iGRC 3	iGRC 3
5 people/km^2	iGRC 2	iGRC 3	iGRC 4	iGRC 5	iGRC 6
50 people/km^2	iGRC 3	iGRC 4	iGRC 5	iGRC 6	iGRC 7
500 people/km^2	iGRC 4	iGRC 5	iGRC 6	iGRC 7	iGRC 8
5,000 people/km^2	iGRC 5	iGRC 6	iGRC 7	iGRC 8	iGRC 9
50,000 people/km^2	iGRC 6	iGRC 7	iGRC 8	iGRC 9	iGRC 10
>50,000 people/km^2	iGRC 7	iGRC 8	n/a	n/a	n/a

1.63 A UA weighing less than or equal to 250g and having a maximum speed less than or equal to 25 m/s is considered to have an iGRC of 1 regardless of population density.

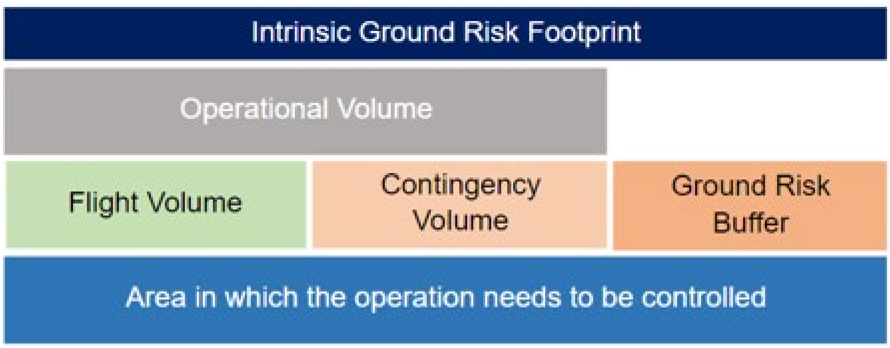
1.64 A UA expected to not penetrate a standard dwelling will get a -1 GRC reduction in Step 3 from the M1(A) sheltering mitigation when not overflying large open-air assemblies of people. See Annex B for additional details.

1.65 Operations that do not have a corresponding iGRC (i.e., grey coloured cells in table 3) are outside the scope of the UK SORA methodology. If UK SORA may not be used, the applicant should contact the CAA regarding the options available.

iGRC footprint

1.66 The applicant **must** define the ground area at risk for the specific operation, termed the iGRC footprint. The calculation should account for the UA's ability to maintain its position in four dimensions (latitude, longitude, height, and time). Factors such as navigation precision, flight technical errors, mapping inaccuracies, and system latencies **must** be considered.

Figure 4 - iGRC Footprint



1.67 The maximum population density within the iGRC **must** be used by the applicant.

Qualitative Ground Risk Determination

1.68 If population density values are not available, not accurate, or an applicant would rather use qualitative descriptors for the iGRC table, the following approximations may be used as guidance:

Qualitative ground risk

Controlled areas and/or extremely remote places

1.69 Maximum Population Value (people/km^2) = 0

1.70 Descriptor: Areas where unauthorised people are not allowed to enter and/or hard to reach areas, where it is reasonably expected that no one will be present:

- Areas of land without public access
- Large bodies of water away from commercial, industrial or recreational users

Areas where a few people may be present

1.71 Maximum Population Value (people/km^2) = 5

1.72 Descriptor: Unpopulated areas with public right of way access by road, cycle path, footpath, bridleway, canal, etc., and/or habited rural areas smaller than a hamlet, and/or bodies of water away from commercial, industrial, or recreational users:

- Forests
- Moorland and heathland
- Large areas of farmland

- Solitary dwellings
- Remote recreational areas

Sparsely populated areas

1.73 Maximum Population Value (people/km²) = 50

1.74 Descriptor: Sparsely populated residential, commercial, industrial and recreational areas with large areas of land, and/or bodies of water close to residential, commercial, industrial or recreational areas:

- Hamlets
- Clusters of small farms
- Residential areas with very large plots of land
- Small industrial and commercial areas
- Small recreational areas
- Small marinas and boat moorings

Lightly populated areas

1.75 Maximum Population Value (people/km²) = 500

1.76 Descriptor: Lightly populated residential, commercial and industrial areas with large areas of land, and/or bodies of water within lightly used commercial, industrial and/or recreational areas:

- Villages
- Medium sized industrial and commercial areas
- Medium sized recreational areas
- Small campsites
- Small tourist attractions
- Large marinas

Moderately populated areas

1.77 Maximum Population Value (people/km²) = 5000

1.78 Descriptor: Moderately populated residential, commercial and industrial areas with moderate areas of land, and/or bodies of water within moderately used commercial, industrial and/or recreational areas. May contain multistorey buildings, but generally most should be low rise:

- Towns
- Residential homes on small plots
- Small blocks of flats and/or apartment complexes
- Large industrial and commercial areas
- Large recreational areas
- Large campsites
- Large/popular tourist attractions
- Harbours and ports

Heavily populated areas

1.79 Maximum Population Value (people/km^2) = 50,000

1.80 Descriptor: Heavily populated residential, commercial and industrial areas with small areas of land, or bodies of water within heavily used commercial, industrial or recreational areas. Urban areas mainly consist of large multistorey buildings. Organised assemblies of people:

- Cities
- Large blocks of flats and/or apartment complexes
- Large office blocks
- Small and medium sized festivals
- Small and medium sized shows and exhibitions
- Small and medium sized sporting events
- Ports with cruise ship docking areas.

Heavily populated areas

1.81 Maximum Population Value (people/km2) more than 50,000

1.82 Descriptor: Densest populated residential, commercial and industrial areas consisting mainly of tall multistorey buildings or popular events with large assemblies of people:

- City Centres
- Areas of dense high-rise buildings

- Large/popular festivals
- Large/popular shows and exhibitions
- Large/popular sporting events

Ground risk buffer

1.83 The applicant **must** define a ground risk buffer that includes an initial calculation and outcome. Refer to JARUS SORA 2.5 Annex A for further guidance. An appropriate initial ground risk buffer could be defined:

(i) With a 1-to-1 principle, (UA height AGL ≤ distance away from uninvolved people); or

(ii) A different ground risk buffer value may be proposed using the principles outlined in Annex E, Containment.

1.84 The initial ground risk buffer will normally be the same as the final ground risk buffer. However, if appropriately robust strategic mitigations are employed, there are cases where the final ground risk buffer may be different than the initial one. These could include:

(i) Using a medium or high level of containment.

(ii) Use of ground risk mitigations, such as a parachute.

Controlled ground areas

1.85 A controlled ground area is defined as an area that **must** only contain involved persons.

1.86 Controlled ground areas may be used to strategically mitigate the ground risk. The area that **must** be controlled is the iGRC footprint. Assurance that there will be no uninvolved persons in the iGRC footprint is the responsibility of the operator.

Non-typical cases

1.87 There are certain cases, for example aircraft whose maximum characteristic dimension and maximum speed differ significantly from the selected column, which may have a large effect on the iGRC. This may not be well represented in the iGRC table and lead to an increase or decrease in iGRC. See JARUS SORA Annex F Section 1.8 for further guidance.

1.88 The applicant may consider that the iGRC is too conservative for their UA. Therefore, an applicant may decide to calculate the iGRC by applying the mathematical model defined in JARUS SORA 2.5 Annex F Section 1.8. The operator should choose the column that matches their risk as identified in JARUS SORA 2.5 Annex F Table 33.

Population density information

1.89 Determining the population density to calculate the iGRC in Step 2 should be done using maps with appropriate grid size based on the operation. See Population density data sources for further guidance.

1.90 If there are no acceptable population density maps available, or if designated by the CAA, the qualitative population density descriptors (see Table 3) may be used to estimate the population density band in the operational volume and ground risk buffer. Alternatively, the authority may require or permit applicants to provide appropriate population density maps. Table 4 below presents the suggested optimal grid size for different maximum operating heights.

Table 4 - Suggested grid size for authoritative maps

Max. Height (AGL) in Feet	Max. Height (AGL) in Metres	Suggested Optimal Grid Size (metre x metre)
500	152	> 200 x 200
1,000	305	> 400 x 400
2,500	762	> 1,000 x 1,000
5,000	1,524	> 2,000 x 2,000
10,000	3,048	> 4,000 x 4,000
20,000	6,096	> 5,000 x 5,000
60,000	18,288	> 10,000 x 10,000

Population density data sources

1.92 The following population density data sources may be used when determining the iGRC:

(i) ONS Census Data https://www.ons.gov.uk/census/maps/

(ii) ESA Copernicus Data https://www.esa.int/Applications/Observing_the_Earth/Copernicus

(iii) Survey data collected by the applicant.

(iv) Other resources may be used, subject to the applicant verifying the accuracy of the data and evidencing their data verification process.

Step 3 Final Ground Risk Class (GRC) determination

1.91 This step is only required if the applicant is planning to reduce their iGRC with strategic mitigations.

1.92 Acceptable mitigations may reduce the intrinsic risk of an uninvolved person being struck by a UA during a LOC. An applicant that wishes to reduce their iGRC **must** identify and apply suitable ground risk mitigations. Annex B contains further guidance on how to complete this step.

Ground Risk Mitigations

1.93 The applicant should identify the applicable mitigations listed in Table 5 that could lower the iGRC of the iGRC footprint. All mitigations **must** be applied in numerical sequence.

Table 5 - Strategic Ground Risk Mitigations

Ref	Mitigation	Low Robustness	Medium Robustness	High Robustness
M1A	Strategic mitigation - Sheltering	-1	-2	N/A
M1B	Strategic mitigations - Operational restrictions	N/A	-1	-2
M1C	Tactical mitigations - Ground observation	-1	N/A	N/A
M2	Effects of UA impact dynamics are reduced	N/A	-1	-2

1.94 In case a mitigation that affects the UA aerodynamics is used, assess if the size of the ground risk buffer is still valid.

Application of Ground Risk Mitigations

1.95 The mitigations used to modify the iGRC have a direct effect on the safety objectives associated with an operation, and therefore it is important to ensure their robustness. This is particularly relevant for technical mitigations (e.g., parachute), where limitations to the robustness and effectiveness of mitigations **must** be considered.

1.96 The Final GRC determination is based on the availability and correct application of the mitigations. Table 5 provides a list of potential mitigations and the associated relative correction factor. All mitigations **must** be applied in numeric sequence to perform the assessment i.e. M1(A), M1(B), M1(C), M2. Annex B provides additional details on the robustness requirements for each mitigation.

1.97 When applying all the M1 mitigations, the final GRC may not be reduced to a value lower than the lowest value in the applicable column in Table 5. This is because it is not possible to reduce the number of people at risk below that of a controlled ground area.

1.98 In case the mitigation influences the aerodynamics of the UA, for example by using a parachute, the ground risk buffer size should be redefined using correct assumptions including the effects of the mitigation means.

1.99 If the final GRC is higher than 7, the operation is considered to have more risk than the UK SORA is designed to support. The applicant should contact the CAA regarding the options available, such as using the Certified category as defined in Article 6 of UK Regulation (EU) 2019/947.

Step 4 Determination of the initial Air Risk Class (ARC)

1.100 In this step, the applicant **must** assess the initial Air Risk Class (ARC) of the operational volume. The initial ARC is a qualitative classification that describes the general collision risk associated with UAS operations before any strategic mitigations are applied.

1.101 The UK SORA Air Risk Model currently only considers encounters between UA and crewed aircraft. A Mid Air Collision (MAC) event between an UA and a crewed aircraft is always assumed to be catastrophic. Additionally, the ability of a crewed aircraft to remain well clear or to avoid collisions with the UA is not directly considered at present.

1.102 The Air Risk model applies to all categories of UAS and all classes of airspace. While the UK SORA methodology is intended to be used to assess UAS operations within the ‘specific’ category, the risk assessment process also allows identification of operations that belong within the ‘certified’ category, and / or where certified components may be required within the ‘specific’ category.

General - Aviation conflict management and BVLOS scalability

1.103 Conflict management within the existing global aviation system is premised on cockpit-based pilot see-and-avoid supporting elements of both layer two and three of the following three-layer system:

(i) Layer 1: Strategic conflict management – Airspace design, demand & capacity balancing, traffic synchronisation. 'Strategic' is used here to mean 'in advance of tactical'. The objective of this layer is to minimise the need to apply the second layer.

(ii) Layer 2: Separation provision – This is a tactical (in-flight) process where the pilot **must** ensure that the aircraft is not operated in such proximity to other aircraft as to create a collision hazard. Typically, this is achieved via cockpit-based see-and-avoid but may be supplemented through the application of separation minima or provision of collision hazard information by an ATM service, dependent upon the airspace classification and flight rules followed.

(iii) Layer 3: Collision avoidance – Required when the separation mode has been compromised, this layer is predominately based on cockpit view pilot 'see & avoid', although for some categories of aircraft, and in some categories of airspace, this may be augmented by systems such as Traffic Collision Avoidance System (TCAS).

1.104 For UAS operations BVLOS of the remote pilot and outside of segregated airspace, a Detect and Avoid (DAA) capability is therefore required to replace the pilot see-and-avoid responsibilities. DAA is defined within the ICAO RPAS Manual Doc 10019 as providing "the capability to see, sense or detect conflicting traffic or other hazards and take the appropriate action". The DAA system therefore enables the Remote Pilot (RP) to exercise their responsibilities with regard to other aircraft, as required within the standardised rules of the air.

1.105 Within their RPAS Concept of Operations (CONOP) for International IFR, ICAO also define the following:

(i) Accommodation – Where UAS may operate along with some level of adaptation or support that compensates for its inability to comply within existing operational constructs.

(ii) Integration – Where UAS enter airspace system routinely without requiring special provisions.

1.106 DAA, as defined above, is therefore a critical enabler for BVLOS UAS operations and the safe integration of UAS into the wider airspace environment. Where the DAA capability is not able to fully replicate the pilot cockpit see-and-avoid capability then accommodation is still possible, with the required ruleset and procedures dependent on the capability of the DAA system.

1.107 The scalability of the BVLOS solution may then be defined by the restrictions imposed on other air users for the accommodation of UAS operations. Such restrictions may include:

(i) Loss of airspace access, e.g., segregation of UA from all other air users.

(ii) Mandatory equipment carriage, e.g., Electronic Conspicuity (EC).

(iii) Air traffic management procedures, e.g., a separation or deconfliction service to structure traffic within the airspace.

(iv) Air traffic density restrictions, e.g., to enable large separation distances.

(v) Air traffic speed / size restrictions, e.g., low speed light aircraft only.

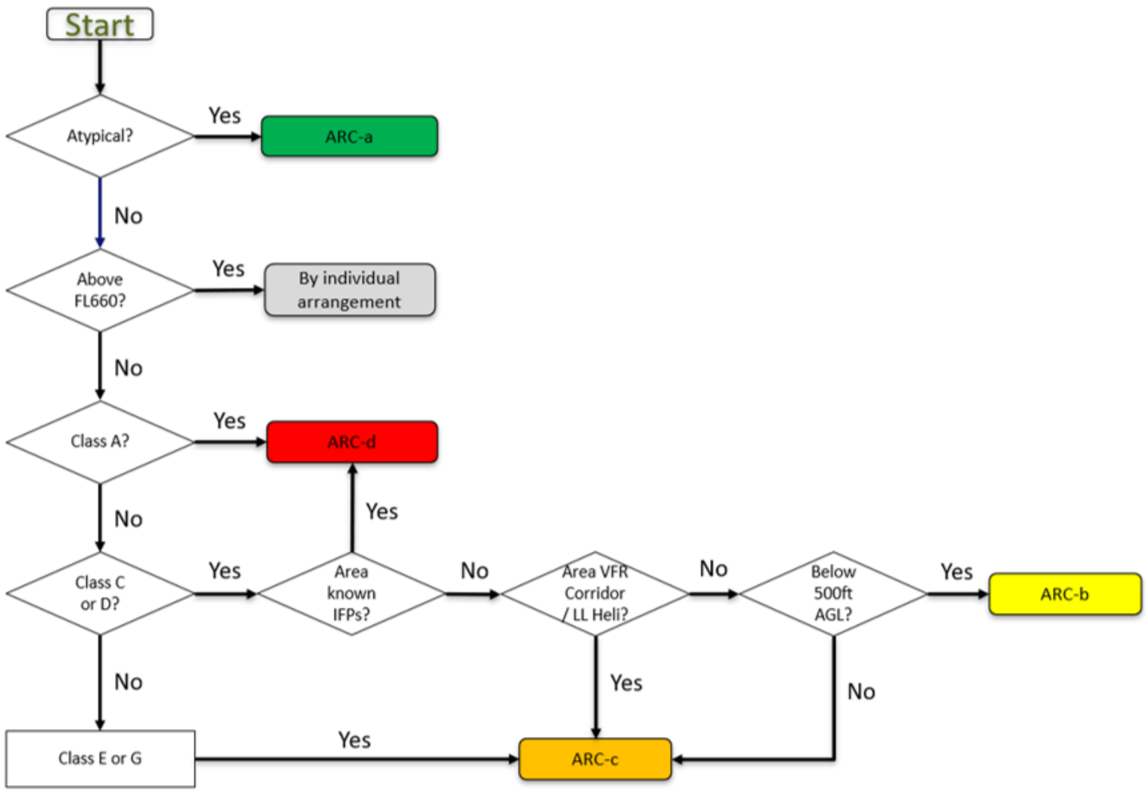
1.108 The requirement for such restrictions, and hence the scalability of the BVLOS solution, is determined largely by the assured performance capability of the UAS DAA system.

Quantitative air risk flow chart

1.109 Figure 5 is the underlying air risk characterisation flow chart describing the UK SORA air risk model characterisation process.

1.110 The UK SORA application service guides applicants through the characterisation process.

Figure 5 - Quantitative Air Risk Flowchart



Encounter Types

1.111 Encounters with two distinct types of flight operations are considered:

(i) Type-1: Operations primarily conducted under self-separation and see-and-avoid (primarily in uncontrolled airspace).

(ii) Type-2: Operations that occur with separation provided by an Air Navigation Service Provider (ANSP) (primarily in controlled airspace).

1.112 Encounters between UA and both Type-1 and Type-2 flight operations are considered, where an encounter is defined as an event associated with the presence of an intruder aircraft. An encounter is simply a measure of when the proximity of two aircraft becomes such that the operation of the UA may be impacted, and the UA may be required to take action to reduce the risk of a MAC, or where a simulation or timeline may start.

1.113 When considering an encounter, its definition must be large enough to include anything which may influence the tactical mitigations of the UA, but not so large that it considers the impact of factors which clearly have no material impact on the operation, such as flights several hundred miles away.

Air Risk Classifications (ARC)

1.114 There are four levels of ARC:

(i) ARC-a (minimal risk);

(ii) ARC-b (Low risk);

(iii) ARC-c (Medium risk); and

(iv) ARC-d (High risk).

1.115 The UK-specific flowchart focusses primarily on encounter types, the airspace ruleset and whether the air environment is either recognised or contains known traffic. The initial ARC assignment has a limited emphasis on encounter rates, which are difficult to predict in a generalised model and are considered primarily via strategic mitigations. Key elements within the flowchart and initial ARC assignment are below:

1.116 **Atypical** – An Atypical Air Environment (AAE) is not a separate classification of airspace, and it may exist within any classification of airspace. Broadly, it may be considered to be a volume of airspace in which it may be reasonably anticipated that there is likely to be an 'improbable encounter rate' with crewed air traffic due to the proximity of certain ground infrastructure, rendering it hazardous for most traditional forms of aviation.

The following examples of what may be considered an AAE should be used as a guide:

(i) Within 100ft / 30.5m of any building or structure.

(ii) Within 50ft of a permanent, above ground level, linear structure. For example, a railway, road, or powerline.

(iii) Within the confines of private property at a height not exceeding 50ft. For example, an industrial site where security personnel use a UA for perimeter inspection.

1.117 CAP 3040 contains further guidance on characterising Atypical Air Environments.

1.118 Above FL660 – Within the UK this region may contain several different types of aircraft, including crewed military, experimental crewed, High Altitude Long Endurance (HALE) UAS, space launch, civil faster than sound, high-altitude balloons, etc. Therefore, this region cannot be treated as segregated without further consideration and potentially mitigation. Note that special consideration will also be required for ingress to / egress from the operating volume, as well as contingency management due to potential risk to aircraft within airspace below the potential operating area.

1.119 **Class A** – This class of airspace provides the highest level of control and is only available to Instrument Flight Rules (IFR) traffic. Air Traffic Control (ATC) clearance and continuous air-ground voice communication is required, and all traffic is under an Air Navigation Service Provider (ANSP) provided separation service. Encountered traffic is expected to be predominately (but not exclusively) large commercial transport, and within the initial ARC flowchart exclusively meets the Type-2 encounter definition. The highest severity consequences lead to the highest safety standard; therefore, an initial ARC-d assignment is appropriate.

1.1201 **Class C or D** – These classes are grouped together as they both allow IFR and Visual Flight Rules (VFR) traffic and follow a similar standard ruleset, where flights are subject to ATC clearance and all traffic is provided with an air traffic control service. In ‘Area of known IFPs’ (See definition below) the aircraft will be predominantly (but not exclusively) large commercial air transport, flying under IFR with a separation service and therefore encounter Type-2 will be appropriate, which dictates initial ARC-d. Outside of this known area, the general risk is from smaller GA aircraft flying under VFR with self-separation through see-and-avoid and therefore encounter Type-1 will be appropriate, which dictates initial ARC-c. The exception is in Class D below 500ft where the traffic is known, cooperative and flies below 500ft by exception (and with ATC knowledge), where the ability to predict a lower encounter rate in this environment allows a lower initial ARC-b characterisation. For example, a crewed aircraft is conspicuous, identified and provided with specific traffic information for a VFR transit within Class D airspace. A clearance to transit ‘not above 1500ft’ is given due to IFR traffic above and ATC request that the crewed aircraft report if descending below 500ft for any reason (landing, forced down by weather etc). Both the UAS and crewed aircraft are in receipt of specific traffic information and will be aware of the others relative position (where necessary) and as the crewed aircraft will report if descending below 500ft, it is a known and cooperative situation where the encounter rate may be controlled and predicted.

1.121 **Area of known IFPs** – Means Instrument Flight Procedures (IFPs) including airways, Standard Instrument Departures (SIDs), Standard Arrival Routes (STARs), Instrument Approach Procedures (IAPs), IFP Protected Areas (Aerodrome Safeguarding) and radar manoeuvring areas. The presence of structures such as Flight Restriction Zones, and Control Zones, may indicate the presence of an IFP. This area may be expected to contain predominantly large commercial transport aircraft, hence is assumed to meet the Type-2 encounter definition and justify an ARC-d assignment.

1.122 **Area VFR corridor / Low Level (LL) Helicopter** – Means corridors through controlled airspace with defined boundaries where aircraft may fly VFR, which have specific rules for altitudes, frequencies, and directions, but maintain the background classification and ruleset of the airspace in which they are contained.

1.123 **Class E or G** – These classes are grouped together as they both allow IFR and VFR traffic and follow a similar standard ruleset (for participating non-IFR traffic), particularly where the VFR traffic is potentially unknown and uncooperative due to the lack of EC and VHF communication requirements. The decision of which encounter type to use for operations in Class E airspace should be made on a case-by-case basis, as the proximity and type of IFR traffic could dictate Type-1 or Type-2 encounters depending on local operations. Class E Airspace is established to ensure separation between IFR and IFR traffic, but not between IFR and VFR traffic despite the likelihood of an ‘area of known IFPs’. Therefore, to be proportionate to the requirements for crewed aircraft as participating non IFR traffic, the UAS requirement equivalent to see and avoid would dictate initial ARC-c. The VFR aircraft should be predominantly small General Aviation or light commercial, self-separated using see and avoid and therefore encounter Type-1 will be appropriate which also dictates initial ARC-c. There is no differentiation below 500ft in these classes of airspace as the traffic is potentially unknown, uncooperative and may fly below 500ft without warning. The ability to predict a lower encounter rate in this environment is therefore greatly reduced and does not allow a lower ARC characterisation ahead of strategic mitigation. All operations above and below 500ft in this environment are therefore initial ARC-c.

General

1.124 In order to navigate the generalised flowchart applicants are referred to the Aeronautical Information Publication (AIP) [NATS, electronic Aeronautical Information Service, NATS UK, NATS UK | Home (ead-it.com)] which defines UK airspace classifications, airspace structures and formal VFR routes such as London Helicopter and Manchester low level routes. Local area specifics on traffic types, informal patterns, mean traffic density and encounter rates (as confirmed via airspace characterisation) may be considered via strategic mitigations.

1.125 It should also be noted that although the initial ARC is intended to be conservative, there may be situations where that conservative assessment may be insufficient. In those situations, the CAA may disagree with the applicant's initial ARC.

1.126 Irrespective of the Air Risk Class (ARC), an applicant **must** initially consider the expected ruleset of the airspace, Section 6 Airspace Classification, proposing changes only if necessary, and with agreement of the ANSP and authority where required. Further information on these rules, for VLOS operations, can be found in AMC1 and GM1 to UAS.SPEC.040(1)(b).

1.127 Use the highest ARC score if the operating area spans multiple ARCs.

Step 5 Application of strategic mitigations to determine residual ARC (optional)

1.128 This step is only required if the applicant is planning to reduce their initial ARC with strategic mitigations.

1.129 Strategic mitigation involves procedures and operational restrictions designed to manage the types of crewed aircraft, encounter rates, or exposure times before take-off. If an applicant believes the initial Air Risk Class (ARC) is too high for the conditions in the local operational volume, they should consult Annex C for guidance on reducing the ARC. If the initial ARC is deemed appropriate for the local conditions, it is then considered the Residual ARC.

1.130 Guidance for the application of strategic mitigations is provided in Annex C.

1.131 To illustrate the value of different strategic mitigations a description of the residual ARCs is provided in Annex C Paragraphs C15-C19.

1.132 For VLOS operations the initial air risk class may be reduced by one class. This may only be reduced to a minimum of ARC-b. This may include the use of an observer in order to meet the VLOS requirement. This could be an Airspace Observer (such as, for BVLOS VM operations), or a UA Observer (such as for First person View operations). The use of an Airspace, or UA, observer must be justified, in claiming this reduction, including demonstrating that instantaneous and effective communication between the Remote Pilot and observer is achieved, thereby enabling immediate and effective collision avoidance action to be taken by the Remote Pilot at all times.

The initial air risk class may be reduced to ARC-a if the operational volume meets the requirements of an Atypical airspace environment, or is later reduced by strategic mitigation(s). In certain environments an additional agreement with ATC or the airspace manager may be required. Further information on VLOS UAS operations above 400ft, within controlled airspace, may be found in AMC1 UAS.SPEC.040(1)(b).

Step 6 – Specific Assurance and Integrity Levels (SAIL) determination

1.133 The SAIL consolidates the final ground and air risk scores. It determines the required compliance evidence the applicant **must** submit for assessment.

1.134 **Below** is the underlying SAIL calculation table for applicant's reference.

Table 6 - SAIL Determination

Final GRC	Residual ARC a	Residual ARC b	Residual ARC c	Residual ARC d
Final GRC ≤2	SAIL 1	SAIL 2	SAIL 4	SAIL 6
Final GRC 3	SAIL 2	SAIL 2	SAIL 4	SAIL 6
Final GRC 4	SAIL 3	SAIL 3	SAIL 4	SAIL 6
Final GRC 5	SAIL 4	SAIL 4	SAIL 4	SAIL 6
Final GRC 6	SAIL 5	SAIL 5	SAIL 5	SAIL 6
Final GRC 7	SAIL 6	SAIL 6	SAIL 6	SAIL 6
Final GRC >7	Certified category	Certified category	Certified category	Certified category

Step 7 – Operation Details

1.135 The operation details are used to describe the proposed operation and demonstrate how the SAIL calculation has been determined.

1.136 The applicant **must** complete the operation details pages, providing the following information:

(i) A brief overview of the operation.

(ii) The make and model of the UA they plan to operate under their authorisation (plus details of any modifications).

(iii) The industry or sector they will operate in, for example agriculture.

(iv) Where they want to operate.

(v) Details of their operational volume and ground risk buffer.

(vi) Details of how they worked out the population densities for the operational area and adjacent area (if applicable).

(vii) Details of any dangerous goods they intend to carry.

(viii) Details of any articles they plan to drop from their UA.

Step 8 - Phase 1 Assessment

1.137 The purpose of this step is for the applicant to submit their SAIL calculation, operational details, and compliance evidence.

1.138 Complete all required steps in the UK SORA application service.

1.139 Make the required Phase 1 payment when prompted.

1.140 The status of the assessment can be found in the relevant section of the UK SORA application service summary page.

1.141 Assessment feedback is provided as it becomes available to allow applicants to action findings as soon as possible.

Step 9 - Final SAIL Decision

1.142 The purpose of this step is for the applicant to receive a decision and feedback on their SAIL calculation.

1.143 If the SAIL is approved the applicant may move to Phase 2.

1.144 If the SAIL is not approved, the applicant will receive feedback in the form of findings. The applicant **must** address the findings to move to Phase 2.

1.145 If the applicant disagrees with a finding or multiple findings, they have the right to appeal. More information about the appeals process can be found here.

Step 10 Determination of containment requirements

1.146 The containment requirements are derived from the difference between the final ground risk level in the operational volume, plus ground risk buffer, and the final ground risk level in the adjacent area.

1.147 The applicant **must** apply at least the level of containment required to ensure that the safety of the operation is maintained in the event of a LOC resulting in the aircraft leaving the operational volume.

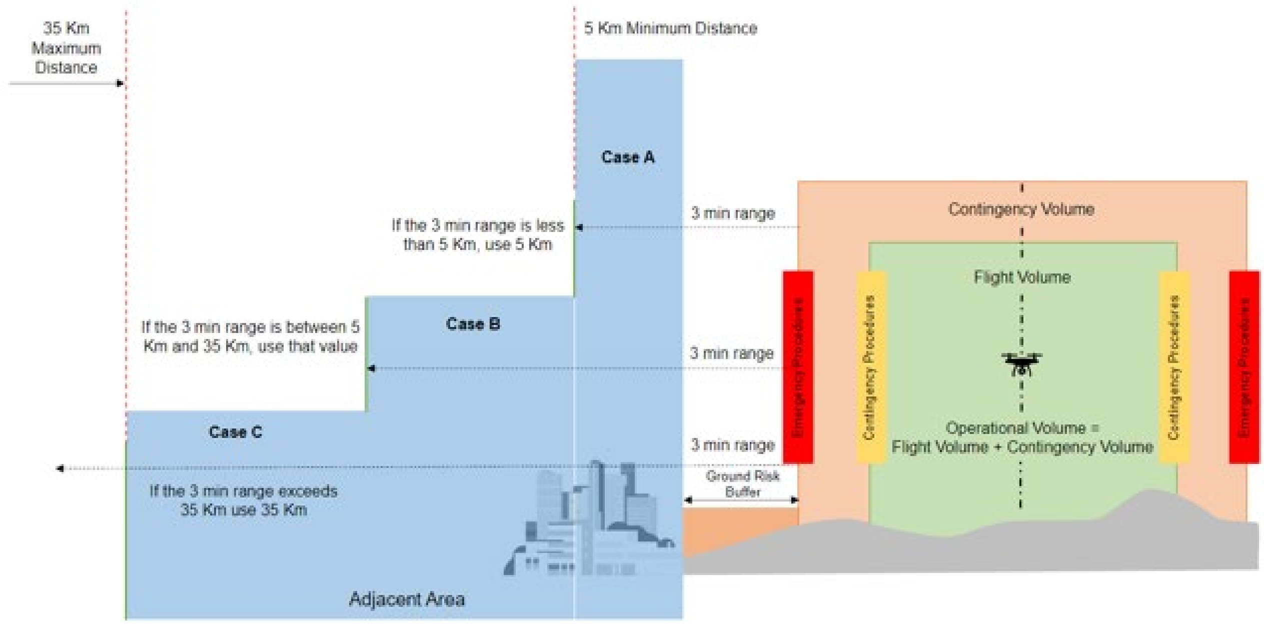
1.148 There are three possible levels of robustness for containment: Low, Medium, and High; each with a set of safety requirements described in Annex E.

1.149 If the ground risk buffer is larger than the adjacent area, containment requirements do not apply.

1.150 If the UA is less than 250g, the applicant **must** apply at least Low containment, or higher. In this case there is no requirement to account for the population in the adjacent area.

1.151 If the UA is more than 250g, the applicant **must** determine the size and population characteristics of the adjacent area. The section below explains how to do this.

Figure 6 - Adjacent area calculation



1.152 Calculate the size of the adjacent area for the operation. The lateral outer limit of the adjacent area is calculated from the operational volume as the distance flown in 3 minutes at the maximum capable speed of the UA:

(i) If the distance is less than 5 km, use 5 km.

(ii) If the distance is between 5 km and 35 km, use the distance calculated.

(iii) If the distance is more than 35 km, use 35 km.

1.153 Determine the average population density between the outer limit of the ground risk buffer and the outer limit of the adjacent area.

1.154 Determine the presence of assemblies of people within 1 km of the outer limit of the operational volume.

1.155 Determine a set of operational limits (average population density allowed and assemblies allowed within 1km of the operational volume) appropriate for intended operation using the Tables 5-12.

1.157 The applicant **must**:

(i) Determine the operational limits for the acceptable average population density in the adjacent area.

(ii) Determine the operational limits for the acceptable size of assemblies of people within 1km surrounding the operational volume.

1.158 Use Tables 7-12 to determine the required containment robustness level for the chosen operational limits, the characteristic dimension of the UA, and the SAIL of the operation.

Table 7 - Containment requirements 1m UA (<25 m/s)

Average population density allowed	**No Upper Limit**	**No Upper Limit**	**< 50,000 ppl/km^2**
Assemblies allowed within 1km of the operational volume	**> 400k**	**Assemblies of 40k to 400k**	**Assemblies < 40k**
SAIL1 & 2	High	Medium	Low
SAIL 3	Medium	Low	Low
SAIL 4	Low	Low	Low
SAIL 5-6	Low	Low	Low

Table 8 - Containment requirements 3m UA (< 35 m/s) applicant claims sheltering as a mitigation

Average population density allowed	**No Upper Limit**	**No Upper Limit**	**< 50,000 ppl/km²**	**< 5,000 ppl/km²**
Assemblies allowed within 1km of the operational volume	**> 400k**	**Assemblies of 40k to 400k**	**Assemblies < 40k**	**Assemblies < 40k**
SAIL1 & 2	Out of scope	High	Medium	Low
SAIL 3	Out of scope	Medium	Low	Low
SAIL 4	Medium	Low	Low	Low
SAIL 5-6	Low	Low	Low	Low

Table 9 - Containment requirements 3m UA (< 35 m/s) applicant does not claim sheltering as a mitigation

Average population density allowed	**No Upper Limit**	**No Upper Limit**	**< 5,000 ppl/km²**	**< 500 ppl/km²**
Assemblies allowed within 1km of the operational volume	**> 400k**	**Assemblies of 40k to 400k**	**Assemblies < 40k**	**Assemblies < 40k**
SAIL1 & 2	Out of scope	High	Medium	Low
SAIL 3	Out of scope	Medium	Low	Low
SAIL 4	Medium	Low	Low	Low
SAIL 5-6	Low	Low	Low	Low

Table 10 - Containment requirements 8m UA (< 75 m/s) applicant does not claim sheltering as a mitigation

Average population density allowed	**No Upper Limit**	**< 50,000 ppl/km²**	**< 5,000 ppl/km²**	**< 500 ppl/km²**	**< 50 ppl/km²**
Assemblies allowed within 1km of the operational volume	**> 400k**	**Assemblies of 40k to 400k**	**Assemblies < 40k**	**Assemblies < 40k**	**Assemblies < 40k**
SAIL1 & 2	Out of scope	Out of scope	High	Medium	Low
SAIL 3	Out of scope	Out of scope	Medium	Low	Low
SAIL 4	Out of scope	Medium	Low	Low	Low
SAIL 5	Medium	Low	Low	Low	Low
SAIL 6	Low	Low	Low	Low	Low

Table 11 - Containment requirements 20m UA (< 125 m/s) applicant does not claim sheltering as a mitigation

Average population density allowed	**No Upper Limit**	**< 50,000 ppl/km²**	**< 5,000 ppl/km²**	**< 500 ppl/km²**	**< 50 ppl/km²**
Assemblies allowed within 1km of the operational volume	**> 400k**	**Assemblies of 40k to 400k**	**Assemblies < 40k**	**Assemblies < 40k**	**Assemblies < 40k**
SAIL1 & 2	Out of scope	Out of scope	Out of scope	High	Medium
SAIL 3	Out of scope	Out of scope	Out of scope	Medium	Low
SAIL 4	Out of scope	Out of scope	Medium	Low	Low

Average population density allowed	**No Upper Limit**	**< 50,000 ppl/km²**	**< 5,000 ppl/km²**	**< 500 ppl/km²**	**< 50 ppl/km²**
Assemblies allowed within 1km of the operational volume	**> 400k**	**Assemblies of 40k to 400k**	**Assemblies < 40k**	**Assemblies < 40k**	**Assemblies < 40k**
SAIL 5	Out of scope	Medium	Low	Low	Low
SAIL 6	Medium	Low	Low	Low	Low

Table 12 - Containment requirements 40m UA (< 200 m/s) applicant does not claim sheltering as a mitigation

Average population density allowed	**No Upper Limit**	**< 50,000 ppl/km²**	**< 5,000 ppl/km²**	**< 500 ppl/km²**	**< 50 ppl/km²**
Assemblies allowed within 1km of the operational volume	**> 400k**	**Assemblies of 40k to 400k**	**Assemblies < 40k**	**Assemblies < 40k**	**Assemblies < 40k**
SAIL1 & 2	Out of scope	Out of scope	Out of scope	Out of scope	High
SAIL 3	Out of scope	Out of scope	Out of scope	Out of scope	Medium
SAIL 4	Out of scope	Out of scope	Out of scope	Medium	Low
SAIL 5	Out of scope	Out of scope	Medium	Low	Low
SAIL 6	Out of scope	Medium	Low	Low	Low

Adjacent area

1.159 The ground area adjacent to the ground risk buffer is defined as the adjacent area. This is the area where it is reasonably expected a UA may crash after a LOC.

1.160 The operator **must not** plan flights in this area, and it will only be overflown unintentionally in the event of a LOC.

1.161 The applicant may use a realistic estimate of the average population density for the adjacent area.

Adjacent area containment requirements

1.162 The UK SORA application service will guide the applicant to determine the containment requirements.

Adjacent area operational limitations

1.163 The operator **must** have a procedure to identify and consider whether there is an assembly of people that exceeds the operational limitations within 1 km of the operational volume.

1.164 The operator **must** have a procedure to determine a realistic estimate of the size of any assembly of people within 1 km of the operational volume.

1.165 If the ground risk buffer size exceeds 1km, the adjacent area consideration for all assemblies of people is not applicable.

Containment effects upon ground risk buffer and operational volume definitions

1.166 The applicant may need to try different SAIL calculations, with variations of their operational volume, ground risk buffer and adjacent area before settling on an appropriate combination.

1.167 If the applicant determines they require medium or high robustness containment for their operational objective, there might be a recursive effect, as these containment requirements have higher requirements on the fidelity of the ground risk buffer size calculation. It is possible, that this results in a bigger ground risk buffer size compared to the one originally defined by the operator.

Containment requirements for adjacent airspace

1.168 By containing flight to the Operational Volume and assuring the immediate cessation of the flight in case of a breach of the operational volume, low robustness containment is generally considered sufficient to allow operations adjacent to all airspaces.

Step 11 Operational Safety Objectives (OSO)

1.169 The purpose of this step is for the applicant to provide their compliance evidence for the relevant OSOs.

1.170 The applicant is responsible for providing compliance evidence. Compliance evidence may be provided by third parties (e.g., the designer of the UAS or equipment, UTM service providers, etc.).

1.171 Table 11 indicates the corresponding OSOs per SAIL. In this table:

(i) NR means not required;

(ii) L means low robustness;

(iii) M means medium robustness;

(iv) H means high robustness.

1.172 The applicant should consider using low robustness even if the OSO is not required at the applicable SAIL.

Table 13 - Operational Safety Objectives (OSO)

OSO ID	OSO Description	SAIL 1	SAIL 2	SAIL 3	SAIL 4	SAIL 5	SAIL 6
OSO01	Ensure the operator is competent and/or proven	NR	L	M	H	H	H
OSO02	UAS manufactured by competent and/or proven entity	NR	NR	L	M	H	H
OSO03	UAS maintained by competent and/or proven entity	L	L	M	M	H	H
OSO04	UAS components essential to safe operations are designed to an Airworthiness Design Standard (ADS)	NR	NR	NR	L	M	H
OSO05	UAS is designed considering system safety and reliability	NR	NR	L	M	H	H
OSO06	C3 link performance is appropriate for the operation	NR	L	L	M	H	H
OSO07	Conformity check of the UAS configuration	L	L	M	M	H	H
OSO08	Operational procedures are defined, validated and adhered to address normal, abnormal and emergency situations potentially resulting from technical issues with the UAS or external systems supporting UAS operation, human errors or critical environmental conditions	L	M	H	H	H	H
OSO09	Remote crew trained and current and able to control the normal, abnormal and emergency situations potentially resulting from technical issues with the UAS or external systems supporting UAS operation, human errors or critical environmental conditions situation	L	L	M	M	H	H
OSO13	External services supporting UAS operations are adequate to the operation	L	L	M	H	H	H
OSO16	Multi crew coordination	L	L	M	M	H	H
OSO17	Remote crew is fit to operate	L	L	M	M	H	H
OSO18	Automatic protection of the flight envelope from Human Error	NR	NR	L	M	H	H
OSO19	Safe recovery from Human Error	NR	NR	L	M	M	H
OSO20	A Human Factors evaluation has been performed and the HMI found appropriate for the mission	NR	L	L	M	M	H
OSO23	Environmental conditions for safe operations defined, measurable and adhered to	L	L	M	M	H	H
OSO24	UAS designed and qualified for adverse environmental conditions	NR	NR	M	H	H	H

Step 12 Tactical mitigation performance requirement (TMPR) and robustness levels

1.173 Tactical Mitigations are applied to mitigate any residual risk of a mid-air collision (as defined by the assigned residual ARC) needed to achieve the applicable airspace safety objective. Tactical Mitigations are usually applied after take-off using a “mitigating feedback loop” to reduce the rate of collisions by modifying the geometry and dynamics of aircraft in conflict, based on real time aircraft conflict information.

1.174 Detailed guidance for the application of strategic mitigations is provided in Annex D.

VLOS Operations

1.175 The applicant **must** develop and document a VLOS deconfliction scheme, in which it is explained which methods will be used for detection.

1.176 The applicant **must** define the associated criteria applied for the decision to avoid other traffic. In case the remote pilot relies on detection by observers, the communication between the remote pilot and observer, including any specific phraseology, **must** be described as well.

BVLOS Operations

1.177 Identify the applicable Detect and Avoid (DAA) requirements for the residual ARC.

Step 13 - Phase 2 Assessment

1.178 The purpose of this step is for the applicant to submit their compliance evidence for OSOs, TMPR, and Containment. The CAA will then evaluate the proposed risk assessment and robustness of the mitigating measures, that the applicant proposes to keep the operation safe.

1.179 The applicant should then:

- Complete all required steps in the UK SORA application service.
- Make the required Phase 2 payment when prompted.

1.180 The CAA will assess the compliance evidence and other information provided by the applicant to determine whether the proposed mitigation measures are adequate and sufficiently robust to keep the operation safe in view of the identified ground and air risks, in order to decide whether to grant the operational authorisation.

1.181 The applicant may obtain information about the progress of an ongoing assessment by checking the relevant section of the UK SORA application service summary page. Status updates are provided for each element of the risk assessment.

1.182 Assessment feedback is provided as it becomes available to allow applicants to action findings as soon as possible.

Step 14 - Compliance Evidence Decision

1.183 The purpose of this step is for the applicant to receive a decision and feedback about their application.

1.184 If the application is approved, the CAA will grant an Operational Authorisation to the applicant.

1.185 If the application is not approved, the CAA will not grant an Operational Authorisation and will provide feedback in the form of findings. The applicant **must** address the findings before an Operational Authorisation may be granted.

1.186 If the applicant disagrees with one or more findings, they have the right to appeal. More information about the appeals process can be found here.

~~GM1 to Article 11 Rules for Conducting an Operational Risk Assessment~~

~~The CAA is currently adapting the previously published AMC for Article 11. Until this is complete, and adopted as AMC/ GM to Article 11, then UAS Operators should continue to use CAP 722A for guidance when producing a risk assessment~~.

GM~~2~~1 to Article 11 ~~-~~ Rules for Conducting an Operational Risk Assessment

Predefined Risk Assessment

When a UAS Operator applies for an OA, they must submit a risk assessment as required by Article 11 of the IR. This may be conducted using the methodology as described in AMC1 to Article 11 Conducting a UK Specific Operation Risk Assessment.

Alternatively, a UAS Operator may submit a request for an OA based on the mitigations and provisions described within a Predefined Risk Assessment (PDRA), as published by the CAA. In the case of a PDRA, the CAA has conducted a risk assessment that is compliant with Article 11.

A PDRA significantly reduces the administrative burden on both the operator and the CAA for simple, repeatable type operations. A UAS Operator provides a ‘shortened’ application to the CAA based on a series of requirements covering topics such as RP competency, OM contents, etc. Accompanying any PDRA based authorisation will be a set of prescriptive conditions an operator must comply with. These conditions form part of the risk mitigation measures identified by the CAA during the creation of a given PDRA.

The CAA will publish PDRAs separately to this AMC/ GM. Operators wishing to make use of PDRAs should use the relevant PDRA to complete the necessary parts of the OM. Completion of the risk assessment part of the OM (Volume 3) is not required, as this has already been carried out. Full instructions on how to make use of a PDRA, and what to submit to the CAA, can be found within CAP 722H.

Note:

A PDRA only addresses safety risk; consequently, additional limitations and provisions might exist within an operation such as security, privacy, environmental protection, the use of the radio frequency (RF) spectrum, etc. It is for the operator to identify and mitigate against non-safety risks.

[Editorial note – the existing GM2 to Article 11 is deleted]

GM1 Article 11(6) – Use of RAE(F)

An RAE(F) approved by the CAA in accordance with the RAE(F) policy (CAP 722J) may carry out the detailed assessment of a UAS against UK SORA requirements for the purpose of advising the CAA as to whether to issue a SAIL Mark certificate or whether the technical features of a specific UAS are consistent with the UK SORA requirements that apply in relation to a given planned operation. The process and criteria for becoming an RAE(F) are set out in the RAE(F) policy (CAP 722J).

An RAE(F) approved by the CAA in accordance with the RAE(F) policy (CAP 722J) may assess a UAS configuration against the criteria in the SAIL Mark policy (CAP 722K) for the purpose of assisting the CAA to decide whether to issue a SAIL Mark certificate in accordance with the SAIL Mark policy (CAP 722K).

GM1 Article 16 – UAS Operations in the Framework of Model Aircraft Clubs and Associations

AMC and GM for Article 16 can be found in ~~Annex B~~ Annex A to Article 16. ~~to this document.~~

AMC1 UAS.SPEC.030(2) Application for an Operational Authorisation

SIGNIFICANT CHANGES TO THE OPERATIONAL AUTHORISATION

Guidance on how to determine whether a change to an operation is significant, can be found in;

- CAP722G, for guidance on significant changes to an OA obtained based on the CAP 722A methodology.
- CAP722L, for guidance on significant changes to an OA obtained based on the UK SORA methodology, described in the AMC to Article 11.

~~Any non-editorial change that affects the OA, or affects any associated documentation that is submitted to demonstrate compliance with the requirements established for the authorisation, is considered a significant change.~~

~~With regard to the information and documentation associated with the authorisation, changes are considered to be significant when they involve, for example:~~

- ~~changes in the operations that affect the assumptions of the risk assessment;~~
- ~~changes that relate to the safety management system (if applicable), or safety processes and procedures of the UAS Operator (including changes of key personnel), its ownership or its principal place of business;~~
- ~~non- editorial changes that affect the OM, including the operational risk assessment.;~~
- ~~non-editorial changes that affect the policies and procedures of the UAS Operator; and~~
- ~~technical changes to the UAS.~~

AMC1 UAS.SPEC.040(1)(b) Operational Authorisation

PROCEDURE FOR COORDINATION WITH SERVICE PROVIDER FOR OPERATION IN CONTROLLED AIRSPACE

Any application for operation in the Specific category must consider the need for involvement of the relevant Air Navigation Service Provider (ANSP), when operating within controlled airspace. ~~This must be set out within a procedure, within the OM~~. This must be set out within suitable procedures. Guidance can be found the AMC to Article 11 (Annex E. OSO8). These procedures must take into account the risk of the operation and provide any necessary coordination with the ATS unit.

For VLOS operations within controlled airspace, below 400ft AGL, no permission or notification to the ANSP is required, unless operating within an FRZ. For VLOS operations within controlled airspace, above 400ft AGL, this must be coordinated via a notification process when required for that portion of airspace, as set out within the AIP. This is in addition to the FRZ permission process, if operating within an FRZ. The AIP may set out additional requirements for the notification, such as a notice period for notification, within the AIP.

Note:

[…]

AMC1 UAS.SPEC.050(1)(a) Responsibilities of the UAS Operator

OPERATIONAL PROCEDURES

The UAS Operator is responsible for developing procedures as required by the OA and for ensuring that those procedures are complied with.

The UAS Operator must:

(1) develop procedures for its UAS operations ~~within an OM~~, detailing the scope of the organisation and the procedures to be followed as a minimum. This manual should be expanded as necessary to cover any increased complexity in the types of UAS being flown (based on the manufacturer's recommendations, if available), or of the types of operation being conducted; and

(2) compile and maintain a list of their personnel and their assigned duties.

The UAS Operator must allocate functions and responsibilities in accordance with the level of autonomy of the UAS during the operation.

These operational procedures must be set out as part of the OA application process. ~~within the OM as described~~ Guidance can be found in the AMC to Article 11 (Annex E. OSO8).

GM1 UAS.SPEC.050(1)(a) Responsibilities of the UAS Operator

OPERATIONAL PROCEDURES TO ENSURE THE SAFETY OF THE OPERATION – HIGH VOLTAGE STORAGE DEVICES

The safe handling of such devices is important, and must be considered within the risk assessment process, described in the AMC/GM to Article 11 (Annex E. OSO8). Consideration should be given to any time that any person may come into contact with such devices, including:

- Payload handlers/loaders
- Ground staff
- The RP
- Any person discovering the UA following an accident

Procedures should be established to cover all such eventualities and should include the display of relevant warnings.

The use of such devices on a UA should be identified and listed within the risk assessment process, and the display of a suitable warning label should be used as part of a mitigation of injury to third parties following an accident.

GM1 UAS.SPEC.050(1)(c) Responsibilities of the UAS Operator

EFFICIENT USE OF RADIO SPECTRUM

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

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

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

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

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

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

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

5.8 GHz is a licenced band which requires a minimum payment and registration with Ofcom. This band is in use with other services including amateur-satellite, weather and military radars. Details can be found on the Ofcom website.

For further UAS specific guidance on whether a licence is required for your UAS, more information can be found on the Ofcom website.

Operations close to any facility that could cause interference (such as a radar station) could potentially disrupt communications with the UAS, whatever the frequency in use. GNSS jamming activities may also disrupt communications as well as C2 signals. Information on scheduled GNSS jamming exercises can be found on the Ofcom website.

The risk assessment process described in the AMC and GM to “Article 11 Rules for conducting an operational risk assessment” ~~on page 48~~ is likely to involve a radio frequency survey, in order to meet “UAS.SPEC.050 Responsibilities of the UAS operator (1)(c)” ~~on page 104~~ ~~(1)(c)~~, which should also include a physical range check.

UAS Operators are advised to carry out such a survey, when assessing the suitability of a site for a proposed UAS Operation. In doing so, the operator should:

- Explain how C2 instructions, as well as telemetry data, are relayed between the command unit and the UA.
- Describe in detail Operational C2 link management, including frequency switchovers and C2 link contingency situations.
- Provide the Link Budget Calculation, wherever possible[1]

The following table may assist in this survey:

Survey element considerations when assessing the suitability of a site for a proposed UAS Operation		
C2 Link	Radio Line Of Sight (RLOS) C2 link	
C2 Link	Beyond Radio Line Of Sight (BRLOS) C2 link (if applicable)	
Transceivers / Modems	Power Levels	
Transceivers / Modems	Transmission Schemes	
Operating Frequencies Used		
Third Party Link Service Provider		
Minimum and average assured data Rates		
Minimum and average assured latencies		
Means of protection against harmful interference		
Any other relevant information		
Operating Frequencies Used		

[1] A link budget calculation is the theoretical calculation of the end-to-end performance of a communications link

Providing a detailed control system architecture diagram that includes informational or data flows and subsystem performance may assist in explaining the requirements above. C2 link could include, direct (RLOS) or relayed (BRLOS). BRLOS includes all satellite systems or relaying C2 link through UA in the air to extend the signal range. The following examples of technical solutions may help make the C2 link secure: pairing, encryption or back up link. It is recommended to use licensed spectrum for BVLOS operations to minimise the chances of external interference and to improve latency. The UAS Operator should identify what alerts, such as warning, caution and advisory alerts, does the system provide to the operator and RP, to advise them of C2 link disruption.

The UAS Operator should consider what design characteristics or procedures are in place to maintain the availability, continuity, and integrity of the datalink. Factors to consider:

- RF or other interference - Flight beyond communications range
- Antenna masking (during turns and/or at high attitude angles)
- Loss of command unit functionality
- Loss of UA functionality
- Atmospheric attenuation including precipitation
- RF wireless site survey to ensure reliable connectivity, it may include:
    - Survey for frequency coverage throughout the potential operating area.
    - Survey for frequency capacity to ensure sufficient bandwidth to support all predicted operations.

AMC1 UAS.SPEC.060(3)(b) Responsibilities of the Remote Pilot

AVOID RISK OF COLLISION WITH ANY MANNED AIRCRAFT - WHEN BEYOND VISUAL LINE OF SIGHT

When operating BVLOS, the risk of collision with a manned aircraft must be mitigated sufficiently. Guidance can be found in AMC to Article 11 (UK SORA) and its appendices. ~~This is achieved using either:~~

- ~~A technical capability which shall reduce the overall risk of a mid-air collision, to an acceptable level (as set out in the AMC to article 11) based on the environment in which the aircraft is operating; or~~
- ~~An operational mitigation, which reduces the likelihood of encountering another aircraft to an acceptable level.~~
- ~~The use of a probabilistic safety argument, to assess the likelihood of encountering other aircraft, is not an operational mitigation if used as the sole component of a safety argument.~~

AVOID RISK OF COLLISION WITH ANY MANNED AIRCRAFT - WHEN OPERATING IN CLOSE PROXIMITY TO HELICOPTER LANDING SITES

[…]

Appendices

Annex A to Article 8

Remote Pilot Competence

Due to the size of the AMC for Article 8, it has been included as an Annex to this document.

AMC1 to Article 8(2) Remote Pilot Competence

INTRODUCTION

The following AMC and GM have been developed to support remote pilot training and progression for increasingly complex UAS operations.

This AMC, in so far as it relates to an RAE(PC), forms part of the RAE(PC) scheme, which also includes the CAA policy for approving an RAE(PC) to carry out the training and assessment of remote pilots, as set out in Unmanned Aircraft System Operations in UK Airspace – Recognised Assessment Entity for Remote Pilot Competence RAE(PC), Fifth Edition (CAP 722B).

The training has been designed to deliver the relevant remote pilot competencies based on the required task performance, knowledge, skills, and attitudes for future remote pilots.

The training is **not** designed to cover all operational scenarios on all types of UAS as this would create significant complexity.

UAS operators continue to be responsible for UA specific training and remote pilot standardisation, proportional to the complexity of their individual organisation. Operators should carefully consider what UA or operation specific training is required for remote pilots prior to making an application for an Operational Authorisation.

DEFINITIONS

For the purposes of this AMC, the following definitions apply:

- **“Trainee”** means a remote pilot undergoing training at an RAE(PC)
- **“OA Applicant”** means applicant for an Operational Authorisation.

- **"Assessment of competence"** means the demonstration of skills, knowledge, and attitudes for the initial issue, revalidation, or renewal of a remote pilot certificate.
- **"Competency"** means a combination of skills, knowledge and attitudes required to perform a task to the prescribed standard.
- **“UA Category”** or **“Category of UA”** means a categorisation of unmanned aircraft according to its basic characteristics. For this AMC that could mean an unmanned aeroplane or unmanned rotorcraft.
- **“Type” or “UA Type”** means a categorisation of unmanned aircraft according to the specific manufacturer and model.
- **“Credit”** means the recognition of prior experience or qualifications.
- **“Flight instruction”** means imparting of aeronautical knowledge through a combination of ground schooling, simulated, and practical flight instruction.
- **“Live flight hours”** means practical flight undertaken in real world conditions and cannot be simulated.
- **“Simulated flight hours”** means flight undertaken in a CAA approved simulator.
- **“Practical Flight Instructor” (PFI)** means an individual who is authorised by an RAE(PC) to conduct flight instruction of remote pilots.
- **“Theoretical Knowledge Instructor” (TKI)** means an individual who is authorised by an RAE(PC) to conduct theoretical training of remote pilots.
- **“Practical Flight Assessor” (PFA)** means an individual who is authorised by an RAE(PC) to conduct flight assessments and evaluations of remote pilots.
- **“Air Risk Class” (ARC)** is a classification of the risk of the air environment as defined in UK SORA.
- **“Certificate Currency”** means the minimum currency to maintain the privileges of the remote pilot competence certificate for the relevant UA category. Certificate currency **must** be live flight hours only.
- **“Operator Currency”** means the minimum currency determined by the operator for the relevant UA type.
- **“RAE(PC)”** means Recognised Assessment Entity (Pilot Competence).
- **“RPC”** means Remote Pilot Certificate.
- "**Must**" indicates (a) a condition a trainee is required to comply with to be assessed as competent to the relevant standard or (b) a condition an RAE(PC) is required to comply with to maintain approval under the RAE(PC) scheme.

REMOTE PILOT FLIGHT LOGGING

Remote pilots must keep accurate flight logs in accordance with mandatory operator's procedures and UAS.SPEC.050(1)(g). To be accepted for the purpose of training course entry requirements, crediting, revalidation, and renewal, remote pilot flight logs, including flight logs for routine flight operations, **must**:

(a) Be accurate and recorded in accordance with UAS.SPEC.050(1)(g).

(b) Be auditable by an RAE(PC) and/or the CAA including by being:

- (1) Verifiable by means of a corresponding aircraft technical log entry held by the operator.
- (2) Supported by all other relevant operational documentation relating to that flight.

It is **not** an operator's responsibility to provide the remote pilot with digital or paper flight records, although this is common practice. Remote pilots should keep their own remote pilot logbook as necessary.

The CAA takes falsification of RP logs extremely seriously. Falsifying RP logs is a serious offence and could result in the suspension or revocation of the RP's certificate of competence and criminal prosecution.

The CAA is also under an obligation to be satisfied, on a continuing basis, of the fitness of character of individuals we licence or approve in accordance with applicable legislation. We must be satisfied that all such individuals can be relied on as honest and truthful and that they are demonstrably consistent in applying the rules, in spirit and letter. When considering these behaviours, we will take into account the overriding need to protect the general public, maintain public confidence in the individual privileges we licence, and maintain public confidence in our decision-making processes. Providing false information or other dishonest behaviour may call into question an individual's fitness of character. This fitness of character policy sits alongside any competence or skills requirements a remote pilot must demonstrate in order to obtain and maintain an RPC. For more information on our fitness of character policy, see Fitness of character policy framework | Civil Aviation Authority (caa.co.uk).

REMOTE PILOT COMPETENCE STRUCTURE

To demonstrate RP competence a RP may hold one of the following certificates of competence in each UA category:

General VLOS Certificate (GVC) Multirotor and/or Fixed Wing

Level 1 Remote Pilot Certificate (RPC-L1) Rotorcraft (R) and/or Aeroplane (A)

Level 2 Remote Pilot Certificate (RPC-L2) Rotorcraft (R) and/or Aeroplane (A)

Level 3 Remote Pilot Certificate (RPC-L3) Rotorcraft (R) and/or Aeroplane (A)

Level 4 Remote Pilot Certificate (RPC-L4) Rotorcraft (R) and/or Aeroplane (A)

General VLOS Certificate (GVC)

COMMON REQUIREMENTS

Below are the common requirements for the issue of a General VLOS Certificate (GVC).

MINIMUM AGE

None

CONDITIONS

A GVC trainee **must** have passed the theoretical assessment and practical flight assessment at a CAA approved RAE(PC).

TRAINING COURSE

(a) A GVC trainee **must** complete a training course at a CAA approved RAE(PC).

(b) The course **must** include theoretical knowledge, operator knowledge, and practical flight assessment appropriate to the privileges of GVC applied for.

ENTRY TO TRAINING

The remote pilot **must** have completed the following initial training prior to being accepted for further training:

(a) Open category online training material UAS.OPEN.020(4)(b) & UAS.OPEN.040(3) & UAS.OPEN.030(2)(a)

(b) Open category online assessment and have obtained a Flyer ID by completing the training course and test provided by the CAA Drone and Model Aircraft Registration System (DMARES) (https://register-drones.caa.co.uk/).

GVC Fixed Wing & Multirotor

THEORETICAL KNOWLEDGE TOPICS

In the tables of Appendix B, the applicable learning objectives (LOs) for each certificate are marked with an ‘X’.

An RAE(PC) should use the LOs when developing the theoretical knowledge elements of the appropriate course. The LOs do not provide a ready-made ground training syllabus for individual RAE(PC)s and an RAE(PC) should not rely on the LOs as a substitute for thorough course design.

THEORETICAL KNOWLEDGE ASSESSMENT

A GVC trainee **must** demonstrate a level of knowledge appropriate to the privileges granted in the following subjects:

(a) Air law.
(b) Aircraft general knowledge.
(c) Human performance.
(d) Meteorology.
(e) Operational procedures.

PRACTICAL FLIGHT ASSESSMENT GENERAL

(a) The RAE(PC) must define the pass/fail criteria for the practical flight assessment ('the practical flight assessment'). As a guide, the criteria should consist of a combination of:
  (1) 'Minor' errors – cumulative up to a maximum of 7, at which point the practical flight assessment is failed;
  (2) 'Major' errors – cumulative up to a maximum of 3, at which point the practical flight assessment is failed;
  (3) 'Safety' errors – any single safety error will result in an automatic failure.
(b) An RAE(PC) may require the remote pilot to undertake further training following any failed practical flight assessment. There is no limit to the number of practical flight assessments that a remote pilot may attempt.

GVC PRACTICAL FLIGHT ASSESSMENT

GVC Practical Flight Assessment	
Section 1 - Pre-Flight	
1.1	Mission planning to include; meteorological checks, airspace considerations, and site risk-assessment
1.2	Aircraft pre-flight inspection and set-up
Section 2 - In Flight Procedures	
2.1	Take-off procedures
2.2	Flight under abnormal conditions
Section 3 - Post Flight Actions	

3.1	Shut down and secure/make safe the UAS
3.2	Post-flight inspection and recording of any relevant data relating to the general condition of the UAS

GVC PRIVILEGES AND CONDITIONS

(a) **Privileges.** The privileges of the holder of a GVC are to act as remote pilot in command or flight crew of a UA where all of the following apply:
(1) the flight is being undertaken in the Specific category.
(2) the flight is being conducted VLOS.
(3) the operational authorisation under which the flight is being conducted states the GVC is the minimum remote pilot competence.

(b) **Conditions.** BVLOS flight is prohibited.

GVC EXPERIENCE REQUIREMENTS AND CREDITING

None

GVC VALIDITY, REVALIDATION, AND RENEWAL

(a) A GVC is valid for 5 years beginning with the date of issue notified on the GVC.

THE GENERAL VLOS CERTIFICATE

To qualify for the issue of a GVC, a RP must:

(a) Have completed the Open category online training material (AMC1 UAS.OPEN.20(4)(b) & UAS OPEN.040(3) & UAS.OPEN.030(a).
(b) Complete the Open category online assessment and have obtained a Flyer ID by completing the training course and test provided by the CAA Drone and Model Aircraft Registration System (DMARES) (https://register-drones.caa.co.uk/).
(c) Complete the necessary theoretical knowledge training.
(d) Complete the necessary practical training to pass the practical flight assessment.
(e) Have an operations manual that can be provided for the practical flight assessment.
(f) Complete the theoretical knowledge assessment.
(g) Complete the practical flight assessment.

Level 1 Remote Pilot Certificate (RPC-L1)

COMMON REQUIREMENTS

Below are the common requirements for the issue of an RPC-L1.

MINIMUM AGE

None

CONDITIONS

An RPC-L1 trainee **must** have passed the theoretical assessment and practical flight assessment at a CAA approved RAE(PC).

TRAINING COURSE

(a) An RPC-L1 trainee **must** complete a training course at a CAA approved RAE(PC).

(b) The course **must** include theoretical knowledge and flight instruction appropriate to the privileges of the RPC-L1.

(c) A trainee may complete their theoretical knowledge instruction and practical flight instruction at an RAE(PC) different from the one where they commenced their training course. This applies at any point in the training course. Where a trainee relies on this flexibility, the new RAE(PC) should assess the trainee's levels of theoretical and practical competence to determine how much further training the trainee requires.

ENTRY TO TRAINING

The RP **must** have completed the following initial training prior to being accepted for further training:

(a) Open category online training material (AMC1 UAS.OPEN.20(4)(b) & UAS.OPEN.040(3) & UAS.OPEN.030(a)

(b) Open category online assessment and have obtained a Flyer ID by completing the training course and test provided by the CAA Drone and Model Aircraft Registration System (DMARES) (https://register-drones.caa.co.uk/).

RPC-L1(A) Aeroplane

GROUND INSTRUCTION

Ground instruction considering take-off and landing area selection, aircraft preparation, ground hazard analysis, route planning, avoidance of uninvolved people, and airspace.

FLIGHT INSTRUCTION

The RPC-L1(A) flight instruction syllabus considers the principles of safe UA operations including:

(a) Ability to apply operational procedures (normal, contingency, and emergency procedures, flight planning, pre-flight and post-flight inspections).

(b) Ability to manage aeronautical communication.

(c) Manage the unmanned aircraft flight path and automation.

(d) Leadership, teamwork, and self-management.

(e) Problem solving and decision-making.

(f) Situational awareness.

(g) Workload management.

(h) Coordination or handover, as applicable.

THEORETICAL KNOWLEDGE TOPICS

In the tables of Appendix B, the applicable learning objectives (LOs) for each certificate are marked with an ‘X’.

An RAE(PC) should use the LOs when developing the theoretical knowledge elements of the appropriate course. But the LOs do not provide a ready-made ground training syllabus for individual RAE(PC)s and an RAE(PC) should not rely on the LOs as a substitute for thorough course design.

THEORETICAL KNOWLEDGE ASSESSMENT

An RPC-L1(A) trainee **must** demonstrate a level of knowledge appropriate to the privileges granted in the following subjects:

(a) Air law.
(b) Aircraft general knowledge.
(c) Human performance.
(d) Meteorology.
(e) Operational procedures.

PRACTICAL FLIGHT ASSESSMENT GENERAL

(a) A trainee for a practical flight assessment for the RPC-L1(A) **must** have received instruction on the same category and type of UAS to be used in the assessment.

(b) An applicant **must** pass all the relevant sections of the practical flight assessment, in accordance with the following:

   (1) If a trainee fails any item in a section, they have failed that section.

   (2) If a trainee fails only one section, they must retake only that section.

   (3) If a trainee more than one section, they must retake the entire practical flight assessment.

   (4) If a trainee fails any section of the retaken practical flight assessment, including any section that was passed on a previous attempt, they must retake the entire practical flight assessment.

(c) All relevant sections of the practical flight assessment **must** be completed within 6 months of the date on which the trainee attempted the first section of the practical flight assessment.

(d) If a trainee fails any individual section of the practical flight assessment, the RAE(PC) may require them to undertake further training. If a trainee fails to achieve a pass in all sections of the practical flight assessment in two attempts, they **must** undertake further training.

(e) There is no limit to the number of practical flight assessments that a trainee may attempt.

CONDUCT OF THE ASSESSMENT

(a) Should the trainee choose to terminate a practical flight assessment for reasons considered inadequate by the Practical Flight Assessor (PFA), the trainee **must** retake the entire practical flight assessment. If the assessment is terminated for reasons considered adequate by the PFA, only those sections not completed **must** be tested in a further flight. Adequate reasons include, but are not limited to, illness, poor weather conditions, equipment failure, and other risks to persons or property.

(b) At the discretion of the PFA, any manoeuvre or procedure of the assessment may be repeated once by the trainee. The PFA may stop the assessment at any stage if they consider that the trainee's demonstration of flying skills requires a complete retest.

(c) A trainee **must** indicate to the PFA the checks and duties carried out. Checks **must** be completed in accordance with the checklist for the UA on which the assessment is being taken. During pre-flight preparation for the assessment, the trainee **must** configure the command unit (CU).

(d) The PFA **must** take no part in the operation of the UA except where intervention is necessary in the interest of safety.

CONTENT OF THE PRACTICAL FLIGHT ASSESSMENT FOR THE ISSUE OF AN RPC-L1(A)

(a) The UAS used for the practical flight assessment **must** meet the requirements for training UAS as set out in the relevant CAA publication.

(b) The practical flight assessment **must** comprise of a general handling assessment in a range of flight modes including non-positioning mode lasting a minimum of 30 minutes.

(c) Every section of the practical flight assessment must assess the use of checklists, situational awareness, control of the UA either manually or by use of the CU, and principles of risk management.

RPC-L1(A) PRACTICAL FLIGHT ASSESSMENT

RPC-L1(A) Practical Flight Assessment	
Section 1 - Pre-Flight	
1.1	Conducts a pre-flight including flight planning, documentation, mass and balance consideration, flight briefing, NOTAMS
1.2	UA inspection and technical logbook
1.3	Take-off
1.4	Performance considerations
Section 2 - General Handling	

2.1	Control of the aeroplane by use of the transmitter/CU in both positioning and non-positioning flight modes including: 1) level flight, control of heading, altitude, and airspeed 2) climbing and descending turns 3) recoveries from unusual attitudes
Section 3 - Approach and Landing	
3.1	Approach procedures
3.2	Go-around landing area blocked
3.3	Normal Landing
3.4	Post flight actions
Section 4 - Abnormal and Emergency Procedures	
4.1	Simulated engine/motor failure
4.2	Equipment malfunctions
4.3	Forced landing
4.4	Oral questions

RPC-L1(A) PRIVILEGES AND CONDITIONS

(a) **Privileges.** The privileges of the holder of an RPC-L1(A) are to act as remote pilot in command or flight crew of a UA where all the following apply:

(1) The flight is being undertaken in the Specific category.

(2) The primary means of lift of the UA is fixed wing(s).

(3) The flight is being conducted VLOS

(4) The operational authorisation under which the flight is being conducted states the RPC-L1(A) is the minimum remote pilot competence.

(b) **Conditions.**

(1) The remote pilot maintains a minimum certificate currency of 2 hours of live flight within the last 90 days.

(2) The remote pilot holds a valid flyer ID.

(3) BVLOS prohibited

RPC-L1(A) EXPERIENCE REQUIREMENTS AND CREDITING

(a) An RPC-L1(A) trainee **must** have completed at least 2 hours of flight instruction at a CAA approved RAE(PC).

(b) An RPC-L1(A) trainee that holds a valid GVC are exempt from the theoretical assessment.

RPC-L1(A) VALIDITY, REVALIDATION, AND RENEWAL

(a) **Validity.** An RPC-L1(A) is valid for 5 years from the date notified on the certificate.

(b) **Revalidation.** An RPC-L1(A) may be revalidated within the 3 months immediately preceding its expiry date if the remote pilot undertakes a revalidation proficiency check at an RAE(PC).

(c) The RAE(PC) **must** determine on a case-by-case basis what steps the revalidation proficiency check requires, having regard to the remote pilot's certificate currency, experience, flight logs, last use of RPC privileges and any other relevant factors RAE(PC).

(d) An RAE(PC) should exempt a remote pilot from a live revalidation check where:

(1) the remote pilot has maintained at least minimum certificate currency for the complete duration of the certificate validity period; and

(2) the remote pilot demonstrates that certificate currency has been maintained through a personal flight log.

(e) An RAE(PC) may exempt a remote pilot from a live revalidation check where certificate currency has not been maintained in accordance with (d) if the RAE(PC) is satisfied that an exemption is appropriate, having regard in particular to:

(1) the remote pilot's experience; and

(2) the amount of time elapsed since the date on which the remote pilot last used privileges of the RPC-L1(A).

(f) The remote pilot **must** undertake a revalidation proficiency check consisting of at least 1 hour of supervised flying covering general handling and emergency procedures where the RAE(PC) considers this to be necessary.

(g) If a remote pilot chooses to fulfil the revalidation requirements earlier than prescribed in point (b), the new 5-year validity period will be set by reference to the date of the successful revalidation proficiency check.

(h) A remote pilot who fails to revalidate their RPC-L1(A) before it expires **must not** exercise any RPC-L1(A) privileges unless they renew their RPC-L1(A) in accordance with the provisions below.

(i) **Renewal**. If an RPC-L1(A) has expired, a remote pilot may renew their privileges, by complying with all the following requirements:

(1) The remote pilot **must** complete a refresher training at an RAE(PC), if the RAE(PC) considers that refresher training is necessary for the remote pilot to reach the level of proficiency needed to pass an RPC-L1(A) proficiency check.

(2) The remote pilot **must** pass an RPC-L1(A) proficiency check at an RAE(PC), including any theoretical knowledge or practical skills checks the RAE(PC) considers necessary.

RPC-L1(A) PROOF OF COMPETENCE

Upon satisfactory completion of the training, the RAE(PC) will advise the CAA as to the competencies demonstrated by remote pilots which must include as a minimum, the trainee’s name, CAA flyer ID, the RAE(PC) approval number, the competence level and category satisfactorily demonstrated.

The RAE(PC) must issue a proof of competence to the RP in a form and manner determined by the CAA.

RPC-L1(R) Rotorcraft

GROUND INSTRUCTION

Ground instruction considering take-off and landing area selection, UA preparation, ground hazard analysis, route planning, avoidance of uninvolved people, and airspace.

FLIGHT INSTRUCTION

The RPC-L1(R) flight instruction syllabus considers the principles of safe UA operations including:

(a) Ability to apply operational procedures (normal, contingency, and emergency procedures, flight planning, pre-flight and post-flight inspections).

(b) Ability to manage aeronautical communication.

(c) Manage the unmanned aircraft flight path and automation.

(d) Leadership, teamwork, and self-management.

(e) Problem solving and decision-making.

(f) Situational awareness.

(g) Workload management.

(h) Coordination or handover, as applicable.

THEORETICAL KNOWLEDGE TOPICS

In the tables of Appendix B, the applicable learning objectives (LOs) for each certificate are marked with an ‘X’.

An RAE(PC) should use the LOs when developing the theoretical knowledge elements of the appropriate course. But the LOs do not provide a ready-made ground training syllabus for individual RAE(PC)s and an RAE(PC) should not rely on the LOs as a substitute for thorough course design.

THEORETICAL KNOWLEDGE ASSESSMENT

An RPC-L1(R) trainee **must** demonstrate a level of knowledge appropriate to the privileges granted in the following subjects:

(a) Air law.
(b) Aircraft general knowledge.
(c) Human performance.
(d) Meteorology.
(e) Operational procedures.

PRACTICAL FLIGHT ASSESSMENT GENERAL

(a) A trainee for a practical flight assessment for the RPC-L1(R) **must** have received instruction on the same category and type of UAS to be used in the assessment.

(b) A trainee **must** pass all the relevant sections of the practical flight assessment, in accordance with the following:
   (1) If a trainee fails any item in a section, they have failed that section.
   (2) If a trainee fails only one section, they must retake only that section.
   (3) If a trainee fails more than one section, they must retake the entire practical flight assessment.

(4) If a trainee fails any section of the retaken practical flight assessment, including any section that was passed on a previous attempt, they must retake the entire practical flight assessment.

(c) All relevant sections of the practical flight assessment **must** be completed within 6 months of the date on which the trainee attempted the first section of the practical flight assessment.

(d) If a trainee fails any individual section of the practical flight assessment, the RAE(PC) may require them to undertake further training. If a trainee fails to achieve a pass in all sections of the practical flight assessment in two attempts, they **must** undertake further training.

(e) There is no limit to the number of practical flight assessments that a trainee may attempt.

CONDUCT OF THE ASSESSMENT

(a) Should the trainee choose to terminate a practical flight assessment for reasons considered inadequate by the PFA, the trainee **must** retake the entire practical flight assessment. If the assessment is terminated for reasons considered adequate by the PFA, only those sections not completed **must** be tested in a further flight. Adequate reasons include, but are not limited to, illness, poor weather conditions, equipment failure, and other risks to persons or property.

(b) At the discretion of the PFA, any manoeuvre or procedure of the assessment may be repeated once by the trainee. The PFA may stop the assessment at any stage if they consider that the trainee’s demonstration of flying skills requires a complete retest.

(c) A trainee **must** indicate to the PFA the checks and duties carried out. Checks **must** be completed in accordance with the checklist for the UA on which the assessment is being taken. During pre-flight preparation for the assessment, the trainee **must** configure the command unit (CU).

(d) The PFA **must** take no part in the operation of the UA except where intervention is necessary in the interest of safety.

CONTENT OF THE PRACTICAL FLIGHT ASSESSMENT FOR THE ISSUE OF AN RPC-L1(R)

(a) The UAS used for the practical flight assessment **must** meet the requirements for training UAS as set out in the relevant CAA publication.

(b) The practical flight assessment **must** comprise of a general handling assessment in a range of flight modes including non-positioning mode lasting a minimum of 30 minutes.

(c) Every section of the practical flight assessment must assess the use of checklists, situational awareness, control of the UA either manually or by use of the CU, and principles of risk management.

RPC-L1(R) PRACTICAL FLIGHT ASSESSMENT

RPC-L1(R) Practical Flight Assessment	
Section 1 - Pre-Flight	
1.1	Conducts a pre-flight, including flight planning, documentation, mass and balance consideration, flight briefing, NOTAMS
1.2	Rotorcraft inspection and technical logbook
1.3	Take-off
1.4	Performance considerations
Section 2 - General Handling	
2.1	Control of the rotorcraft by use of the transmitter/CU on both positioning and non-positioning flight modes including: 1) level flight, control of heading, altitude, and airspeed 2) climbing and descending 3) recoveries from unusual attitudes
2.5	Hover manoeuvres
2.6	Autorotation (if equipped)
Section 3 - Approach and Landing	
3.1	Approach procedures
3.2	Go-around TOLA blocked
3.3	Normal Landing
3.4	Post flight actions

Section 4 - Abnormal and Emergency Procedures	
4.1	Simulated engine/motor failure
4.2	Equipment malfunctions
4.3	Forced landing
4.4	Oral questions

RPC-L1(R) PRIVILEGES AND CONDITIONS

(a) **Privileges.** The privileges of the holder of an RPC-L1(R) are to act as remote pilot in command or flight crew of a UA where all the following apply:

(1) The flight is being undertaken in the Specific Category.

(2) The primary means of lift of the UA is rotating wing(s).

(3) The flight is being conducted VLOS

(4) The operational authorisation under which the flight is being conducted states the RPC-L1(R) is the minimum remote pilot competence.

(b) **Conditions.**

(1) The remote pilot maintains a minimum certificate currency of 2 hours of live flight within the last 90 days.

(2) The remote pilot holds a valid flyer ID.

(3) BVLOS flight is prohibited.

RPC-L1(R) EXPERIENCE REQUIREMENTS AND CREDITING

(a) An RPC-L1(R) trainee **must** have completed a minimum of 2 hours of instruction at a CAA approved RAE(PC).

(b) An RPC-L1(R) trainee that holds a valid GVC **must** be exempt from the theoretical assessment.

RPC-L1(R) VALIDITY, REVALIDATION, AND RENEWAL

(a) **Validity.** An RPC-L1(R) is valid for 5 years from the date notified on the certificate.

(b) **Revalidation.** An RPC-L1(R) may be revalidated within the 3 months immediately preceding its expiry date if the remote pilot undertakes a revalidation proficiency check at an RAE(PC).

(c) The RAE(PC) **must** determine on a case-by-case basis what steps the revalidation proficiency check requires, having regard to the remote pilot's certificate currency, experience, flight logs, last use of RPC privileges and any other relevant factors RAE(PC).

(d) An RAE(PC) should exempt a remote pilot from a live revalidation check where:

(1) the remote pilot has maintained at least minimum certificate currency for the complete duration of the certificate validity period; and

(2) the remote pilot demonstrates that certificate currency has been maintained through a personal flight log.

(e) An RAE(PC) may exempt a remote pilot from a live revalidation check where certificate currency has not been maintained in accordance with (d) if the RAE(PC) is satisfied that an exemption is appropriate, having regard in particular to:

(1) the remote pilot's experience; and

(2) the amount of time elapsed since the date on which the remote pilot last used privileges of the RPC-L1(R).

(f) The remote pilot **must** undertake a revalidation proficiency check consisting of at least 1 hour of supervised flying covering general handling and emergency procedures where the RAE(PC) considers this to be necessary.

(g) If a remote pilot chooses to fulfil the revalidation requirements earlier than prescribed in point (b), the new 5-year validity period will be set by reference to the date of the successful revalidation proficiency check.

(h) A remote pilot who fails to revalidate their RPC-L1(R) before it expires **must not** exercise any RPC-L1(R) privileges unless they renew their RPC-L1(R) in accordance with the provisions below.

(i) **Renewal**. If an RPC-L1(R) has expired, a remote pilot may renew their privileges, by complying with all the following requirements:

(1) The remote pilot **must** complete a refresher training at an RAE(PC), if the RAE(PC) considers that refresher training is necessary for the remote pilot to reach the level of proficiency needed to pass an RPC-L1(R) proficiency check.

(2) The remote pilot **must** pass an RPC-L1(R) proficiency check at an RAE(PC), including any theoretical knowledge or practical skills checks the RAE(PC) considers necessary.

(j) The RAE(PC) **must** determine on a case-by-case basis what amount of refresher training and what theoretical and practical skills checks are necessary to assess a remote pilot's RPC-L1(R) proficiency, having regard in particular to:

(1) the experience of the remote pilot; and

(2) the amount of time elapsed since the remote pilot last used the privileges of the RPC-L1(R); and

(3) the complexity of the remote pilot's experience.

RPC-L1(R) PROOF OF COMPETENCE

Upon satisfactory completion of the training, the RAE(PC) will advise the CAA as to the competencies demonstrated by remote pilots which must include as a minimum, the trainee's name, CAA flyer ID, the RAE(PC) approval number, the competence level and category satisfactorily demonstrated.

The RAE(PC) must issue a proof of competence to the RP in a form and manner determined by the CAA.

Level 2 Remote Pilot Certificate (RPC-L2)

COMMON REQUIREMENTS

Below are the common requirements for the issue of an RPC-L2.

MINIMUM AGE

The minimum age for trainees for the RPC-L2 is 18.

CONDITIONS

An RPC-L2 trainee **must** have passed the theoretical assessment and practical flight assessment at a CAA approved RAE(PC).

TRAINING COURSE

(a) An RPC-L2 trainee **must** complete a training course at a CAA approved RAE(PC).

(b) The course **must** include theoretical knowledge and flight instruction appropriate to the privileges of the RPC-L2.

(c) A trainee may complete their theoretical knowledge instruction and practical flight instruction at an RAE(PC) different from the one where they commenced their training course. This applies at any point in the training course. Where a trainee relies on this flexibility, the new RAE(PC) should assess the trainee's levels of theoretical and practical competence to determine how much further training the trainee requires.

ENTRY TO TRAINING

The RP **must** have completed the following initial training prior to being accepted for further training:

(a) Hold a valid RPC-L1 certificate for the same UA category.
(b) Have at least 50 logged flight hours on a UA of the same category conducted in the Specific category.

RPC-L2(A) Aeroplane

GROUND INSTRUCTION

Ground instruction considering take-off and landing area selection, aircraft preparation, ground hazard analysis, route planning, avoidance of uninvolved people, and airspace.

FLIGHT INSTRUCTION

The RPC-L2(A) flight instruction syllabus considers the principle of safe UA operations including:

(a) Ability to apply operational procedures (normal, contingency, and emergency procedures, flight planning, pre-flight and post-flight inspections).

(b) Ability to manage aeronautical communication.

(c) Manage the unmanned aircraft flight path and automation.

(d) Leadership, teamwork, and self-management.

(e) Problem solving and decision-making.

(f) Situational awareness.

(g) Workload management.

(h) Coordination or handover, as applicable.

SYLLABUS OF FLIGHT INSTRUCTION

Details of the flight instruction syllabus can be found in Appendix A. The syllabus details are intended to be used by an RAE(PC) when developing the RPC-L2(A) flight training elements of the appropriate course. It should be noted, however, that they do not provide a ready-made flight training syllabus for individual RAE(PC)s and should not be seen by organisations as a substitute for thorough course design.

The RPC-L2(A) flight instruction syllabus should consider the principles of threat and error management and **must** be competency-based training throughout.

THEORETICAL KNOWLEDGE TOPICS

In the tables of Appendix B, the applicable learning objectives (LOs) for each certificate are marked with an 'X'.

An RAE(PC) should use the LOs when developing the theoretical knowledge elements of the appropriate course. But the LOs do not provide a ready-made ground training syllabus for individual RAE(PC)s and an RAE(PC) should not rely on the LOs as a substitute for thorough course design.

THEORETICAL KNOWLEDGE ASSESSMENT

An RPC-L2(A) trainee **must** demonstrate a level of knowledge appropriate to the privileges granted in the following subjects:

(a) BVLOS operational procedures.

PRACTICAL FLIGHT ASSESSMENT GENERAL

(a) A trainee for a practical flight assessment for the RPC-L2(A) **must** have received instruction on the same category and type of UAS to be used in the assessment.

(b) A trainee **must** pass all the relevant sections of the practical flight assessment, in accordance with the following:
  (1) If a trainee fails any item in a section, they have failed that section.
  (2) If a trainee fails only one section, they must retake only that section.
  (3) If a trainee fails more than one section, they must retake the entire practical flight assessment.
  (4) If a trainee fails any section of the retaken practical flight assessment, including any section that was passed on a previous attempt, they must retake the entire practical flight assessment.

(c) All relevant sections of the practical flight assessment **must** be completed within 6 months of the date on which the trainee attempted the first section of the practical flight assessment.

(d) If a trainee fails any individual section of the practical flight assessment, the RAE(PC) may require them to undertake further training. If a trainee fails to achieve a pass in all sections of the practical flight assessment in two attempts, they **must** undertake further training.

(e) There is no limit to the number of practical flight assessments that a trainee may attempt.

CONDUCT OF THE ASSESSMENT

(a) Should the trainee choose to terminate a practical flight assessment for reasons considered inadequate by the PFA, the trainee **must** retake the entire practical flight assessment. If the assessment is terminated for reasons considered adequate by the PFA, only those sections not completed **must** be tested in a further flight. Adequate reasons include, but are not limited to, illness, poor weather conditions, equipment failure, and other risks to persons or property.

(b) At the discretion of the PFA, any manoeuvre or procedure of the assessment may be repeated once by the trainee. The PFA may stop the assessment at any stage if they consider that the trainee's demonstration of flying skills requires a complete retest.

(c) A trainee **must** indicate to the PFA the checks and duties carried out. Checks **must** be completed in accordance with the checklist for the UA on which the assessment is being taken. During pre-flight preparation for the assessment, the trainee **must** configure the command unit (CU).

(d) The PFA **must** take no part in the operation of the UA except where intervention is necessary in the interest of safety.

CONTENT OF THE PRACTICAL FLIGHT ASSESSMENT FOR THE ISSUE OF AN RPC-L2(A)

(a) The UAS used for the practical flight assessment **must** meet the requirements for training UAS as set out in the relevant CAA publication.

(b) The practical flight assessment **must** comprise of at least two BVLOS flights conducted under ARC-a conditions lasting at least 30mins flight time in total.

(c) Every section of the practical flight assessment must assess the use of checklists, situational awareness, control of the UA either manually or by use of the CU, and principles of risk management.

RPC-L2(A) Practical Flight Assessment	
Section 1 - Pre-Flight Operations	
1.1	Conducts a pre-flight, including flight planning, documentation, mass and balance consideration, flight brief, NOTAMS
1.2	CU configuration
1.3	UA inspection and technical logbook
1.4	Take-off
1.5	Performance considerations
Section 2 - Inflight Procedures	
2.1	Control of the UA by the CU, flight path management, and range/endurance considerations
2.2	Monitoring of flight progress, fuel/energy usage, airspace, and ground risks
2.3	Altitude, speed, heading control
2.4	Monitoring navigation and communication system performance
2.5	CU management
Section 3 - Approach and Landing	
3.1	Approach procedures
3.3	Go-around TOLA blocked
3.4	Normal Landing
3.5	Post flight actions
Section 4 - Abnormal and Contingency Procedures	
4.1	Engine/motor failure
4.2	Equipment malfunctions

4.3	Tactical deconfliction procedures
4.4	Forced landing
4.5	Oral questions

RPC-L2(A) PRIVILEGES AND CONDITIONS

(a) **Privileges.** The privileges of the holder of an RPC-L2(A) are to act as remote pilot in command or flight crew of a UA where all the following apply:

(1) The flight is being undertaken in the Specific category.

(2) The primary means of lift of the UA is fixed wing(s).

(3) The maximum air risk class (ARC) of the flight is ARC-a.

(4) The operational authorisation under which the flight is being conducted states the RPC-L2(A) is the minimum remote pilot competence.

(b) **Conditions**.

(1) The remote pilot maintains a minimum certificate currency of 2 hours of live flight within the last 90 days.

(2) The remote pilot holds a valid flyer ID.

(3) No intentional traffic deconfliction permitted.

RPC-L2(A) EXPERIENCE REQUIREMENTS AND CREDITING

(a) An RPC-L2(A) trainee **must** have completed at least 5 hours of flight instruction of which up to 2 hours may be completed using a CAA approved flight simulator device to facilitate emergency procedures training.

(b) An RPC-L2(A) trainee that holds a valid RPC-L2 in another category may be credited towards the requirements in (a).

(c) The amount of credit **must** be decided by the RAE(PC) where the pilot undergoes the training course but **must** in any case not exceed 50% (2.5 hours) of the hours required in (a).

RPC-L2(A) VALIDITY, REVALIDATION AND RENEWAL

(a) **Validity.** An RPC-L2(A) is valid for 3 years from the date notified on the certificate.

(b) **Revalidation.** An RPC-L2(A) may be revalidated within the 3 months immediately preceding its expiry date if the remote pilot undertakes a revalidation proficiency check at an RAE(PC).

(c) The RAE(PC) **must** determine on a case-by-case basis what steps the revalidation proficiency check requires, having regard to the remote pilot's certificate currency, experience, flight logs, last use of RPC privileges and any other relevant factors.

(d) An RAE(PC) should exempt a remote pilot from a live revalidation check where:

(1) the remote pilot has maintained at least minimum certificate currency for the complete duration of the certificate validity period; and

(2) the remote pilot demonstrates that certificate currency has been maintained through a personal flight log.

(e) An RAE(PC) may exempt a remote pilot from a live revalidation check where certificate currency has not been maintained in accordance with (d) if the RAE(PC) is satisfied that an exemption is appropriate, having regard to:

(1) the remote pilot's experience; and

(2) the amount of time elapsed since the date on which the remote pilot last used privileges of the RPC-L2(A).

(f) The remote pilot **must** undertake a revalidation proficiency check consisting of at least 1 hour of supervised flying covering general handling and emergency procedures where the RAE(PC) considers this to be necessary.

(g) If a remote pilot chooses to fulfil the revalidation requirements earlier than prescribed in point (b), the new 3-year validity period will be set by reference to the date of the successful revalidation proficiency check.

(h) A remote pilot who fails to revalidate their RPC-L2(A) before it expires **must not** exercise any RPC-L2(A) privileges unless they renew their RPC-L2(A) in accordance with the provisions below.

(i) **Renewal**. If an RPC-L2(A) has expired, a remote pilot may renew their privileges, by complying with all the following requirements:

(1) The remote pilot **must** complete a refresher training at an RAE(PC), if the RAE(PC) considers that refresher training is necessary for the remote pilot to reach the level of proficiency needed to pass an RPC-L2(A) proficiency check.

(2) The remote pilot **must** pass an RPC-L2(A) proficiency check at an RAE(PC), including any theoretical knowledge or practical skills checks the RAE(PC) considers necessary.

(j) The RAE(PC) must determine on a case-by-case basis what amount of refresher training and what theoretical and practical skills checks are necessary to assess a remote pilot's RPC-L2(A) proficiency, having regard in particular to:

(1) the experience of the remote pilot;

(2) the amount of time elapsed since the remote pilot last used the privileges of the RPC-L2(A); and

(3) the complexity of the remote pilot's experience.

RPC-L2(A) PROOF OF COMPETENCE

Upon satisfactory completion of the training, the RAE(PC) will advise the CAA as to the competencies demonstrated by remote pilots which must include as a minimum, the trainee's name, CAA flyer ID, the RAE(PC) approval number, the competence level, and category satisfactorily demonstrated.

The RAE(PC) must issue a proof of competence to the RP in a form and manner determined by the CAA.

RPC-L2(R) Rotorcraft

GROUND INSTRUCTION

Ground instruction considering take-off and landing area selection, aircraft preparation, ground hazard analysis, route planning, avoidance of uninvolved people, and airspace.

FLIGHT INSTRUCTION

The RPC-L2(R) flight instruction syllabus considers the principle of safe UA operations including:

(a) Ability to apply operational procedures (normal, contingency, and emergency procedures, flight planning, pre-flight and post-flight inspections),

(b) Ability to manage aeronautical communication,

(c) Manage the unmanned aircraft flight path and automation,

(d) Leadership, teamwork, and self-management,

(e) Problem solving and decision-making,

(f) Situational awareness,

(g) Workload management,

(h) Coordination or handover, as applicable.

SYLLABUS OF FLIGHT INSTRUCTION

Details of the flight instruction syllabus can be found in Appendix A. The syllabus details are intended to be used by an RAE(PC) when developing the RPC-L2(R) flight training elements of the appropriate course. It should be noted, however, that they do not provide a ready-made flight training syllabus for individual RAE(PC)s and should not be seen by organisations as a substitute for thorough course design.

THEORETICAL KNOWLEDGE TOPICS

In the tables of Appendix B, the applicable learning objectives (LOs) for each certificate are marked with an 'X'.

An RAE(PC) should use the LOs when developing the theoretical knowledge elements of the appropriate course. But the LOs do not provide a ready-made ground training syllabus for individual RAE(PC)s and an RAE(PC) should not rely on the LOs as a substitute for thorough course design.

THEORETICAL KNOWLEDGE ASSESSMENT

An RPC-L2(R) trainee **must** demonstrate a level of knowledge appropriate to the privileges granted in the following subjects:

(a) BVLOS operational procedures

PRACTICAL FLIGHT ASSESSMENT GENERAL

(a) A trainee for a practical flight assessment for the RPC-L2(R) **must** have received instruction on the same category and type of UAS to be used in the assessment.

(b) A trainee **must** pass all the relevant sections of the practical flight assessment, in accordance with the following:
   (1) If a trainee fails any item in a section, they have failed that section.
   (2) If a trainee fails only one section, they must retake only that section.
   (3) If a trainee fails more than one section, they must retake the entire practical flight assessment.

(4) If a trainee fails any section of the retaken practical flight assessment, including any section that was passed on a previous attempt, they must retake the entire practical flight assessment.

(c) All relevant sections of the practical flight assessment **must** be completed within 6 months of the date on which the trainee attempted the first section of the practical flight assessment.

(d) If a trainee fails any individual section of the practical flight assessment, the RAE(PC) may require them to undertake further training. If a trainee fails to achieve a pass in all sections of the practical flight assessment in two attempts, they **must** undertake further training.

(e) There is no limit to the number of practical flight assessments that a trainee may attempt.

CONDUCT OF THE ASSESSMENT

(a) Should the trainee choose to terminate a practical flight assessment for reasons considered inadequate by the PFA, the trainee **must** retake the entire practical flight assessment. If the assessment is terminated for reasons considered adequate by the PFA, only those sections not completed **must** be tested in a further flight. Adequate reasons include, but are not limited to, illness, poor weather conditions, equipment failure, and other risks to persons or property.

(b) At the discretion of the PFA, any manoeuvre or procedure of the assessment may be repeated once by the trainee. The PFA may stop the assessment at any stage if they consider that the trainee’s demonstration of flying skills requires a complete retest.

(c) A trainee **must** indicate to the PFA the checks and duties carried out. Checks **must** be completed in accordance with the checklist for the UA on which the assessment is being taken. During pre-flight preparation for the assessment, the trainee **must** configure the command unit (CU).

(d) The PFA **must** take no part in the operation of the UA except where intervention is necessary in the interest of safety.

CONTENT OF THE PRACTICAL FLIGHT ASSESSMENT FOR THE ISSUE OF AN RPC-L2(R)

(a) The UAS used for the practical flight assessment **must** meet the requirements for training UAS as set out in the relevant CAA publication.

(b) The practical flight assessment **must** comprise of at least two BVLOS flights conducted under ARC-a conditions lasting at least 30mins flight time in total.

(c) Every section of the practical flight assessment must assess the use of checklists, situational awareness, control of the UA either manually or by use of the CU, and principles of risk management.

RPC-L2(R) Practical Flight Assessment	
Section 1 - Pre-Flight Operations	
1.1	Conducts a pre-flight, including flight planning, documentation, mass and balance consideration, flight brief, NOTAMS
1.2	CU Configuration
1.3	UA inspection and technical logbook
1.4	Take-off
1.5	Performance considerations
Section 2 - Inflight Procedures	
2.1	Control of the UA by the CU, flight path management, and range/endurance considerations
2.2	Monitoring of flight progress, fuel/energy usage, airspace, and ground risks
2.3	Altitude, speed, heading control
2.4	Monitoring navigation and communication system performance
2.5	CU management
Section 3 - Approach and Landing	
3.1	Approach procedures
3.3	Go-around TOLA blocked
3.4	Normal Landing
3.5	Post flight actions
Section 4 - Abnormal and Contingency Procedures	

4.1	Engine/motor failure
4.2	Equipment malfunctions
4.3	Tactical deconfliction procedures
4.4	Forced landing
4.5	Oral questions

RPC-L2(R) PRIVILEGES AND CONDITIONS

(a) **Privileges.** The privileges of the holder of an RPC-L2(R) are to act as remote pilot in command or flight crew of a UA where all of the following apply:
- (1) the flight is being undertaken in the Specific Category.
- (2) the primary means of lift of the UA is rotating wing(s).
- (3) the maximum air risk class (ARC) of the flight is ARC-a.
- (4) the operational authorisation under which the flight is being conducted states the RPC-L2(R) is the minimum remote pilot competence.

(b) **Conditions.**
- (1) The remote pilot maintains a minimum certificate currency of 2 hours of live flight within the last 90 days.
- (2) The remote pilot holds a valid flyer ID.
- (3) No intentional traffic deconfliction.

RPC-L2(R) EXPERIENCE REQUIREMENTS AND CREDITING

(a) An RPC-L2(R) trainee **must** have completed at least 5 hours of flight instruction of which up to 2 hours may be completed using a CAA approved flight simulator device to facilitate emergency procedures training.

(b) An RPC-L2(R) trainee that holds a valid RPC-L2 in another category may be credited towards the requirements in (a).

(c) The amount of credit **must** be decided by the RAE(PC) where the pilot undergoes the training course, but **must** in any case not exceed 50% (2.5 hours) of the hours required in (a).

RPC-L2(R) VALIDITY, REVALIDATION AND RENEWAL

(a) **Validity.** An RPC-L2(R) is valid for 3 years from the date notified on the certificate.

(b) **Revalidation.** An RPC-L2(R) may be revalidated within the 3 months immediately preceding its expiry date if the remote pilot undertakes a revalidation proficiency check at an RAE(PC).

(c) The RAE(PC) **must** determine on a case-by-case basis what steps the revalidation proficiency check requires, having regard to the remote pilot's certificate currency, experience, flight logs, last use of RPC privileges and any other relevant factors.

(d) An RAE(PC) should exempt a remote pilot from a live revalidation check where:

(1) the remote pilot has maintained at least minimum certificate currency for the complete duration of the certificate validity period; and

(2) the remote pilot demonstrates that certificate currency has been maintained through a personal flight log.

(e) An RAE(PC) may exempt a remote pilot from a live revalidation check where certificate currency has not been maintained in accordance with (d) if the RAE(PC) is satisfied that an exemption is appropriate, having regard in particular to:

(1) the remote pilot's experience; and

(2) the amount of time elapsed since the date on which the remote pilot last used privileges of the RPC-L2(R).

(f) The remote pilot **must** undertake a revalidation proficiency check consisting of at least 1 hour of supervised flying covering general handling and emergency procedures where the RAE(PC) considers this to be necessary.

(g) If a remote pilot chooses to fulfil the revalidation requirements earlier than prescribed in point (b), the new 3-year validity period will be set by reference to the date of the successful revalidation proficiency check.

(h) A remote pilot who fails to revalidate their RPC-L2(R) before it expires **must not** exercise any RPC-L2(R) privileges unless they renew their RPC-L2(R) in accordance with the provisions below.

(i) **Renewal**. If an RPC-L2(R) has expired, a remote pilot may renew their privileges, by complying with all the following requirements:

(1) The remote pilot **must** complete a refresher training at an RAE(PC), if the RAE(PC) considers that refresher training is necessary for the remote pilot to reach the level of proficiency needed to pass an RPC-L2(R) proficiency check.

(2) The remote pilot **must** pass an RPC-L2(R) proficiency check at an RAE(PC), including any theoretical knowledge or practical skills checks the RAE(PC) considers necessary.

RPC-L2(R) PROOF OF COMPETENCE

Upon satisfactory completion of the training, the RAE(PC) will advise the CAA as to the competencies demonstrated by remote pilots which must include as a minimum the trainee's name, CAA flyer ID, the RAE(PC) approval number, the competence level, and category satisfactorily demonstrated.

The RAE(PC) must issue a proof of competence to the RP in a form and manner determined by the CAA.

Level 3 Remote Pilot Certificate (RPC-L3)

COMMON REQUIREMENTS

Below are the common requirements for the issue of an RPC-L3.

MINIMUM AGE

The minimum age for trainees for the RPC-L3 is 18.

CONDITIONS

An RPC-L3 trainee **must** have fulfilled the requirements of the relevant training course at a CAA approved RAE(PC).

TRAINING COURSE

(a) An RPC-L3 trainee **must** complete a training course at a CAA approved RAE(PC).

(b) The course **must** include theoretical knowledge and flight instruction appropriate to the privileges of the RPC-L3.

(c) A trainee may complete their theoretical knowledge instruction and practical flight instruction at an RAE(PC) different from the one where they commenced their training course. This applies at any point in the training course. Where a trainee relies on this flexibility, the new RAE(PC) should assess the trainee's levels of theoretical and practical competence to determine how much further training the trainee requires.

ENTRY TO TRAINING

An RPC-L3 trainee **must** have completed the following initial training prior to being accepted for further training:

(a) Hold a valid RPC-L2 certificate.

(b) Have logged at least 50 hours of BVLOS flight as RP in command in the Specific category on the same UA category.

(c) Hold at least a valid LAPL medical certificate.

RPC-L3(A) Aeroplane

GROUND INSTRUCTION

Ground instruction considering take-off and landing area selection, aircraft preparation, ground hazard analysis, route planning, avoidance of uninvolved people, and airspace.

FLIGHT INSTRUCTION

The RPC-L3(A) flight instruction syllabus considers the principles of safe UA operations including:

(a) Ability to apply operational procedures (normal, contingency, and emergency procedures, flight planning, pre-flight and post-flight inspections).

(b) Ability to manage aeronautical communication.

(c) Manage the unmanned aircraft flight path and automation.

(d) Leadership, teamwork, and self-management.

(e) Problem solving and decision-making.

(f) Situational awareness.

(g) Workload management.

(h) Coordination or handover, as applicable.

SYLLABUS OF FLIGHT INSTRUCTION

Details of the flight instruction syllabus can be found in Appendix A. The syllabus details are intended to be used by an RAE(PC) when developing the RPC-L3(A) flight training elements of the appropriate course. It should be noted, however, that they do not provide a ready-made flight training syllabus for individual RAE(PC)s and should not be seen by organisations as a substitute for thorough course design.

The RPC-L3(A) flight instruction syllabus should consider the principles of threat and error management and **must** be competency-based training throughout.

THEORETICAL KNOWLEDGE TOPICS

In the tables of Appendix B, the applicable learning objectives (LOs) for each certificate are marked with an 'X'. The LOs define the subject knowledge and applied knowledge, skills, and attitudes that a student remote pilot should have assimilated during the theoretical knowledge course.

An RAE(PC) should use the LOs when developing the theoretical knowledge elements of the appropriate course. But the LOs do not provide a ready-made ground training syllabus for individual RAE(PC)s and an RAE(PC) should not rely on the LOs as a substitute for thorough course design.

THEORETICAL KNOWLEDGE ASSESSMENT

An RPC-L3(A) trainee **must** demonstrate a level of knowledge appropriate to the privileges granted in the following subjects:

(a) Air law.
(b) Aircraft general knowledge.
(c) Human performance and limitations.
(d) Meteorology.
(e) Operational procedures.

PRACTICAL FLIGHT ASSESSMENT GENERAL

(a) A trainee for a practical flight assessment for the RPC-L3(A) **must** have received instruction on the same category and type of UAS to be used in the assessment.

(b) A trainee **must** pass all the relevant sections of the practical flight assessment, in accordance with the following:
   (1) If a trainee fails any item in a section, they have failed that section.
   (2) If a trainee fails only one section, they must retake only that section.
   (3) If a trainee fails more than one section, they must retake the entire practical flight assessment.

(4) If a trainee fails any section of the retaken practical flight assessment, including any section that was passed on a previous attempt, they must retake the entire practical flight assessment.

(c) All relevant sections of the practical flight assessment **must** be completed within 6 months of the date on which the trainee attempted the first section of the practical flight assessment.

(d) If a trainee fails any individual section of the practical flight assessment, the RAE(PC) may require them to undertake further training. If a trainee fails to achieve a pass in all sections of the practical flight assessment in two attempts, they **must** undertake further training.

(e) There is no limit to the number of practical flight assessments that a trainee may attempt.

CONDUCT OF THE ASSESSMENT

(a) Should the trainee choose to terminate a practical flight assessment for reasons considered inadequate by the PFA, the trainee **must** retake the entire practical flight assessment. If the assessment is terminated for reasons considered adequate by the PFA, only those sections not completed **must** be tested in a further flight. Adequate reasons include, but are not limited to, illness, poor weather conditions, equipment failure, and other risks to persons or property.

(b) At the discretion of the PFA, any manoeuvre or procedure of the assessment may be repeated once by the trainee. The PFA may stop the assessment at any stage if they consider that the trainee's demonstration of flying skills requires a complete retest.

(c) A trainee **must** indicate to the PFA the checks and duties carried out. Checks **must** be completed in accordance with the checklist for the UA on which the assessment is being taken. During pre-flight preparation for the assessment, the trainee **must** configure the command unit (CU).

(d) The PFA **must** take no part in the operation of the UA except where intervention is necessary in the interest of safety.

CONTENT OF THE PRACTICAL FLIGHT ASSESSMENT FOR THE ISSUE OF AN RPC-L3(A)

(a) The UAS used for the practical flight assessment **must** meet the requirements for training UAS as set out in the relevant CAA publication.

(b) The practical flight assessment **must** comprise of 3 elements to be completed at the end of each phase of training:

(1) General handling BVLOS flight conducted in at least ARC-b lasting at least 45 minutes returning to the departure location.

(2) Cross country flight conducted in at least ARC-b including landing at a location different to the departure location where:

(ii) The outbound leg is at least 10 nautical miles.

(iii) The return leg is at least 10 nautical miles.

(iiii) The remote pilot will be responsible for all aspects of the operation including the remote recovery and repositioning of the aircraft at the destination location.

(3) Emergency procedures assessment lasting at least 45 minutes conducted in a simulator.

(c) Every section of the practical flight assessment must assess the use of checklists, situational awareness, control of the UA either manually or by use of the CU, and principles of risk management.

RPC-L3(A) PRIVILEGES AND CONDITIONS

(a) **Privileges.** The privileges of the holder of an RPC-L3(A) are to act as remote pilot in command or flight crew of a UA where all of the following apply:

(1) The flight is being undertaken in the Specific category.

(2) The primary means of lift of the UA is fixed wing(s).

(3) The maximum air risk class (ARC) of the flight is ARC-c.

(4) The operational authorisation under which the flight is being conducted states the RPC-L3(A) is the minimum remote pilot competence.

(b) **Conditions.**

(1) The remote pilot maintains a minimum certificate currency of 2 hours of live flight within the last 90 days.

(2) The remote pilot holds a valid flyer ID.

(3) Airspace classified as ARC-d prohibited.

RPC-L3(A) EXPERIENCE REQUIREMENTS AND CREDITING

Experience Requirements. An RPC-L3(A) trainee, **must** be able to demonstrate that they meet both flight experience requirements below prior to the issue of an RPC-L3(A) certificate:

(a) at least 55 hours of instruction completed, which **must** include:

(1) 35 hours of beyond visual line of sight (BVLOS) dual flight simulator instruction, and

(2) 15 hours of BVLOS dual practical flight instruction, and

(3) 5 hours of supervised practical flight as RP in command; and

(b) at least 75 hours of logged live BVLOS flight in total as RP in command, which may include live practical flight instruction undertaken during this training course, or a previous RPC training course.

Crediting. An RPC-L3(A) trainee with equivalent prior experience as a remote pilot, or experience as a manned aeroplane pilot may be credited towards the requirements in (1)(a). The amount of credit **must** be decided by the RAE(PC) where the pilot undergoes the training course, based on a pre-entry flight assessment, but **must** in any case:

(a) Not exceed 20% of the hours required in (1)(a).

(b) Not include the requirements in (1)(b), (1)(c), or (2).

Crediting. An RPC-L3(A) trainee that holds a valid RPC-L3 in another category may be credited towards the requirements in (a) subject to completion of a suitable bridging course at a CAA approved RAE(PC).

Crediting. An RPC-L3(A) trainee who holds a valid ATPL or CPL theory certificate in the appropriate category may be credited towards the requirements in Appendix A subject to completion of a suitable theoretical bridging course and assessment at a CAA approved RAE(PC).

RPC-L3(A) VALIDITY, REVALIDATION AND RENEWAL

(a) **Validity.** An RPC-L3(A) is valid for 3 years from the date notified on the certificate.

(b) **Revalidation.** An RPC-L3(A) may be revalidated within the 3 months immediately preceding its expiry date if the remote pilot undertakes a revalidation proficiency check at an RAE(PC).

(c) The RAE(PC) **must** determine on a case-by-case basis what steps the revalidation proficiency check requires, having regard to the remote pilot's certificate currency, experience, flight logs, last use of RPC privileges and any other relevant factors.

(d) An RAE(PC) should exempt a remote pilot from a live revalidation check where:

(1) the remote pilot has maintained at least minimum certificate currency for the complete duration of the certificate validity period; and

(2) the remote pilot demonstrates that certificate currency has been maintained through a personal flight log.

(e) An RAE(PC) may exempt a remote pilot from a live revalidation check where certificate currency has not been maintained in accordance with (d) if the RAE(PC) is satisfied that an exemption is appropriate, having regard in particular to:

(1) the remote pilot's experience; and

(2) the amount of time elapsed since the date on which the remote pilot last used privileges of the RPC-L3(A).

(f) The remote pilot **must** undertake a revalidation proficiency check consisting of at least 1 hour of supervised flying covering general handling and emergency procedures where the RAE(PC) considers this to be necessary.

(g) If a remote pilot chooses to fulfil the revalidation requirements earlier than prescribed in point (b), the new 3-year validity period will be set by reference to the date of the successful revalidation proficiency check.

(h) A remote pilot who fails to revalidate their RPC-L3(A) before it expires **must not** exercise any RPC-L3(A) privileges unless they renew their RPC-L3(A) in accordance with the provisions below.

(i) **Renewal**. If an RPC-L3(A) has expired, a remote pilot may renew their privileges, by complying with all the following requirements:

(1) The remote pilot **must** complete a refresher training at an RAE(PC), if the RAE(PC) considers that refresher training is necessary for the remote pilot to reach the level of proficiency needed to pass an RPC-L3(A)proficiency check.

(2) The remote pilot **must** pass an RPC-L3(A) proficiency check at an RAE(PC), including any theoretical knowledge or practical skills checks the RAE(PC) considers necessary.

(j) The RAE(PC) must determine on a case-by-case basis what amount of refresher training and what theoretical and practical skills checks are necessary to assess a remote pilot's RPC-L3(A) proficiency, having regard in particular to:

(1) the experience of the remote pilot; and

(2) the amount of time elapsed since the remote pilot last used the privileges of the RPC-L3(A); and

(3) the complexity of the remote pilot's experience.

RPC-L3(A) PROOF OF COMPETENCE

Upon satisfactory completion of the training the RAE(PC) will advise the CAA as to the competencies demonstrated by remote pilots which must include as a minimum the trainee’s name, CAA flyer ID, the RAE(PC) approval number, the competence level, and category satisfactorily demonstrated.

The RAE(PC) must issue a proof of competence to the RP in a form and manner determined by the CAA.

RPC-L3(R) Rotorcraft

GROUND INSTRUCTION

Ground instruction considering take-off and landing area selection, aircraft preparation, ground hazard analysis, route planning, avoidance of uninvolved people, and airspace.

FLIGHT INSTRUCTION

The RPC-L3(R) flight instruction syllabus considers the principles of safe UA operations including:

(a) Ability to apply operational procedures (normal, contingency, and emergency procedures, flight planning, pre-flight and post-flight inspections).

(b) Ability to manage aeronautical communication.

(c) Manage the unmanned aircraft flight path and automation.

(d) Leadership, teamwork, and self-management.

(e) Problem solving and decision-making.

(f) Situational awareness.

(g) Workload management.

(h) Coordination or handover, as applicable.

SYLLABUS OF FLIGHT INSTRUCTION

Details of the flight instruction syllabus can be found in Appendix A. The syllabus details are intended to be used by an RAE(PC) when developing the RPC-L3(R) flight training elements of the appropriate course. It should be noted, however, that they do not provide a ready-made flight training syllabus for individual RAE(PC)s and should not be seen by organisations as a substitute for thorough course design.

The RPC-L3(R) flight instruction syllabus should consider the principles of threat and error management and **must** be competency-based training throughout.

THEORETICAL KNOWLEDGE TOPICS

In the tables of Appendix B, the applicable learning objectives (LOs) for each certificate are marked with an 'X'.

An RAE(PC) should use the LOs when developing the theoretical knowledge elements of the appropriate course. But the LOs do not provide a ready-made ground training syllabus for individual RAE(PC)s and an RAE(PC) should not rely on the LOs as a substitute for thorough course design.

THEORETICAL KNOWLEDGE ASSESSMENT

An RPC-L3(R) trainee(s) **must** demonstrate a level of knowledge appropriate to the privileges granted in the following subjects:

(a) Air law.
(b) Aircraft general knowledge.
(c) Human performance and limitations.
(d) Meteorology.
(e) Operational procedures.

PRACTICAL FLIGHT ASSESSMENT GENERAL

(a) A trainee for a practical flight assessment for the RPC-L3(R) **must** have received instruction on the same category and type of UAS to be used in the assessment.

(b) A trainee **must** pass all the relevant sections of the practical flight assessment, in accordance with the following:

  (1) If trainee fails any item in a section, they have failed that section.
  (2) If a trainee fails only one section, they must retake only that section.
  (3) If a trainee fails more than one section, they must retake the entire practical flight assessment.
  (4) If a trainee fails any section of the retaken practical flight assessment, including any section that was passed on a previous attempt, they must retake the entire practical flight assessment.

(c) All relevant sections of the practical flight assessment **must** be completed within 6 months of the date on which the trainee attempted the first section of the practical flight assessment.

(d) If a trainee fails any individual section of the practical flight assessment, the RAE(PC) may require them to undertake further training. If a trainee fails to achieve a pass in all sections of the practical flight assessment in two attempts, they **must** undertake further training.

(e) There is no limit to the number of practical flight assessments that a trainee may attempt.

CONDUCT OF THE ASSESSMENT

(a) Should the trainee choose to terminate a practical flight assessment for reasons considered inadequate by the PFA, the trainee **must** retake the entire practical flight assessment. If the assessment is terminated for reasons considered adequate by the PFA, only those sections not completed **must** be tested in a further flight. Adequate reasons include, but are not limited to, illness, poor weather conditions, equipment failure, and other risks to persons or property.

(b) At the discretion of the PFA, any manoeuvre or procedure of the assessment may be repeated once by the trainee. The PFA may stop the assessment at any stage if they consider that the trainee’s demonstration of flying skills requires a complete retest.

(c) A trainee **must** indicate to the PFA the checks and duties carried out. Checks **must** be completed in accordance with the checklist for the UA on which the assessment is being taken. During pre-flight preparation for the assessment, the trainee **must** configure the command unit (CU).

(d) The PFA **must** take no part in the operation of the UA except where intervention is necessary in the interest of safety.

CONTENT OF THE PRACTICAL FLIGHT ASSESSMENT FOR THE ISSUE OF AN RPC-L3(R)

(a) The UAS used for the practical flight assessment **must** meet the requirements for training UAS as set out in the relevant CAA publication.

(b) The practical flight assessment **must** comprise of 3 elements to be completed at the end of each phase of training:

  (1) General handling BVLOS flight conducted in at least ARC-b lasting at least 45 minutes returning to the departure location.

  (2) Cross country flight conducted in at least ARC-b including landing at a location different to the departure location where:

    (ii) The outbound leg is at least 10 nautical miles.

    (iii) The return leg is at least 10 nautical miles.

(iiii) The remote pilot will be responsible for all aspects of the operation including the remote recovery and repositioning of the aircraft at the destination location.

(3) Emergency procedures assessment lasting at least 45 minutes conducted in a simulator.

(c) Every section of the practical flight assessment must assess the use of checklists, situational awareness, control of the UA either manually or by use of the CU, and principles of risk management.

RPC-L3(R) PRIVILEGES AND CONDITIONS

(a) **Privileges.** The privileges of the holder of an RPC-L3(R) are to act as remote pilot in command or flight crew of a UA where all of the following apply:

(1) The flight is being undertaken in the Specific Category.

(2) The primary means of lift of the UA is rotating wings(s).

(3) The maximum air risk class (ARC) of the flight is ARC-c.

(4) The operational authorisation under which the flight is being conducted states the RPC-L3(R) is the minimum remote pilot competence.

(b) **Conditions**.

(1) The remote pilot maintains a minimum certificate currency of 2 hours of live flight within the last 90 days.

(2) The remote pilot holds a valid Flyer ID.

(3) Airspace classified as ARC-d prohibited.

RPC-L3(R) EXPERIENCE REQUIREMENTS AND CREDITING

Experience Requirements. An RPC-L3(R) trainee **must** be able to demonstrate that they meet both flight experience requirements below:

(a) at least 55 hours of instruction completed, which **must** include:

(1) 35 hours of beyond visual line of sight (BVLOS) dual flight simulator instruction, and

(2) 15 hours of BVLOS dual practical flight instruction, and

(3) 5 hours of supervised practical flight as RP in command; and

(b) at least 75 hours of logged live BVLOS flight in total as RP in command, which may include live practical flight instruction undertaken during this training course, or a previous RPC training course.

Crediting. An RPC-L3(R) trainee with equivalent prior experience as a remote pilot, or experience as a manned aeroplane pilot may be credited towards the requirements in (1)(a). The amount of credit **must** be decided by the RAE(PC) where the pilot undergoes the training course, based on a pre-entry flight assessment, but **must** in any case:

(a) Not exceed 20% of the hours required in (1)(a).
(b) Not include the requirements in (1)(b), (1)(c), or (2).

Crediting. An RPC-L3(R) trainee that holds a valid RPC-L3 in another category may be credited towards the requirements in (a) subject to completion of a suitable bridging course at a CAA approved RAE(PC).

Crediting. An RPC-L3(R) trainee who hold a valid ATPL or CPL theory certificate in the appropriate category may be credited towards the requirements in Appendix A subject to completion of a suitable bridging course and assessment at a CAA approved RAE(PC).

RPC-L3(R) VALIDITY, REVALIDATION AND RENEWAL

(a) **Validity.** An RPC-L3(R) is valid for 3 years from the date notified on the certificate.
(b) **Revalidation.** An RPC-L3(R) may be revalidated within the 3 months immediately preceding its expiry date if the remote pilot undertakes a revalidation proficiency check at an RAE(PC).
(c) The RAE(PC) **must** determine on a case-by-case basis what steps the revalidation proficiency check requires, having regard to the remote pilot's certificate currency, experience, flight logs, last use of RPC privileges and any other relevant factors.
(d) An RAE(PC) should exempt a remote pilot from a live revalidation check where:
    (1) the remote pilot has maintained at least minimum certificate currency for the complete duration of the certificate validity period; and
    (2) the remote pilot demonstrate certificate currency has been maintained through a personal flight log.
(e) An RAE(PC) may exempt a remote pilot from a live revalidation check where certificate currency has not been maintained in accordance with (d) if the RAE(PC) is satisfied that an exemption is appropriate, having regard in particular to:
    (1) the remote pilot's experience; and

(2) the amount of time elapsed since the date on which the remote pilot last used privileges of the RPC-L3(R).

(f) The remote pilot **must** undertake a revalidation proficiency check consisting of at least 1 hour of supervised flying covering general handling and emergency procedures where the RAE(PC) considers this to be necessary.

(g) If a remote pilot chooses to fulfil the revalidation requirements earlier than prescribed in point (b), the new 3-year validity period will be set by reference to the date of the successful revalidation proficiency check.

(h) A remote pilot who fails to revalidate their RPC-L3(R) before it expires **must not** exercise any RPC-L3(R) privileges unless they renew their RPC-L3(R) in accordance with the provisions below.

(i) **Renewal**. If an RPC-L3(R) has expired, a remote pilot may renew their privileges, by complying with all the following requirements:

(1) The remote pilot **must** complete a refresher training at an RAE(PC), if the RAE(PC) considers that refresher training is necessary for the remote pilot to reach the level of proficiency needed to pass an RPC-L3(A) proficiency check.

(2) The remote pilot **must** pass an RPC-L3(R) proficiency check at an RAE(PC), including any theoretical knowledge or practical skills checks the RAE(PC) considers necessary.

(j) The RAE(PC) **must** determine on a case-by-case basis what amount of refresher training and what theoretical and practical skills checks are necessary to assess a remote pilot’s RPC-L3(R) proficiency, having regard in particular to:

(1) the experience of the remote pilot; and

(2) the amount of time elapsed since the remote pilot last used the privileges of the RPC-L3(R); and

(3) the complexity of the remote pilot’s experience.

RPC-L3(R) PROOF OF COMPETENCE

Upon satisfactory completion of the training the RAE(PC) will advise the CAA as to the competencies demonstrated by remote pilots which must include as a minimum the trainee’s name, CAA flyer ID, the RAE(PC) approval number, the competence level, and category satisfactorily demonstrated.

The RAE(PC) must issue a proof of competence to the RP in a form and manner determined by the CAA.

Level 4 Remote Pilot Certificate (RPC-L4)

The level 4 RPC considers the **future possibility** of full integration between UAS and manned aircraft in the Specific category. The UAS technical assurance, operator procedures, and flight crew training requirements to perform these types of operations could be very high. Several other national and international policies need to be adopted prior to the commencement of these types of operations. Therefore, the following should be considered a **framework for further development**.

COMMON REQUIREMENTS

Below are the common requirements for the issue of an RPC-L4.

MINIMUM AGE

The minimum age for trainees for the RPC-L4 is 18.

CONDITIONS

An RPC-L4 trainee **must** have fulfilled the requirements of the relevant training course at a CAA approved RAE(PC).

TRAINING COURSE

(a) An RPC-L4 trainee **must** complete a training course at a CAA approved RAE(PC).

(b) The course **must** include theoretical knowledge and flight instruction appropriate to the privileges of the RPC-4 applied for.

(c) A trainee may complete their theoretical knowledge instruction and practical flight instruction at an RAE(PC) different from the one where they commenced their training course. This applies at any point in the training course. Where a trainee relies on this flexibility, the new RAE(PC) should assess the trainee's levels of theoretical and practical competence to determine how much further training the trainee requires.

ENTRY TO TRAINING

An RPC-L4 trainee **must** have completed the following initial training prior to being accepted for further training:

(a) Hold a valid RPC-L3 certificate.

(b) Have logged at least 75 hours of BVLOS flight as RP in command in the Specific category on the application UA category.

(c) Hold at least a valid LAPL medical certificate.

RPC-L4(A) Aeroplane

GROUND INSTRUCTION

Ground instruction considering take-off and landing area selection, aircraft preparation, ground hazard analysis, route planning, avoidance of uninvolved people, and airspace.

FLIGHT INSTRUCTION

The RPC-L4(A) flight instruction syllabus considers the principles of safe UA operations including:

(a) Ability to apply operational procedures (normal, contingency, and emergency procedures, flight planning, pre-flight and post-flight inspections).

(b) Ability to manage aeronautical communication.

(c) Manage the unmanned aircraft flight path and automation.

(d) Leadership, teamwork, and self-management.

(e) Problem solving and decision-making.

(f) Situational awareness.

(g) Workload management.

(h) Coordination or handover, as applicable.

SYLLABUS OF FLIGHT INSTRUCTION

Details of the flight instruction syllabus can be found in Appendix A. The syllabus details are intended to be used by an RAE(PC) when developing the RPC-L4 flight training elements of the appropriate course. It should be noted, however, that they do not provide a ready-made flight training syllabus for individual RAE(PC)s and should not be seen by organisations as a substitute for thorough course design.

The RPC-L4(A) flight instruction syllabus should consider the principles of threat and error management and **must** be competency-based training throughout.

THEORETICAL KNOWLEDGE TOPICS

In the tables of Appendix B, the applicable learning objectives (LOs) for each certificate are marked with an 'X'.

An RAE(PC) should use the LOs when developing the theoretical knowledge elements of the appropriate course. But the LOs do not provide a ready-made ground training syllabus for individual RAE(PC)s and an RAE(PC) should not rely on the LOs as a substitute for thorough course design.

THEORETICAL KNOWLEDGE ASSESSMENT

An RPC-L4(A) trainee **must** demonstrate a level of knowledge appropriate to the privileges granted in the following subjects:

(a) International Air Law.
(b) IFR Navigation.
(c) IFR Operational procedures.

PRACTICAL FLIGHT ASSESSMENT GENERAL

(a) A trainee for a practical flight assessment for the RPC-L4(A) **must** have received instruction on the same category and type of UAS to be used in the assessment.

(b) An RPC-L4(A) trainee **must** pass all the relevant sections of the practical flight assessment, in accordance with the following:
   (1) If a trainee fails any item in a section, they have failed that section.
   (2) If a trainee fails only one section, they must retake only that section.
   (3) If a trainee fails more than one section, they must retake the entire practical flight assessment.
   (4) If a trainee fails any section of the retaken practical flight assessment, including any section that was passed on a previous attempt, they must retake the entire practical flight assessment.

(c) All relevant sections of the practical flight assessment **must** be completed within 6 months of the date on which the trainee attempted the first section of the practical flight assessment.

(d) If a trainee fails any individual section of the practical flight assessment, the RAE(PC) may require them to undertake further training. If a trainee fails to achieve a pass in all sections of the practical flight assessment in two attempts, they **must** undertake further training.

(e) There is no limit to the number of practical flight assessments that a trainee may attempt.

CONDUCT OF THE ASSESSMENT

(a) Should the trainee choose to terminate a practical flight assessment for reasons considered inadequate by the PFA, the trainee **must** retake the entire practical flight assessment. If the assessment is terminated for reasons considered adequate by the PFA, only those sections not completed **must** be tested in a further flight. Adequate reasons include, but are not limited to, illness, poor weather conditions, equipment failure, and other risks to persons or property.

(b) At the discretion of the PFA, any manoeuvre or procedure of the assessment may be repeated once by the trainee. The PFA may stop the assessment at any stage if they consider that the trainee’s demonstration of flying skills requires a complete retest.

(c) A trainee **must** indicate to the PFA the checks and duties carried out. Checks **must** be completed in accordance with the checklist for the UA on which the assessment is being taken. During pre-flight preparation for the assessment, the trainee **must** configure the command unit (CU).

(d) The PFA **must** take no part in the operation of the UA except where intervention is necessary in the interest of safety.

CONTENT OF THE PRACTICAL FLIGHT ASSESSMENT FOR THE ISSUE OF AN RPC-L4(A)

(a) The UAS used for the practical flight assessment **must** meet the requirements for training UAS as set out in the relevant CAA publication.

(b) The practical flight assessment **must** comprise of a practical flight assessment conducted in ARC-d airspace.

(c) Every section of the practical flight assessment must assess the use of checklists, situational awareness, control of the UA either manually or by use of the CU, and principles of risk management.

RPC-L4(A) PRIVILEGES AND CONDITIONS

(a) **Privileges.** The privileges of the holders of an RPC-L4(A) are to act as remote pilot in command or flight crew of a UA where all of the following apply:

(1) The flight is being undertaken in the Specific category.

(2) The primary means of lift of the UA is fixed wing(s).

(3) The maximum air risk class (ARC) of the flight is ARC-d.

(4) The operational authorisation under which the flight is being conducted states the RPC-L4(A) is the minimum remote pilot competence.

(b) **Conditions.**

(1) The remote pilot maintains a minimum certificate currency of 2 hours of live flight within the last 90 days.

(2) The remote pilot holds a valid flyer ID.

RPC-L4(A) EXPERIENCE REQUIREMENTS AND CREDITING

Experience Requirements. An RPC-L4(A) trainee **must** be able to demonstrate that they meet both flight experience requirements below:

(a) at least 28 hours of instruction completed, which **must** include:

(1) 14 hours of beyond visual line of sight dual flight simulator instruction, and

(2) 14 hours of beyond visual line of sight dual practical flight instruction; and

(b) at least 100 hours of logged live BVLOS flight in total as RP in command, which may include live practical flight instruction undertaken during this training course, or a previous RPC training course.

Crediting. Trainees for the RPC-L4(A) that hold valid RPC-L4 in another category may be credited towards the requirements in (1)(a) subject to completion of a suitable bridging course at a CAA approved RAE(PC).

RPC-L4(A) VALIDITY, REVALIDATION AND RENEWAL

(a) **Validity.** An RPC-L4(A) is valid for 1 year from the date notified on the certificate.

(b) **Revalidation.** An RPC-L4(A) may be revalidated within the 3 months immediately preceding its expiry date if the remote pilot undertakes a revalidation proficiency check at an RAE(PC).

(c) The RAE(PC) **must** determine on a case-by-case basis what steps the revalidation proficiency check requires, having regard to the remote pilot's certificate currency, experience, flight logs, last use of RPC privileges and any other relevant factors.

(d) An RAE(PC) should exempt a remote pilot from a live revalidation check where:

(1) the remote pilot has maintained at least minimum certificate currency for the complete duration of the certificate validity period; and

(2) the remote pilot demonstrate certificate currency has been maintained through a personal flight log.

(e) An RAE(PC) may exempt a remote pilot from a live revalidation check where certificate currency has not been maintained in accordance with (d) if the RAE(PC) is satisfied that an exemption is appropriate, having regard in particular to:

(1) the remote pilot's experience; and

(2) the amount of time elapsed since the date on which the remote pilot last used privileges of the RPC-L4(A).

(f) The remote pilot **must** undertake a revalidation proficiency check consisting of at least 1 hour of supervised flying covering general handling and emergency procedures where the RAE(PC) considers this to be necessary.

(g) If a remote pilot chooses to fulfil the revalidation requirements earlier than prescribed in point (b), the new 1-year validity period will be set by reference to the date of the successful revalidation proficiency check.

(h) A remote pilot who fails to revalidate their RPC-L4(A) before it expires **must not** exercise any RPC-L4(A) privileges unless they renew their RPC-L4(A)in accordance with the provisions below.

(i) **Renewal**. If an RPC-L4(A) has expired, a remote pilot may renew their privileges, by complying with all the following requirements:

(1) The remote pilot **must** complete a refresher training at an RAE(PC), if the RAE(PC) considers that refresher training is necessary for the remote pilot to reach the level of proficiency needed to pass an RPC-L4(A) proficiency check.

(2) The remote pilot **must** pass an RPC-L4(A) proficiency check at an RAE(PC), including any theoretical knowledge or practical skills checks the RAE(PC) considers necessary.

(j) The RAE(PC) must determine on a case-by-case basis what amount of refresher training and what theoretical and practical skills checks are necessary to assess a remote pilot's RPC-L4(A) proficiency, having regard in particular to:

(1) the experience of the remote pilot; and

(2) the amount of time elapsed since the remote pilot last used the privileges of the RPC-L4(A); and

(3) the complexity of the remote pilot's experience.

RPC-L4(A) PROOF OF COMPETENCE

Upon satisfactory completion of the training the RAE(PC) will advise the CAA as to the competencies demonstrated by remote pilots which must include as a minimum the trainee’s name, CAA flyer ID, the RAE(PC) approval number, the competence level, and category satisfactorily demonstrated.

The RAE(PC) must issue a proof of competence to the RP in a form and manner determined by the CAA.

RPC-L4(R) Rotorcraft

GROUND INSTRUCTION

Ground instruction considering take-off and landing area selection, aircraft preparation, ground hazard analysis, route planning, avoidance of uninvolved people, and airspace.

FLIGHT INSTRUCTION

The RPC-L4(R) flight instruction syllabus considers the principles safe UA operations including:

(a) Ability to apply operational procedures (normal, contingency, and emergency procedures, flight planning, pre-flight and post-flight inspections).

(b) Ability to manage aeronautical communication.

(c) Manage the unmanned aircraft flight path and automation.

(d) Leadership, teamwork, and self-management.

(e) Problem solving and decision-making.

(f) Situational awareness.

(g) Workload management.

(h) Coordination or handover, as applicable.

SYLLABUS OF FLIGHT INSTRUCTION

Details of the flight instruction syllabus can be found in Appendix A. The syllabus details are intended to be used by an RAE(PC) when developing the RPC-L4 flight training elements of the appropriate course. It should be noted, however, that they do not provide a ready-made flight training syllabus for individual RAE(PC)s and should not be seen by organisations as a substitute for thorough course design.

The RPC-L4(R) flight instruction syllabus should consider the principles of threat and error management and **must** be competency-based training throughout.

THEORETICAL KNOWLEDGE TOPICS

In the tables of Appendix B, the applicable learning objectives (LOs) for each certificate are marked with an 'X'.

An RAE(PC) should use the LOs when developing the theoretical knowledge elements of the appropriate course. But the LOs do not provide a ready-made ground training syllabus for individual RAE(PC)s and an RAE(PC) should not rely on the LOs as a substitute for thorough course design.

THEORETICAL KNOWLEDGE ASSESSMENT

An RPC-L4(R) trainee **must** demonstrate a level of knowledge appropriate to the privileges granted in the following subjects:

(a) International Air Law.
(b) IFR Navigation.
(c) IFR Operational procedures.

PRACTICAL FLIGHT ASSESSMENT GENERAL

(a) A trainee for a practical flight assessment for the RPC-L4(R) **must** have received instruction on the same category and type of UAS to be used in the assessment.

(b) A trainee **must** pass all the relevant sections of the practical flight assessment, in accordance with the following:
(1) If a trainee fails any item in a section, they have failed that section.
(2) If a trainee fails only one section, they must retake only that section.
(3) If a trainee fails more than one section, they must retake the entire practical flight assessment.
(4) If a trainee fails any section of the retaken practical flight assessment, including any section that was passed on a previous attempt, they must retake the entire practical flight assessment.

(c) All relevant sections of the practical flight assessment **must** be completed within 6 months of the date on which the trainee attempted the first section of the practical flight assessment.

(d) If a trainee fails any individual section of the practical flight assessment, the RAE(PC) may require them to undertake further training. If a trainee fails to achieve a pass in all sections of the practical flight assessment in two attempts, they **must** undertake further training.

(e) There is no limit to the number of practical flight assessments that a trainee may attempt.

CONDUCT OF THE ASSESSMENT

(a) Should the trainee choose to terminate a practical flight assessment for reasons considered inadequate by the PFA, the trainee **must** retake the entire practical flight assessment. If the assessment is terminated for reasons considered adequate by the PFA, only those sections not completed **must** be tested in a further flight. Adequate reasons include, but are not limited to, illness, poor weather conditions, equipment failure, and other risks to persons or property.

(b) At the discretion of the PFA, any manoeuvre or procedure of the assessment may be repeated once by the trainee. The PFA may stop the assessment at any stage if they consider that the trainee’s demonstration of flying skills requires a complete retest.

(c) A trainee **must** indicate to the PFA the checks and duties carried out. Checks **must** be completed in accordance with the checklist for the UA on which the assessment is being taken. During pre-flight preparation for the assessment, the trainee **must** configure the command unit (CU).

(d) The PFA **must** take no part in the operation of the UA except where intervention is necessary in the interest of safety.

CONTENT OF THE PRACTICAL FLIGHT ASSESSMENT FOR THE ISSUE OF AN RPC-L4(R)

(a) The UAS used for the practical flight assessment **must** meet the requirements for training UAS as set out in the relevant CAA publication.

(b) The practical flight assessment **must** comprise of a practical flight assessment lasting at least 1 hour conducted in ARC-d conditions departing from and returning to a licenced aerodrome.

(c) Every section of the practical flight assessment must assess the use of checklists, situational awareness, control of the UA either manually or by use of the CU, and principles of risk management.

RPC-L4(R) PRIVILEGES AND CONDITIONS

(a) **Privileges.** The privileges of the holders of an RPC-L4(R) are to act as remote pilot in command or flight crew of a UA where all of the following apply:
  (1) The flight is being undertaken in the Specific Category.
  (2) The primary means of lift of the UA is rotating wing(s).
  (3) The maximum air risk class (ARC) of the flight is ARC-d.
  (4) The operational authorisation under which the flight is being conducted states the RPC-L4(R) is the minimum remote pilot competence.

(b) **Conditions.**
  (1) The remote pilot maintains a minimum certificate currency of 2 hours of live flight within the last 90 days.
  (2) The remote pilot holds a valid flyer ID.

RPC-L4(R) EXPERIENCE REQUIREMENTS AND CREDITING

Experience Requirements. An RPC-L4(R) trainee **must** be able to demonstrate that they meet both flight experience requirements below:

(a) at least 28 hours of instruction completed, which **must** include:
  (1) 14 hours of beyond visual line of sight dual flight simulator instruction, and
  (2) 14 hours of beyond visual line of sight dual practical flight instruction; and

(b) at least 100 hours of logged live BVLOS flight in total as RP in command, which may include live practical flight instruction undertaken during this training course, or a previous RPC training course.

Crediting. An RPC-L4(R) trainee that holds a valid RPC-L4 in another category may be credited towards the requirements in (1)(a) subject to completion of a suitable bridging course at a CAA approved RAE(PC).

RPC-L4(R) VALIDITY, REVALIDATION AND RENEWAL

(a) **Validity.** An RPC-L4(R) is valid for 1 year from the date notified on the certificate.

(b) **Revalidation.** An RPC-L4(R) may be revalidated within the 3 months immediately preceding its expiry date if the remote pilot undertakes a revalidation proficiency check at an RAE(PC).

(c) The RAE(PC) **must** determine on a case-by-case basis what steps the revalidation proficiency check requires, having regard to the remote pilot's certificate currency, experience, flight logs, last use of RPC privileges and any other relevant factors.

(d) An RAE(PC) should exempt a remote pilot from a live revalidation check where:

(1) the remote pilot has maintained at least minimum certificate currency for the complete duration of the certificate validity period; and

(2) the remote pilot demonstrate certificate currency has been maintained through a personal flight log.

(e) An RAE(PC) may exempt a remote pilot from a live revalidation check where certificate currency has not been maintained in accordance with (d) if the RAE(PC) is satisfied that an exemption is appropriate, having regard in particular to:

(1) the remote pilot's experience; and

(2) the amount of time elapsed since the date on which the remote pilot last used privileges of the RPC-L4(R).

(f) The remote pilot **must** undertake a revalidation proficiency check consisting of at least 1 hour of supervised flying covering general handling and emergency procedures where the RAE(PC) considers this to be necessary.

(g) If a remote pilot chooses to fulfil the revalidation requirements earlier than prescribed in point (b), the new 1-year validity period will be set by reference to the date of the successful revalidation proficiency check.

(h) A remote pilot who fails to revalidate their RPC-L4(R) before it expires **must not** exercise any RPC-L4(R)privileges unless they renew their RPC-L4(R) in accordance with the provisions below.

(i) **Renewal**. If an RPC-L4(R) has expired, a remote pilot may renew their privileges, by complying with all the following requirements:

(1) The remote pilot **must** complete a refresher training at an RAE(PC), if the RAE(PC) considers that refresher training is necessary for the remote pilot to reach the level of proficiency needed to pass an RPC-L4(R) proficiency check.

(2) The remote pilot **must** pass an RPC-L4(R) proficiency check at an RAE(PC), including any theoretical knowledge or practical skills checks the RAE(PC) considers necessary.

(j) The RAE(PC) must determine on a case-by-case basis what amount of refresher training and what theoretical and practical skills checks are necessary to assess a remote pilot's RPC-L4(R) proficiency, having regard in particular to:

(1) the experience of the remote pilot; and

(2) the amount of time elapsed since the remote pilot last used the privileges of the RPC-L4(R); and

(3) the complexity of the remote pilot's experience.

RPC-L4(R) PROOF OF COMPETENCE

Upon satisfactory completion of the training the RAE(PC) will advise the CAA as to the competencies demonstrated by remote pilots which must include as a minimum the trainee's name, CAA flyer ID, the RAE(PC) approval number, the competence level, and category satisfactorily demonstrated.

The RAE(PC) must issue a proof of competence to the RP in a form and manner determined by the CAA.

Appendix A – Flight Instruction

The LOs in this appendix are intended to be used by an RAE(PC) when developing the simulated and practical training events of the appropriate course. It should be noted, however, that the LOs do not provide a ready-made flight training syllabus for individual RAE(PC)s and should not be seen by organisations as a substitute for thorough course design.

FLIGHT INSTRUCTION – RPC-L1

To be defined by the RAE(PC) through course design.

FLIGHT INSTRUCTION – RPC-L2

Ref	ARC	Learning Objectives (LO)	Sim	Live
FAM-1	**All**	**CU Familiarisation**		
		Introduce the UAS Command Unit		X
		Introduce flight planning		X
GH-S1	**All**	**Start Up Procedures**		
		Practice CU set-up		X
		Consolidate performance planning		X
		Introduce automation handling		X
		Introduce flight briefing		X
		Introduce pre-start / start procedures		X
		Introduce shutdown		X
GH-1	**All**	**Aircraft Preparation**		
		Introduce walk around		X
		Introduce refuelling		X
GH-S2	**All**	**Flight Preparation Procedures**		
		Consolidate Flight Planning		X
		Consolidate Flight Briefing		X
		Consolidate CU setup procedures		X
		Consolidate Startup procedures		X
		Consolidate emergency procedures		X
		Introduce pre-take off procedures		X
GH-S3	**A**	**Introduce Take-off**		
		Introduce take-off procedures		X
		Introduce basic automation management		X
GH-L2	**A**	**Consolidate Start-up, Taxi, Take-off**		
		Consolidate GH-S1, GH-S2, and GH-S3		X
		Observe landing and shutdown		X
		Introduce C2 link emergencies		X
GH-S4	**A**	**Introduce Landing**		
		TOAL site approaches		X
		Landing procedures		X
AM-1	**A**	**Automation Management**		
		Basic automation handling		X
		Introduce high/low speed flight awareness		X

Ref	ARC	Learning Objectives (LO)	Sim	Live
		Introduce climbs and descents		X
EP-S1	**A**	**Emergency Procedures**		
		Introduce basic EP management	X	
		Introduce startup emergencies	X	
		Introduce engine emergency procedures	X	
		Introduce C2 link emergencies	X	
		Automation and sensor Failures	X	
		Introduce automation / FCA / Pitot Static failures	X	
		Introduce low visibility operations	X	

FLIGHT INSTRUCTION – RPC-L3

Ref	ARC	Learning Objectives	Sim	Live
FAM-1	**All**	**CU Familiarisation**		
		Introduce the UAS Command Unit (CU)	X	
		Introduce flight planning	X	
		Introduce performance planning	X	
GH-S1	**All**	**Start-up Procedures**		
		Practice CU set-up	X	
		Consolidate performance planning	X	
		Introduce automation handling	X	
		Introduce flight briefing	X	
		Introduce pre-start & start procedures	X	
		Introduce shutdown procedures	X	
EP-1	**All**	**Emergency Procedures**		
		Introduce basic EP management	X	
		Introduce startup emergencies	X	
GH-L1	**All**	**Aircraft Preparation**		
		Introduce walk around		X
		Introduce refuelling		X
GH-S2	**All**	**Taxi and Positioning Procedures**		
		Consolidate Flight Planning	X	
		Consolidate Flight Briefing	X	
		Consolidate CU setup procedures	X	
		Consolidate startup procedures	X	
		Consolidate emergency procedures	X	
		Introduce pre-take off procedures	X	
GH-S3	**C**	**Introduce Take-off and Departure**		
		Consolidate taxi and positioning	X	
		Introduce take-off procedures	X	
		Introduce departure procedures	X	
		Introduce basic automation management	X	
EP-2	**C**	**Consolidate Emergency Procedures**		
		Consolidate EP-1	X	
		Introduce engine emergency procedures	X	
GH-L2	**C**	**Consolidate Start-up, Taxi, Take-off**		
		Consolidate GH-S1, GH-S2, and GH-S3		X
		Observe landing and shutdown		X

Ref	ARC	Learning Objectives	Sim	Live
EP-S3	**C**	**Consolidate Emergency Procedures**		
		Consolidate EP-1 and EP-2	X	
		Introduce C2 link emergencies	X	
GH-S4	**C**	**Introduce Landing**		
		Introduce circuits to land	X	
		Straight-in approaches	X	
		Circuits with visual traffic	X	
GH-S5	**C**	**Consolidate Circuits to Land**		
		Introduce airfield recovery	X	
		Consolidate circuits to land	X	
GH-L3	**C**	**Consolidate Circuits**		
		Consolidate Circuits - dual		X
GH-L4	**C**	**Consolidate Circuits**		
		Solo circuits		X
GH-S6	**C**	**Consolidate Automation Management**		
		Basic automation handling	X	
		Introduce high/low speed flight awareness	X	
		Consolidate engine failure	X	
		Introduce climbs and descents	X	
GH-L5	**C**	**Introduce General Handling**		
		General handling exercises		X
GH-L6	**C**	**General Handling**		
		Consolidate handling		X
EP-S4	**C**	**Consolidate Emergency Procedures**		
		Automation and sensor Failures	X	
		Introduce automation / FCA / Pitot Static failures	X	
		Introduce low visibility operations	X	
GH-S7	**C**	**Introduce Threat Management**		
		Consolidate automation management	X	
		Introduce threat management - weather	X	
		Introduce IMC flight	X	
		Consolidate recovery	X	
GH-S8	**C**	**Introduce Traffic Avoidance**		
		Introduction to DAA systems	X	
		Introduction to airspace transits	X	
EP-S5	**C**	**Consolidate Emergency Procedures**		
		Consolidate EP-S3 and EP-S4	X	
		Introduce electrical system failures	X	
GH-S9	**C**	**Consolidate Traffic Avoidance**		
		Consolidate traffic avoidance	X	
		Consolidate departure	X	
ST-L1	**C**	**Phase 1 GH Practical Flight Assessment**		
		Practical flight assessment evaluation		X
GH-L7	**C**	**Consolidate Departure and Transit**		
		Solo departure, transit, and GH		X
GH-L8	**C**	**Introduce Remote Departure Procedures**		

Ref	ARC	Learning Objectives	Sim	Live
		Consolidate departure and transit		X
		Introduce departure remote aerodrome		X
GH-L9	**C**	**Consolidate Remote Departure Procedures**		
		Departure, transit, and land at remote aerodrome		X
		Departure remote aerodrome and return to base		X
ST-L2	**C**	**Phase 2 Cross Country Practical Flight Assessment**		
		Cross Country Practical flight assessment		X
ST-EP	**C**	**Phase 4 Emergency Procedures Assessment**		
		Emergency Procedures Assessment	X	

FLIGHT INSTRUCTION – RPC-L4

Ref	ARC	Learning Objectives	Sim	Live
IFR-S1	**D**	**Introduce IFR Departure and Transit**		
		Introduce IFR workflow	X	
		Introduce ANSP coordination	X	
IFR-S2	**D**	**Standard Instrument Departures and Arrivals**		
		Consolidate IFR workflow	X	
		Introduce SIDs and STARs	X	
IFR-S3	**D**	**Enroute IFR Procedures**		
		Introduce en-route holding	X	
		Consolidate SIDs and STARs	X	
IFR-S4	**D**	**Holding Procedures**		
		Introduce terminal aera holds	X	
IFR-S5	**D**	**Instrument Approaches to Specified Minima**		
		Consolidate IFR-S2, IFR-S3, and IFR-S4	X	
IFR-S6	**D**	**Missed Approach Procedures**		
		Go around procedures		
IFR-L1	**D**	**IFR Departure**		
		IFR Departure – Dual		X
		IFR Exercises		X
IFR-L2	**D**	**IFR Instrument Departure**		
		SID exercises		X
IFR-L3	**D**	**IFR Holds**		
		Holds and IFR exercises		X
IFR-L4	**D**	**IFR Exercises**		
		Holds into approaches		X
IFR-L5	**D**	**IFR Exercises Dual**		
		Dual departure, hold and recovery		X
IFR-L6	**D**	**IFR Exercises Solo**		
		Solo departure, hold, and recovery		X
IFR-ST	**D**	**IFR Practical Flight Assessment**		

Appendix B – Theorical Knowledge Topics

AIR LAW

Syllabus Reference	Syllabus Details and Associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
LAW.SPEC.00.00	**Air Law**									
LAW.SPEC.01.00	**UK UAS Regulations**									
LAW.SPEC.01.01	Demonstrate an understanding of the UK Regulation (EU) 2019/947.	X	X	X						
LAW.SPEC.01.02	Demonstrate an understanding of the Acceptable Means of Compliance to UK Regulation (EU) 2019/947.	X	X	X						
LAW.SPEC.01.03	Demonstrate an understanding of other relevant CAA supporting documents and polices.	X	X	X						
LAW.SPEC.01.04	Describe the requirements of article 8 in relation to remote pilot competence. **Source: UK Regulation (EU) 2019/947 Art 8.**						X	X		
LAW.SPEC.01.05	State the privileges of each of the remote pilot competence certificates in the Specific category. **Source: UK Regulation (EU) 2019/947 Art 8.**						X	X		
LAW.SPEC.01.06	Describe the responsibilities of a remote pilot in accordance with UAS.SPEC.050. **Source: UAS.SPEC.050**						X	X		
LAW.SPEC.01.07	Describe the responsibilities of a UAS operator in accordance with UAS.SPEC.060. **Source: UAS.SPEC.060**						X	X		
LAW.SPEC.01.08	Explain key differences between these responsibilities.						X	X		
LAW.SPEC.02.00	**UK National UAS Regulations - The Air Navigation Order**									
LAW.SPEC.02.01	Demonstrate awareness of the UK Air Navigation Order including residual articles relevant to UAS operations.	X	X	X						
LAW.SPEC.02.02	Describe the relationship between the ANO and UK Regulation (EU) 2019/947.						X	X		
LAW.SPEC.02.03	Describe how article 23 of the ANO limits the scope of the order in relation to UAS operations.						X	X		
LAW.SPEC.02.04	Describe the residual articles of the ANO that remain in scope of the order.						X	X		
LAW.SPEC.03.00	**The issue of an Operational Authorisation**									

Syllabus Reference	Syllabus Details and Associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
LAW.SPEC.03.01	Demonstrate an understanding of an Operational Authorisation (OA) and how it describes the privileges and conditions it sets out.	X	X	X						
LAW.SPEC.04.00	**The Convention on International Civil Aviation (Chicago) — ICAO Doc 7300/9**									
LAW.SPEC.04.01	Explain the circumstances that led to the establishment of the Convention on International Civil Aviation, Chicago, 7 December 1944. **Source: ICAO Doc 7300/9 Preamble**						X	X		
LAW.SPEC.05.00	**The Standard European Rules of the Air (SERA)**									
LAW.SPEC.05.01	Reserved - Rights of Way.								X	X
LAW.SPEC.06.00	**Flightworthiness of UAS**									
LAW.SPEC.06.01	For use after the implementation of the UK SAIL mark for flightworthiness.						X	X		

OPERATIONAL PROCEDURES

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
OPS.SPEC.00.00	**Operational Procedures**									
OPS.SPEC.01.00	**Visual Line of Sight Procedures**									
OPS.SPEC.01.01	Describe specific airspace classifications and types.	X	X	X						
OPS.SPEC.01.02	Describe the UK airspace reservations such as: (a) Danger Areas (b) Restricted Areas (c) Prohibited areas	X	X	X						
OPS.SPEC.01.03	Demonstrate an understanding of official sources of information that support UAS operations.	X	X	X						
OPS.SPEC.01.04	Extract information from relevant aeronautical information sources.	X	X	X						
OPS.SPEC.01.05	Interpret information from aeronautical information sources for their applicability to UAS operations.	X	X	X						
OPS.SPEC.02.00	**Beyond Visual Line of Sight Procedures**									
OPS.SPEC.02.01	Demonstrate an understanding of coordination procedures with air traffic control (ATC) for BVLOS flights.				X	X				

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
OPS.SPEC.03.00	**BVLOS Flight Planning**									
OPS.SPEC.03.01	Describe the regulatory boundaries of BVLOS flight operations in terms of UK SORA (GRC, ARC, and Total SAIL).				X	X				
OPS.SPEC.04.00	**BVLOS Route Selection**									
OPS.SPEC.04.01	Describe the process of route optimisation considering factors such as terrain, obstacles, and populated areas.				X	X				
OPS.SPEC.05.00	**Waypoint Planning**									
OPS.SPEC.05.01	Describe the process to determine the position of waypoints along the chosen route.				X	X				
OPS.SPEC.05.02	Explain the need for precision navigation, obstacle avoidance, and compliance with airspace restrictions.				X	X				

UA GENERAL KNOWLEDGE

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
AGK.SPEC.00.00	**UA General Knowledge**									
AGK.SPEC.01.00	**SAIL Certification**									
AGK.SPEC.01.01	Reserved for future.									
AGK.SPEC.02.00	**Stress, Strain and Loads**									
AGK.SPEC.02.01	Explain how stress and strain are always present in a UA structure both when parked and during manoeuvring.						X	X		
AGK.SPEC.02.02	Describe the following types of loads that an unmanned aircraft may be subjected to, when they occur, and how a remote pilot may affect their magnitude: (a) static loads (b) dynamic loads (c) cyclic loads						X	X		
AGK.SPEC.02.03	Describe the areas typically prone to stress that should be given particular attention during a pre-flight inspection and highlight the limited visual cues of any deformation that may be evident.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
AGK.SPEC.03.00	**Fatigue and Corrosion**									
AGK.SPEC.03.01	Describe the effects of corrosion and how it can be visually identified by a remote pilot during the pre-flight inspection.						X	X		
AGK.SPEC.03.02	Describe the operating environments where the risk of corrosion is increased and how to minimise the effects of the environmental factors.						X	X		
AGK.SPEC.03.03	Explain fatigue, how it affects the useful life of an unmanned aircraft, and the effect of the following factors on the development of fatigue: (a) corrosion (b) number of cycles (c) type of flight manoeuvres (d) stress level						X	X		
AGK.SPEC.04.00	**UA Maintenance**									
AGK.SPEC.04.01	Reserved for future.									
AGK.SPEC.05.00	**Airframe**									
AGK.SPEC.05.01	Describe the following attachment methods used for unmanned aircraft parts and components: (a) riveting (b) welding (c) bolting (d) pinning (e) adhesives (bonding (f) screwing						X	X		
AGK.SPEC.05.02	Explain how the development of a faulty attachment between unmanned aircraft parts or components can be detected by a remote pilot during the pre-flight inspection.						X	X		
AGK.SPEC.06.00	**Composite and Other Materials**									
AGK.SPEC.06.01	Explain the principle of a composite material, and give examples of typical non-metallic materials used on unmanned aircraft: (a) carbon (b) glass fibre (c) Kevlar aramid						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
AGK.SPEC.06.02	State the advantages and disadvantages of composite materials compared with metal alloys by considering the following: (a) strength-to-weight ratio (b) capability to tailor the strength to the direction of the load (c) stiffness (d) electrical conductivity (lightning) (e) resistance to fatigue and corrosion (f) resistance to cost (g) discovering damage during a pre-flight inspection.						X	X		
AGK.SPEC.06.03	State that several types of materials are used on unmanned aircraft and that they are chosen based on type of structure or component and the required/desired material properties.						X	X		
AGK.SPEC.07.00	**Aeroplane: Wings, Tail Surfaces, and Control Surfaces**									
AGK.SPEC.07.01	Describe the different types of UA design and explain their advantages and disadvantages.						X	X		
AGK.SPEC.08.00	**Structural Components**									
AGK.SPEC.08.01	Describe the function of a wing spar and other critical structural components.						X	X		
AGK.SPEC.09.00	**Loads, Stresses and Aeroelastic Vibrations (flutter)**									
AGK.SPEC.09.01	Describe the vertical and horizontal loads on the ground and during normal flight.						X	X		
AGK.SPEC.10.00	**Rotorcraft Structural Aspects of Fight Controls**									
AGK.SPEC.10.01	List the functions of flight controls.						X	X		
AGK.SPEC.10.02	Explain why vertical and horizontal stabilisers may have different shapes and alignments.						X	X		
AGK.SPEC.11.00	**Structural Components, and Materials**									
AGK.SPEC.11.01	Describe the fatigue life and methods of checking for serviceability of the components and materials of flight and control surfaces.						X	X		
AGK.SPEC.12.00	**Loads, Stresses, and Aeroelastic Vibrations**									
AGK.SPEC.12.01	Describe the dangers and stresses regarding safety and serviceability in flight when the manufacturer’s design envelope is exceeded.						X	X		
AGK.SPEC.12.02	Explain that blade tracking is important both to minimise vibration and to help						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
	ensure uniformity of flow through the disc.									
AGK.SPEC.12.03	Describe the early indications and vibrations which are likely to be experienced when the main-rotor blades and tail rotor are out of balance or tracking, including the possible early indications due to possible fatigue and overload.						X	X		
AGK.SPEC.12.04	Explain how a vibration harmonic can be set up in other components which can lead to their early failure.						X	X		
AGK.SPEC.12.05	State the three planes of vibration measurement, i.e. vertical, lateral, fore and aft.						X	X		
AGK.SPEC.13.00	**Brakes**									
AGK.SPEC.13.01	Describe the basic operating principle of a disc brake.						X	X		
AGK.SPEC.13.02	Explain the limitation of brake energy and describe the operational. consequences.						X	X		
AGK.SPEC.13.03	Explain how brakes are actuated: hydraulically, electrically, or mechanically						X	X		
AGK.SPEC.13.04	Describe the function of a parking brake.						X	X		
AGK.SPEC.14.00	**Flight Controls**									
AGK.SPEC.14.01	Define a ‘primary flight control’ in the context of a UA.	X	X	X						
AGK.SPEC.14.02	List the following primary flight control surfaces elevator, aileron, roll spoilers, flaperon and rudder.	X	X	X						
AGK.SPEC.14.03	List the various means of control surface actuation.	X	X	X						
AGK.SPEC.15.00	**Rotorcraft Flight Controls**									
AGK.SPEC.15.01	Describe the following four axes of control operation, their operating principle, and their associated cockpit controls: (a) collective control (b) cyclic fore and aft (pitch axis) (c) cyclic lateral (roll axis) (d) yaw	X	X	X						
AGK.SPEC.15.02	Describe the swash plate or azimuth star control system including the following: (a) swash plate inputs (b) the function of the non-rotating swash plate (c) the function of the rotating swash plate (d) how swash plate tilt is achieved						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
	(e) swash plate pitch axis (f) swash plate roll axis (g) balancing of pitch/roll/collective inputs to the swash plate to equalise torsional loads on the blades									
AGK.SPEC.15.03	Describe how flight control is achieved in multirotor UA.	X	X	X						
AGK.SPEC.15.04	Describe how transition between vertical and horizontal flight is achieved in VTOL UA.	X	X	X						
AGK.SPEC.16.00	**Piston Engines**									
AGK.SPEC.16.01	State the types of fuel used by a piston engine and their associated limitations: (a) diesel (b) JET-A1 (for high-compression engines) (c) AVGAS						X	X		
AGK.SPEC.16.02	State the main characteristics of these fuels and give typical values regarding their flash points, freezing points and density.						X	X		
AGK.SPEC.17.00	**Design, Operation, System Components, Indications**									
AGK.SPEC.17.01	State the tasks of the fuel system.						X	X		
AGK.SPEC.17.02	Name the following main components of a fuel system, and state their location and their function: (a) lines (b) pumps (c) pressure valves (d) filter/strainer (e) tanks (f) vent system (g) fuel-quantity sensor; fuel-temperature sensor						X	X		
AGK.SPEC.17.03	Describe a gravity fuel feed system and a pressure feed fuel system.						X	X		
AGK.SPEC.17.04	Describe the construction of the different types of fuel tanks and state their advantages and disadvantages: (a) drum tank (b) bladder tank (c) integral tank						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
AGK.SPEC.17.05	Define the term ‘unusable fuel’.						X	X		
AGK.SPEC.17.06	List the following parameters that maybe monitored for the fuel system: (a) fuel quantity (low-level warning) (b) fuel temperature						X	X		
AGK.SPEC.18.00	**Turbine Engines**									
AGK.SPEC.18.01	State the types of fuel used by a gas turbine engine: (a) JET-A (b) JET-A1 (c) JET-B						X	X		
AGK.SPEC.18.02	State the main characteristics of these fuels and give typical values regarding their flash points, freezing points and density.						X	X		
AGK.SPEC.18.03	State the existence of additives for freezing.						X	X		
AGK.SPEC.19.00	**Design, operation, system components, indications**									
AGK.SPEC.19.01	Explain the function of the fuel system: (a) lines (b) pumps (c) pressure valves (d) filter/strainer (e) tanks (f) vent system (g) fuel-quantity sensor; fuel-temperature sensor						X	X		
AGK.SPEC.20.00	**Electrics**									
AGK.SPEC.20.01	Explain static electricity and describe the flying conditions where unmanned aircraft are most susceptible to build-up of static electricity.						X	X		
AGK.SPEC.20.02	Describe a static discharger and explain the following: (a) its purpose (b) typical locations (c) remote pilot’s role of observing it during pre-flight inspection						X	X		
AGK.SPEC.20.03	Explain why an unmanned aircraft must first be grounded before refuelling/defueling.						X	X		
AGK.SPEC.20.04	Explain the reason for electrical bonding.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
AGK.SPEC.21.00	**Direct Current (DC)**									
AGK.SPEC.21.01	Explain the term direct current (DC), and state that current can only flow in a closed circuit.	X	X	X						
AGK.SPEC.21.02	Explain the basic principles of conductivity and give examples of conductors, semiconductors, and insulators.	X	X	X						
AGK.SPEC.21.03	Describe the difference in use of the following mechanical switches and explain the difference in observing their state (e.g. ON/OFF), and why some switches are guarded: (a) toggle switch (b) rocker switch (c) pushbutton switch (d) rotary switch						X	X		
AGK.SPEC.21.04	Define voltage and current and state their unit of measurement.	X	X	X						
AGK.SPEC.21.05	Explain Ohm’s law in qualitative terms.	X	X	X						
AGK.SPEC.21.06	Explain the effect on total resistance when resistors are connected in series or in parallel.						X	X		
AGK.SPEC.21.07	State that resistances can have a positive or a negative temperature coefficient (PTC/NTC) and state their use.						X	X		
AGK.SPEC.21.08	Define electrical power and state the unit of measurement.	X	X	X						
AGK.SPEC.22.00	**Alternating Current (AC)**									
AGK.SPEC.22.01	Explain the term ‘alternating current’ (AC) and compare its use to DC regarding complexity.						X	X		
AGK.SPEC.22.02	Define the term ‘phase’, and explain the basic principle of single- phase and three-phase AC.						X	X		
AGK.SPEC.22.03	State that unmanned aircraft can use single-phase or three-phase AC.						X	X		
AGK.SPEC.22.04	Define frequency and state the unit of measurement.						X	X		
AGK.SPEC.22.05	Define ‘phase shift’ in qualitative terms.						X	X		
AGK.SPEC.23.00	**Electromagnetism**									
AGK.SPEC.23.01	State that an electrical current produces a magnetic field.						X	X		
AGK.SPEC.23.02	Describe how the strength of the magnetic field changes with the magnitude of the current.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
AGK.SPEC.23.03	Explain the purpose and the working principle of a solenoid.						X	X		
AGK.SPEC.23.04	Explain the purpose and the working principle of a relay.						X	X		
AGK.SPEC.23.05	Explain the principle of electromagnetic induction and how two electrical components or systems may affect each other through this principle.						X	X		
AGK.SPEC.24.00	**Circuit Protection**									
AGK.SPEC.24.01	Explain the working principle of a fuse and a circuit breaker.	X	X	X						
AGK.SPEC.24.02	Explain how a fuse is rated.	X	X	X			X	X		
AGK.SPEC.24.03	Describe how circuit breakers may be used to reset unmanned aircraft systems/computers in the event of system failure.						X	X		
AGK.SPEC.24.04	Explain a short circuit in practical terms using Ohm's Law, power and energy expressions highlighting the risk of fire due to power transfer and extreme energy dissipation.						X	X		
AGK.SPEC.24.05	Explain the risk of fire resulting from excessive heat in a circuit subjected to overcurrent.	X	X	X						
AGK.SPEC.24.06	Explain that overcurrent situations may be transient.									
AGK.SPEC.24.07	Explain the hazards of the use of incorrect fuse rating when replacing blown fuses.	X	X	X						
AGK.SPEC.25.00	**Semiconductors and Logic Circuits (Reserved)**									
AGK.SPEC.26.00	**Batteries**									
AGK.SPEC.26.01	State the functions of an unmanned aircraft battery.	X	X	X						
AGK.SPEC.26.02	Name the types of rechargeable batteries used in unmanned aircraft: (a) lithium-ion (b) lithium-polymer	X	X	X						
AGK.SPEC.26.03	Compare the different battery types with respect to: (a) load behaviour (b) charging characteristics (c) risk of thermal runaway	X	X	X						
AGK.SPEC.26.04	Explain the term 'cell voltage' and describe how a battery may consist of several cells that combined provide the desirable voltage and capacity.	X	X	X						
AGK.SPEC.26.05	Explain the difference between battery voltage and charging voltage.	X	X	X						
AGK.SPEC.26.06	Define the term 'capacity of batteries' and state the unit of measurement used.	X	X	X						

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
AGK.SPEC.26.07	State the effect of temperature on battery capacity and performance.	X	X	X						
AGK.SPEC.26.08	State that in the case of loss of all generated power (battery power only) the remaining electrical power is time limited.	X	X	X						
AGK.SPEC.26.09	Describe how to contain a battery thermal runaway highlighting how one cell can affect the neighbouring cells.	X	X	X						
AGK.SPEC.27.00	**DC Generation**									
AGK.SPEC.27.01	Describe the basic working principle of a simple DC generator or DC alternator.						X	X		
AGK.SPEC.27.02	Explain the principle of voltage control and why it is required.						X	X		
AGK.SPEC.27.03	Describe the basic operating principle of a starter generator and state its purpose.						X	X		
AGK.SPEC.28.00	**DC Distribution**									
AGK.SPEC.28.01	Describe a simple DC electrical system of an unmanned aircraft.	X	X	X						
AGK.SPEC.28.02	Give examples of DC consumers.	X	X	X						
AGK.SPEC.29.00	**Electrical Motors**									
AGK.SPEC.29.01	State that the purpose of an electrical motor is to convert electrical energy into mechanical energy.	X	X	X						
AGK.SPEC.29.02	Describe how electrical motors are rated for use in unmanned aircraft.	X	X	X						
AGK.SPEC.29.03	State that because of the similarity in design, a generator and an electrical motor may be combined into a starter generator.						X	X		
AGK.SPEC.30.00	**Operating Principle**									
AGK.SPEC.30.01	Describe how the torque of an electrical motor is determined by the supplied voltage and current, and the resulting magnetic fields within the motor.						X	X		
AGK.SPEC.31.00	**Components**									
AGK.SPEC.31.01	Name the following components of an electrical motor: rotor (rotating part of an electrical motor); stator (stationary part of an electrical motor).	X	X	X						
AGK.SPEC.32.00	**Piston Engines**									
AGK.SPEC.32.01	Define the following terms and expressions: (a) rpm (b) torque						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
	(c) manifold absolute pressure (MAP) (d) power output (e) specific fuel consumption (f) compression ratio, clearance volume, swept (displaced) volume, total volume									
AGK.SPEC.33.00	**Piston Engine: Design, Operation, Components**									
AGK.SPEC.33.01	Describe the basic operating principle of a piston engine: (a) crankcase (b) crankshaft (c) connecting rod (d) piston (e) piston pin (f) piston rings (g) cylinder (h) cylinder head (i) valves (j) valve springs (k) push rod (l) camshaft (m) rocker arm (n) camshaft gear (o) bearings						X	X		
AGK.SPEC.33.02	Name and identify the various types of engine design with regard to cylinder arrangement and their advantages/disadvantages’						X	X		
AGK.SPEC.33.03	Describe the differences between petrol and diesel engines with respect to: (a) means of ignition (b) maximum compression ratio (c) regulating air or mixture supply to the cylinder (d) pollution from the exhaust						X	X		
AGK.SPEC.34.00	**Fuel**									
AGK.SPEC.34.01	Name the type of fuel used for petrol engines including its colour (AVGAS); (a) 100 (green) (b) 100LL (blue)						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
AGK.SPEC.34.02	Name the type of fuel normally used for aviation diesel engines (JET-A1).						X	X		
AGK.SPEC.34.03	Define the term ‘octane rating’.						X	X		
AGK.SPEC.34.04	Define the term ‘detonation’ and describe the causes and effects of detonation for both petrol and diesel engines.						X	X		
AGK.SPEC.34.05	Define the term ‘pre-ignition’ and describe the causes and effects of pre-ignition for both petrol and diesel engines.						X	X		
AGK.SPEC.34.06	Identify the conditions and power settings that promote detonation for petrol engines.						X	X		
AGK.SPEC.34.07	Describe how detonation in petrol engines is recognised.						X	X		
AGK.SPEC.34.08	Describe the method and occasions for checking the fuel for water content.						X	X		
AGK.SPEC.34.09	State the typical value of fuel density for aviation gasoline and diesel fuel.						X	X		
AGK.SPEC.34.10	Explain volatility, viscosity and vapour locking in petrol and diesel fuels.						X	X		
AGK.SPEC.35.00	**Engine Fuel Pumps**									
AGK.SPEC.35.01	Describe common fuel pumps used in unmanned aircraft.						X	X		
AGK.SPEC.36.00	**Carburettor/Injection System**									
AGK.SPEC.36.01	State the purpose of a carburettor.						X	X		
AGK.SPEC.36.02	Explain the advantages and difference in operation of an injection system compared with a carburettor system.						X	X		
AGK.SPEC.37.00	**Icing**									
AGK.SPEC.37.01	Describe the causes and effects of carburettor icing.						X	X		
AGK.SPEC.37.02	Name the meteorological conditions under which carburettor icing may occur.						X	X		
AGK.SPEC.37.03	Describe the indications of the presence of carburettor icing for a rotorcraft.						X	X		
AGK.SPEC.37.04	Describe the indications that will occur upon selection of carburettor heat depending on whether ice is present or not.						X	X		
AGK.SPEC.37.05	Explain the reason for the use of alternate air on fuel injection systems and describe its operating principle.						X	X		
AGK.SPEC.37.06	State the meteorological conditions under which induction system icing may occur.						X	X		
AGK.SPEC.38.00	**Cooling Systems**									

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
AGK.SPEC.38.01	Specify the reasons for cooling a piston engine.						X	X		
AGK.SPEC.38.02	Describe the design features to enhance cylinder air cooling for aeroplanes.						X	X		
AGK.SPEC.38.03	Describe the design features to enhance cylinder air cooling for rotorcraft.						X	X		
AGK.SPEC.38.04	Compare the differences between liquid- and air-cooling systems.						X	X		
AGK.SPEC.39.00	**Lubrication Systems**									
AGK.SPEC.39.01	Describe the term 'viscosity' including the effect of temperature.						X	X		
AGK.SPEC.39.02	Describe the viscosity grade numbering system used in aviation.						X	X		
AGK.SPEC.39.03	Design, operation, indications, and warnings.						X	X		
AGK.SPEC.39.04	State the functions of a piston-engine lubrication system.						X	X		
AGK.SPEC.39.05	Describe the working principle of a dry-sump lubrication system and describe the functions of the following components: (a) oil tank (b) check valve (non-return valve). (c) pressure pump and pressure-relief valve. (d) scavenge pump (e) filters (f) oil cooler (g) oil cooler bypass valve (h) pressure and temperature sensors (i) lines						X	X		
AGK.SPEC.39.06	Describe a wet-sump lubrication system.						X	X		
AGK.SPEC.39.07	State the differences between a wet- and a dry-sump lubrication system and their advantages and disadvantages.						X	X		
AGK.SPEC.39.08	List the following factors that influence oil consumption: (a) oil grade (b) cylinder and piston wear; condition of piston rings						X	X		
AGK.SPEC.39.09	Describe the interaction between oil pressure, oil temperature and oil quantity.						X	X		
AGK.SPEC.40.00	**Ignition Circuits**									
AGK.SPEC.40.01	Describe the working principle of a magneto-ignition system and the functions of the following components:						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
	(a) magneto (b) contact-breaker points (c) capacitor (condenser) (d) coils or windings (e) ignition switches (f) distributor (g) spark plug (h) high-tension (HT) cable									
AGK.SPEC.40.02	State why piston engines maybe equipped with two electrically independent ignition systems.						X	X		
AGK.SPEC.40.03	Explain how combustion is initiated in diesel engines.						X	X		
AGK.SPEC.41.00	**Fuel and Air Mixture**									
AGK.SPEC.41.01	Define the term mixture.						X	X		
AGK.SPEC.41.02	State the typical fuel-to-air ratio values or range of values for the above mixtures.						X	X		
AGK.SPEC.41.03	Describe the advantages and disadvantages of weak and rich mixtures.						X	X		
AGK.SPEC.41.04	Describe the relation between engine-specific fuel consumption and mixture ratio.						X	X		
AGK.SPEC.42.00	**Aeroplane: Propellers**									
AGK.SPEC.42.01	Describe the operating principle of a fixed pitch propeller system	X	X							
AGK.SPEC.43.00	**Performance and Engine Handling**									
AGK.SPEC.43.01	Describe the effect on power output of a petrol and diesel engine taking into consideration the following parameters: (a) ambient pressure, exhaust back pressure (b) temperature (c) density altitude (d) humidity						X	X		
AGK.SPEC.44.00	**Engine Handling**									
AGK.SPEC.44.01	Define the following terms: (a) take-off power (b) maximum continuous power						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
AGK.SPEC.44.02	Describe the start problems associated with extreme cold weather.						X	X		
AGK.SPEC.45.00	**Turbine Engines**									
AGK.SPEC.45.01	Describe how thrust is produced by a basic gas turbine engine.						X	X		
AGK.SPEC.45.02	Describe how thrust is produced by a basic electric ducted fan (EDF) engine.						X	X		
AGK.SPEC.45.03	Describe the simple form of the thrust formula for a basic, straight jet engine and perform simple calculations (including pressure thrust).						X	X		
AGK.SPEC.46.00	**Design, Types and Components of Turbine Engines**									
AGK.SPEC.46.01	List the main components of a basic gas turbine engine: (a) inlet (b) compressor (c) combustion chamber (d) turbine (e) outlet						X	X		
AGK.SPEC.46.02	List the different types of gas turbine engines: (a) straight jet (b) turboprop						X	X		
AGK.SPEC.46.03	State that a gas turbine engine can have one or more spools.						X	X		
AGK.SPEC.46.04	Describe how thrust is produced by turbojet engines.						X	X		
AGK.SPEC.46.05	Describe how power is produced by turboprop engines.						X	X		
AGK.SPEC.47.00	**Aeroplane: Air Intake**									
AGK.SPEC.47.01	State the functions of the engine air inlet/air intake.						X	X		
AGK.SPEC.47.02	Describe the reasons for, and the dangers of, the following operational problems concerning the engine air inlet: (a) airflow separation (b) inlet icing (c) inlet damage (d) foreign object damage (FOD) (e) heavy in-flight turbulence						X	X		
AGK.SPEC.48.00	**Compressor and Diffuser**									
AGK.SPEC.48.01	State the purpose of the compressor.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
AGK.SPEC.48.02	Describe the working principle of a centrifugal and an axial flow compressor.						X	X		
AGK.SPEC.48.03	Name the following main components of a single stage and describe their function for a centrifugal compressor: (a) impeller (b) diffuser						X	X		
AGK.SPEC.48.04	Name the following main components of a single stage and describe their function for an axial compressor: (a) rotor vanes (b) stator vanes						X	X		
AGK.SPEC.48.05	Describe the gas-parameter changes in a compressor stage.						X	X		
AGK.SPEC.48.06	Define the term 'pressure ratio' and state a typical value for one stage of a centrifugal and an axial flow compressor and for the complete compressor.						X	X		
AGK.SPEC.48.07	State the advantages and disadvantages of increasing the number of stages in a centrifugal compressor.						X	X		
AGK.SPEC.48.08	Explain the difference in sensitivity for FOD of a centrifugal compressor compared with an axial flow type.						X	X		
AGK.SPEC.48.09	Explain the convergent air annulus through an axial flow compressor.						X	X		
AGK.SPEC.48.10	Describe the reason for twisting the compressor blades.						X	X		
AGK.SPEC.48.11	State the tasks of inlet guide vanes (IGVs).						X	X		
AGK.SPEC.48.12	State the advantages of increasing the number of spools.						X	X		
AGK.SPEC.48.13	Explain the implications of tip losses and describe the design features to minimise the problem.						X	X		
AGK.SPEC.48.14	Explain the problems of blade bending and flapping and describe the design features to minimise the problem.						X	X		
AGK.SPEC.48.15	Explain the following terms: (a) compressor stall (b) engine surge						X	X		
AGK.SPEC.48.16	State the conditions that are possible causes of stall and surge.						X	X		
AGK.SPEC.48.17	Describe the indications of stall and surge.						X	X		
AGK.SPEC.48.18	Describe the design features used to minimise the occurrence of stall and surge.						X	X		
AGK.SPEC.48.19	Describe a compressor map (surge envelope) with rpm lines, stall limit, steady						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
	state line and acceleration line.									
AGK.SPEC.48.20	Describe the function of the diffuser.						X	X		
AGK.SPEC.49.00	**Combustion Chamber**									
AGK.SPEC.49.01	Define the purpose of the combustion chamber.						X	X		
AGK.SPEC.49.02	List the requirements for combustion.						X	X		
AGK.SPEC.49.03	Describe the working principle of a combustion chamber.						X	X		
AGK.SPEC.49.04	Explain the reason for reducing the airflow axial velocity at the combustion chamber inlet (snout).						X	X		
AGK.SPEC.49.05	State the function of the swirl vanes (swirler).						X	X		
AGK.SPEC.49.06	State the function of the drain valves.						X	X		
AGK.SPEC.49.07	Define the terms ‘primary airflow’ and ‘secondary airflow’ and explain their purpose.						X	X		
AGK.SPEC.49.08	Explain the following two mixture ratios: (a) primary airflow to fuel (b) total airflow (within the combustion chamber) to fuel						X	X		
AGK.SPEC.49.09	Describe the gas-parameter changes in the combustion chamber.						X	X		
AGK.SPEC.49.10	State a typical maximum value of the outlet temperature of the combustion chamber.						X	X		
AGK.SPEC.49.11	Describe the following types of combustion chambers and state the differences between them: (a) can type (b) can-annular, cannular or turbo-annular (c) annular (d) reverse-flow annular						X	X		
AGK.SPEC.50.00	**Turbine**									
AGK.SPEC.50.01	Explain the purpose of a turbine in different types of gas turbine engines.						X	X		
AGK.SPEC.50.02	Describe the principles of operation of impulse, reaction, and impulse-reaction axial flow turbines.						X	X		
AGK.SPEC.50.03	Name the main components of a turbine stage and their function.						X	X		
AGK.SPEC.50.04	Describe the working principle of a turbine.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
AGK.SPEC.50.05	Describe the gas-parameter changes in a turbine stage.						X	X		
AGK.SPEC.50.06	Describe the function and the working principle of active clearance control.						X	X		
AGK.SPEC.50.07	Describe the implications of tip losses and the means to minimise them.						X	X		
AGK.SPEC.50.08	Explain why the available engine thrust is limited by the turbine inlet temperature.						X	X		
AGK.SPEC.50.09	Explain the divergent gas-flow annulus through an axial-flow turbine.						X	X		
AGK.SPEC.50.10	Explain the high mechanical thermal stress in the turbine blades and wheels/discs.						X	X		
AGK.SPEC.51.00	**Aeroplane: Exhaust**									
AGK.SPEC.51.01	Name the following main components of the exhaust unit and their function: (a) jet pipe (b) propelling nozzle (c) exhaust cone						X	X		
AGK.SPEC.51.02	Describe the working principle of the exhaust unit.						X	X		
AGK.SPEC.51.03	Describe the gas-parameter changes in the exhaust unit.						X	X		
AGK.SPEC.51.04	Define the term 'choked exhaust nozzle' (not applicable to turboprops).						X	X		
AGK.SPEC.51.05	Explain how jet exhaust noise can be reduced.						X	X		
AGK.SPEC.52.00	**Rotorcraft: Air Intake**									
AGK.SPEC.52.01	Name and explain the main task of the engine air intake.						X	X		
AGK.SPEC.52.02	Describe the use of a convergent air-intake ducting on rotorcrafts.						X	X		
AGK.SPEC.52.03	Describe the reasons for and the dangers of the following operational problems concerning engine air intake: (a) airflow separations (b) intake icing (c) intake damage (d) FOD						X	X		
AGK.SPEC.52.04	Describe the conditions and circumstances during ground operations when FOD is most likely to occur.						X	X		
AGK.SPEC.52.05	Describe and explain the principles of air intake filter systems that can be fitted to some rotorcrafts for operations in icing and sand conditions.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
AGK.SPEC.52.06	Describe the function of the heated pads on some rotorcraft air intakes.						X	X		
AGK.SPEC.53.00	**Rotorcraft: Exhaust**									
AGK.SPEC.53.01	Describe the working principle of the exhaust unit.						X	X		
AGK.SPEC.53.02	Describe the gas-parameter changes in the exhaust unit.						X	X		
AGK.SPEC.54.00	**Additional Components and Systems**									
AGK.SPEC.54.01	Name the main components of the engine fuel system and state their function: (a) filters (b) pump (c) fuel manifold (d) fuel nozzles (e) fuel control system						X	X		
AGK.SPEC.54.02	State the tasks of the fuel control unit.						X	X		
AGK.SPEC.54.03	List the possible input parameters to a fuel control unit to achieve a given thrust/power setting.						X	X		
AGK.SPEC.55.00	**Engine control system**									
AGK.SPEC.55.01	State the tasks of the engine control system.						X	X		
AGK.SPEC.56.00	**Engine lubrication**									
AGK.SPEC.56.01	State the tasks of an engine lubrication system.						X	X		
AGK.SPEC.56.02	Name the following main components of a lubrication system and state their function: (a) oil tank (b) oil pump (c) oil filters (d) oil sumps (e) chip detectors (f) coolers						X	X		
AGK.SPEC.57.00	**Engine Ignition**									
AGK.SPEC.57.01	State the task of the ignition system.						X	X		
AGK.SPEC.57.02	Name the following main components of the ignition system and state their function.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
AGK.SPEC.58.00	**Engine Starter**									
AGK.SPEC.58.01	Name the main components of the starting system and state their function.						X	X		
AGK.SPEC.58.02	Explain the principle of a turbine engine start.						X	X		
AGK.SPEC.58.03	Define 'self-sustaining rpm'.						X	X		
AGK.SPEC.59.00	**Rotorcraft specifics on design, operation and components for additional components and systems such as lubrication system, ignition circuit, starter, accessory gearbox**									
AGK.SPEC.59.01	State the task of the lubrication system.						X	X		
AGK.SPEC.59.02	List and describe the common rotorcraft lubrication systems.						X	X		
AGK.SPEC.59.03	Name the following main components of a rotorcraft lubrication system.						X	X		
AGK.SPEC.60.00	**Engine Operation and Monitoring**									
AGK.SPEC.60.01	Explain spool-up time.						X	X		
AGK.SPEC.60.02	State the parameters that can be used for setting and monitoring the thrust/power.						X	X		
AGK.SPEC.60.03	Explain how the exhaust gas temperature is used to monitor turbine stress.						X	X		
AGK.SPEC.60.04	Describe the possible effects on engine components when EGT limits are exceeded.						X	X		
AGK.SPEC.60.05	Explain why engine-limit exceedances must be reported.						X	X		
AGK.SPEC.60.06	Explain the term 'engine seizure'.						X	X		
AGK.SPEC.60.07	State the possible causes of engine seizure and explain their preventative measures.						X	X		
AGK.SPEC.60.08	Explain oil-filter clogging (blockage) and the implications for the lubrication system.						X	X		
AGK.SPEC.60.09	Give examples of monitoring instruments of an engine.						X	X		
AGK.SPEC.60.10	Describe how to identify and assess engine damage based on instrument indications.						X	X		
AGK.SPEC.61.00	**Relight Envelope**									
AGK.SPEC.61.01	Explain the relight envelope.						X	X		
AGK.SPEC.62.00	**Rotorcraft: Rotor-Heads**									

Syllabus Reference	Syllabus details and associated Learning Objectives	GV C	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
AGK.SPEC.62.01	Describe the following rotor-head system.						X	X		
AGK.SPEC.62.02	Describe in basic terms the following configuration of rotor systems and their advantages and disadvantages.						X	X		
AGK.SPEC.62.03	Explain how flapping, dragging and feathering is achieved in each rotor-head system.						X	X		
AGK.SPEC.63.00	**Structural Components and Materials, Stresses, Structural Limitations**									
AGK.SPEC.63.01	Identify from a diagram the main structural components of the main types of rotor-head systems.						X	X		
AGK.SPEC.64.00	**Design and Construction**									
AGK.SPEC.64.01	Describe the material technology used in rotor-head design, including construction, using the following materials or mixture of materials: (a) composites (b) fibreglass (c) alloys (d) elastomer						X	X		
AGK.SPEC.65.00	**Adjustment**									
AGK.SPEC.65.01	Describe and explain the methods of adjustment which are possible on various rotorcraft rotor-head assemblies.						X	X		
AGK.SPEC.66.00	**Tail Rotor Types**									
AGK.SPEC.66.01	Describe common tail-rotor systems used on UA.						X	X		
AGK.SPEC.66.02	Identify from a diagram the main structural components of common tail-rotor systems used on UA.						X	X		
AGK.SPEC.66.03	Explain pitch-input mechanisms.									
AGK.SPEC.66.04	Explain the relationship between tail-rotor thrust and engine power.						X	X		
AGK.SPEC.66.05	Describe how the vertical fin on some types reduces the power demand of the tail rotor.						X	X		
AGK.SPEC.67.00	**Design and Construction**									
AGK.SPEC.67.01	List and describe the various tail-rotor designs and construction methods used on rotorcrafts currently in service.						X	X		
AGK.SPEC.68.00	**Rotorcraft: Transmission**									

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
AGK.SPEC.68.01	Describe the following main principles of rotorcraft transmission systems used in UA.						X	X		
AGK.SPEC.69.00	**Rotor Brake**									
AGK.SPEC.69.01	Describe the main function of the disc type of rotor brake.						X	X		
AGK.SPEC.69.02	Describe the different options for the location of the rotor brake.						X	X		
AGK.SPEC.70.00	**Driveshaft and Associated Installation**									
AGK.SPEC.70.01	Describe how power is transmitted from the engine to the main- rotor gearbox.						X	X		
AGK.SPEC.70.02	Describe the material and construction of the driveshaft.						X	X		
AGK.SPEC.70.03	Explain the need for alignment between the engine and the main- rotor gearbox.						X	X		
AGK.SPEC.70.04	Identify how temporary misalignment occurs between driving and driven components.						X	X		
AGK.SPEC.70.05	Explain the relationship between driveshaft speed and torque.						X	X		
AGK.SPEC.70.06	Describe the methods with which power is delivered to the tail rotor.						X	X		
AGK.SPEC.71.00	**Intermediate and Tail Gearbox**									
AGK.SPEC.71.01	Explain and describe the various arrangements when the drive changes direction and the need for an intermediate or tail gearbox.						X	X		
AGK.SPEC.72.00	**Clutches**									
AGK.SPEC.72.01	Explain the purpose of a clutch.						X	X		
AGK.SPEC.72.02	Describe and explain the operation of a: (a) centrifugal clutch (b) actuated clutch						X	X		
AGK.SPEC.72.03	List the typical components of the various clutches.						X	X		
AGK.SPEC.73.00	**Rotorcraft: Blades**									
AGK.SPEC.73.01	Describe the different types of blade construction and the need for torsional stiffness.						X	X		
AGK.SPEC.73.02	Describe the fully articulated rotor with hinges and feathering hinges.						X	X		
AGK.SPEC.74.00	**Structural Components and Materials**									
AGK.SPEC.74.01	List the materials used in the construction of main-rotor blades.						X	X		
AGK.SPEC.74.02	List the main structural components of a main-rotor blade and their function.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
AGK.SPEC.74.03	Describe the drag hinge of the fully articulated rotor and the lag flexure in the hinge-less rotor.						X	X		
AGK.SPEC.75.00	**Forces and Stresses**									
AGK.SPEC.75.01	Describe main-rotor blade-loading on the ground and in flight.						X	X		
AGK.SPEC.75.02	Describe where the most common stress areas are on rotor blades.						X	X		
AGK.SPEC.76.00	**Structural Limitations**									
AGK.SPEC.76.01	Explain the structural limitations in terms of bending and rotor rpm.						X	X		
AGK.SPEC.77.00	**Adjustment**									
AGK.SPEC.77.01	Explain the use of trim tabs.						X	X		
AGK.SPEC.78.00	**Tip Shape**									
AGK.SPEC.78.01	Describe the various blade-tip shapes used by different manufacturers and compare their advantages and disadvantages.						X	X		
AGK.SPEC.79.00	**Lateral Vibrations**									
AGK.SPEC.79.01	Explain blade imbalances, causes, and effects.						X	X		
AGK.SPEC.80.00	**Tail-Rotor Design and Blade Design**									
AGK.SPEC.80.01	Describe the most common design of tail-rotor blade construction.						X	X		
AGK.SPEC.80.02	Describe the dangers to ground personnel and to the rotor blades, and how to minimise these dangers.						X	X		
AGK.SPEC.81.00	**Stresses, Vibrations and Balancing**									
AGK.SPEC.81.01	Describe the tail-rotor blade-loading on the ground and in flight.						X	X		
AGK.SPEC.81.02	Explain the sources of vibration of the tail rotor and the resulting high frequencies.						X	X		
AGK.SPEC.81.03	Explain balancing and tracking of the tail rotor.						X	X		
AGK.SPEC.82.00	**Structural Limitations**									
AGK.SPEC.82.01	Describe the structural limitations of the tail-rotor blades.						X	X		
AGK.SPEC.82.02	Describe the method of checking the strike indicators placed on the tip of some tail-rotor blades.						X	X		
AGK.SPEC.83.00	**Adjustment**									

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
AGK.SPEC.83.01	Describe the adjustment of yaw pedals in the cockpit to obtain full-control authority of the tail rotor.						X	X		

HUMAN PERFORMANCE AND LIMITATIONS

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
HPL.SPEC.00.00	**Human Performance and Limitations**									
HPL.SPEC.01.00	**Human Factors: Basic Concepts**									
HPL.SPEC.01.01	State that competence is based on knowledge, skills and attitudes of the individual remote pilot.	X	X	X						
HPL.SPEC.02.00	**Flight Safety Concepts**									
HPL.SPEC.02.01	Explain the three components of the TEM model.						X	X		
HPL.SPEC.02.02	Explain and give examples of latent threats.						X	X		
HPL.SPEC.02.03	Explain and give examples of environmental threats.						X	X		
HPL.SPEC.02.04	Explain and give examples of organisational threats.						X	X		
HPL.SPEC.02.05	Explain and give a definition of ‘error’ according to the TEM model of ICAO Doc 9683 (Part II, Chapter 2).						X	X		
HPL.SPEC.02.06	Give examples of different countermeasures which may be used to manage threats, errors, and undesired unmanned aircraft states.						X	X		
HPL.SPEC.02.07	Explain and give examples of procedural error, communication errors, and unmanned aircraft handling errors.						X	X		
HPL.SPEC.02.08	Explain and give examples of ‘undesired unmanned aircraft states’.						X	X		
HPL.SPEC.02.09	State the components of the SHELL model.						X	X		
HPL.SPEC.02.10	State the relevance of the SHELL model to the work in the flightdeck						X	X		
HPL.SPEC.03.00	**Safety Culture and Safety Management**									
HPL.SPEC.03.01	Distinguish between ‘open cultures’ and ‘closed cultures’.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
HPL.SPEC.03.02	Illustrate how safety culture is reflected in national culture.						X	X		
HPL.SPEC.03.03	Discuss the established expression 'safety first' in a commercial entity.						X	X		
HPL.SPEC.03.04	Explain James Reason's 'Swiss Cheese Model'.						X	X		
HPL.SPEC.03.05	State the important factors that promote a good safety culture.						X	X		
HPL.SPEC.03.06	Distinguish between 'just culture' and 'non-punitive culture'.						X	X		
HPL.SPEC.03.07	Name the five components which form safety culture (according to James Reason: informed culture, reporting culture, learning culture, just culture, flexible culture).						X	X		
HPL.SPEC.03.08	Name the basic concepts of safety management system (SMS) (including hazard identification and risk management) and its relationship with safety culture.						X	X		
HPL.SPEC.04.00	**The Sensory System**									
HPL.SPEC.04.01	List the different senses	X	X	X						
HPL.SPEC.05.00	**Central, Peripheral and Autonomic Nervous System**									
HPL.SPEC.05.01	Define the term 'sensory threshold'.						X	X		
HPL.SPEC.05.02	Define the term 'sensitivity', especially in the context of vision.						X	X		
HPL.SPEC.05.03	Give examples of sensory adaptation.						X	X		
HPL.SPEC.05.04	Define the term 'habituation' and state its implication for flight safety.						X	X		
HPL.SPEC.06.00	**Vision - Function**									
HPL.SPEC.06.01	Name the most important parts of the eye and the pathway to the visual cortex.						X	X		
HPL.SPEC.06.02	State the basic functions of the parts of the eye.	X	X	X						
HPL.SPEC.06.03	Define 'accommodation'.						X	X		
HPL.SPEC.06.04	Distinguish between the functions of the rod and cone cells.						X	X		
HPL.SPEC.06.05	Describe the distribution of rod and cone cells in the retina and explain their relevance to vision.						X	X		
HPL.SPEC.06.06	Explain the terms 'visual acuity', 'visual field', 'central vision', 'peripheral vision' and 'the fovea', and explain their function in the process of vision.						X	X		
HPL.SPEC.06.07	List the factors that may degrade visual acuity and the importance of 'lookout'.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
HPL.SPEC.06.08	State the limitations of night vision and the different scanning techniques at both night and day	X	X	X						
HPL.SPEC.06.09	State the time necessary for the eye to adapt both to bright light and the dark.						X	X		
HPL.SPEC.06.10	Reserved.									
HPL.SPEC.06.11	Explain the nature of colour blindness.						X	X		
HPL.SPEC.06.12	Distinguish between monocular and binocular vision.	X	X	X						
HPL.SPEC.06.13	Explain the basis of depth perception.	X	X	X						
HPL.SPEC.06.14	List the possible monocular cues for depth perception.						X	X		
HPL.SPEC.06.15	Explain long-sightedness, short-sightedness, and astigmatism.						X	X		
HPL.SPEC.06.16	List the causes of and the precautions that may be taken to reduce the probability of vision loss due to: (a) presbyopia (b) cataract (c) glaucoma						X	X		
HPL.SPEC.06.17	State the possible problems associated with contact lenses.						X	X		
HPL.SPEC.06.18	Explain the significance of the 'blind spot' on the retina in detecting other traffic in flight.	X	X	X						
HPL.SPEC.07.00	**Hearing**									
HPL.SPEC.07.01	Descriptive and functional anatomy.	X	X	X						
HPL.SPEC.07.02	State the basic parts and functions of the outer, the middle and the inner ear.	X	X	X						
HPL.SPEC.07.03	Differentiate between the functions of the vestibular apparatus and the cochlea in the inner ear.						X	X		
HPL.SPEC.07.04	Define the main causes of the following hearing defects/loss: — conductive deafness — noise-induced hearing loss — presbycusis						X	X		
HPL.SPEC.07.05	Summarise the effects of environmental noise on hearing.						X	X		
HPL.SPEC.07.06	State the decibel level of received noise that will cause NIHL.						X	X		
HPL.SPEC.07.07	Identify the potential occupational risks that may cause hearing loss.						X	X		
HPL.SPEC.07.08	List the main sources of hearing loss in the unmanned flying environment.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
HPL.SPEC.07.09	List the precautions that may be taken to reduce the probability of onset of hearing loss.						X	X		
HPL.SPEC.08.00	**Integration of Sensory Inputs**									
HPL.SPEC.08.01	Define the term ‘illusion’.	X	X	X						
HPL.SPEC.08.02	Give examples of visual illusions based on shape constancy, size constancy, aerial perspective, atmospheric perspective, the absence of focal or ambient cues, autokinesis, vectional false horizons, field myopia, and surface planes.	X	X	X						
HPL.SPEC.09.00	**Body Rhythm and Sleep**									
HPL.SPEC.09.01	Name some internal body rhythms and their relevance to sleep. Explain that the most important of which is body temperature.						X	X		
HPL.SPEC.09.02	Explain the term ‘circadian rhythm’.						X	X		
HPL.SPEC.09.03	State the approximate duration of a ‘free-running’ rhythm.						X	X		
HPL.SPEC.09.04	Explain the significance of the ‘internal clock’ in regulating the normal circadian rhythm.						X	X		
HPL.SPEC.09.05	State the effect of the circadian rhythm of body temperature on an individual’s performance standard and on an individual’s sleep patterns.						X	X		
HPL.SPEC.09.06	List and describe the stages of a sleep cycle.						X	X		
HPL.SPEC.09.07	Differentiate between rapid eye movement (REM) and non-REM sleep.						X	X		
HPL.SPEC.09.08	Explain the function of sleep and describe the effects of insufficient sleep on performance.						X	X		
HPL.SPEC.09.09	Explain the simple calculations for the sleep/wake credit/debit situation.						X	X		
HPL.SPEC.09.10	Explain how sleep debit can become cumulative.						X	X		
HPL.SPEC.09.11	Describe the main effects of lack of sleep on an individual’s performance.	X	X	X			R	R		
HPL.SPEC.10.00	**Intoxication**									
HPL.SPEC.10.01	State the harmful effects of tobacco on: — the respiratory system — the cardiovascular system						X	X		
HPL.SPEC.10.02	Indicate the level of caffeine dosage at which performance is degraded.						X	X		
HPL.SPEC.10.03	Besides coffee, indicate other beverages containing caffeine.						X	X		
HPL.SPEC.10.04	State the maximum acceptable limit of alcohol for flight crew according to the applicable regulations.	X	X	X			R	R		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
HPL.SPEC.10.05	State the effects of alcohol consumption on: — the ability to reason — inhibitions and self-control — vision — the sense of balance and sensory illusions — sleep patterns	X	X	X			R	R		
HPL.SPEC.10.06	State the effects alcohol may have if consumed together with other drugs.	X	X	X						
HPL.SPEC.10.07	List the signs and symptoms of alcoholism.						X	X		
HPL.SPEC.10.08	List the factors that may be associated with the development of alcoholism.						X	X		
HPL.SPEC.10.09	Define the 'unit' of alcohol and state the approximate elimination rate from the blood.						X	X		
HPL.SPEC.10.10	State the maximum daily and weekly intake of units of alcohol which may be consumed without causing damage to the organs and systems of the human body.						X	X		
HPL.SPEC.10.11	Discuss the actions that might be taken if a crew member is suspected of being an alcoholic.						X	X		
HPL.SPEC.10.12	State the dangers associated with the use of non-prescription drugs.	X	X	X			R	R		
HPL.SPEC.10.13	State the side effects of common non-prescription drugs used to treat colds, flu, hay fever and other allergies, especially medicines containing antihistamine preparations.	X	X	X			R	R		
HPL.SPEC.10.14	Interpret the rules relevant to using (prescription or non-prescription) drugs that the remote pilot has not used before.	X	X	X						
HPL.SPEC.10.15	Interpret the general rule that 'if a remote pilot is so unwell that they require any medication, then they should consider themselves unfit to fly'.	X	X	X						
HPL.SPEC.10.16	List those materials present in an unmanned aircraft which may, when uncontained, cause severe health problems.						X	X		
HPL.SPEC.10.17	List those unmanned aircraft component parts which if burnt may give off toxic fumes.						X	X		
HPL.SPEC.11.00	**Incapacitation**									
HPL.SPEC.11.01	State that incapacitation is most dangerous when its onset is insidious.	X	X	X			R	R		
HPL.SPEC.11.02	List the major causes of remote pilot incapacitation.	X	X	X			R	R		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
HPL.SPEC.11.03	State the importance of crew to be able to recognise and promptly react upon incapacitation of other crew members, should it occur in flight.						X	X		
HPL.SPEC.11.04	Explain methods and procedures to cope with incapacitation in flight.	X	X	X			R	R		
HPL.SPEC.12.00	**Human Information Processing (HIP)**									
HPL.SPEC.12.01	Differentiate between 'attention' and 'vigilance'.	X	X	X			R	R		
HPL.SPEC.12.02	Differentiate between 'selective' and 'divided' attention.						X	X		
HPL.SPEC.12.03	Define 'hypovigilance'.						X	X		
HPL.SPEC.12.04	Identify the factors that may affect the state of vigilance.						X	X		
HPL.SPEC.12.05	List the factors that may forestall hypovigilance during flight.						X	X		
HPL.SPEC.12.06	Indicate the signs of reduced vigilance.						X	X		
HPL.SPEC.12.07	List the factors that affect a person's level of attention.	X	X	X						
HPL.SPEC.13.00	**Perception**									
HPL.SPEC.13.01	Name the basis of the perceptual process.	X	X	X						
HPL.SPEC.13.02	Describe the mechanism of perception ('bottom-up'/'top-down' process).						X	X		
HPL.SPEC.13.03	Illustrate why perception is subjective and state the relevant factors that influence interpretation of perceived information						X	X		
HPL.SPEC.13.04	Describe some basic perceptual illusions.						X	X		
HPL.SPEC.13.05	Illustrate some basic perceptual concepts.						X	X		
HPL.SPEC.13.06	Give examples where perception plays a decisive role in flight safety.						X	X		
HPL.SPEC.13.07	Stress how persuasive and believable mistaken perception can manifest itself both for an individual and a group.						X	X		
HPL.SPEC.14.00	**Memory**									
HPL.SPEC.14.01	Explain the link between the types of memory (to include sensory, working/short-term and long-term memory).						X	X		
HPL.SPEC.14.02	Describe the differences between the types of memory in terms of capacity and retention time.						X	X		
HPL.SPEC.14.03	Justify the importance of sensory-store memories in processing information.						X	X		
HPL.SPEC.14.04	State the average maximum number of separate items that may be held in working memory (5 ± 2).						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
HPL.SPEC.14.05	Stress how interruption can affect short-term/working memory.						X	X		
HPL.SPEC.14.06	Give examples of items that are important for pilots to hold in working memory during flight.						X	X		
HPL.SPEC.14.07	Describe how the capacity of the working-memory store may be increased.						X	X		
HPL.SPEC.14.08	State the subdivisions of long-term memory and give examples of their content.						X	X		
HPL.SPEC.14.09	Explain that skills are kept primarily in the long-term memory.						X	X		
HPL.SPEC.14.10	Describe amnesia and how it affects memory.						X	X		
HPL.SPEC.14.11	Name the common problems with both the long- and short-term memories and the best methods to try to counteract them.						X	X		
HPL.SPEC.15.00	**Learning Principles and Techniques**									
HPL.SPEC.15.01	Explain and distinguish between the following basic forms of learning: — classic and operant conditioning (behaviouristic approach) learning by insight (cognitive approach) — learning by imitating (modelling)						X	X		
HPL.SPEC.15.02	Recognise pilot-related examples as behaviouristic, cognitive or modelling forms of learning.						X	X		
HPL.SPEC.15.03	State the factors that are necessary for and promote the quality of learning: — intrinsic motivation — good mental health — rehearsals for improvement of memory — consciousness — vigilance — application in practical exercises						X	X		
HPL.SPEC.15.04	Explain ways to facilitate the memorisation of information with the following learning techniques: — mnemonics — mental training						X	X		
HPL.SPEC.15.05	Describe the advantage of planning and anticipation of future actions: — define the term ‘skills’ — state the three phases of learning a skill (Anderson cognitive, associative and autonomous phase)						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
HPL.SPEC.15.06	Explain the term ‘motor programme’ or ‘mental schema’.						X	X		
HPL.SPEC.15.07	Describe the advantages and disadvantages of mental schemas.						X	X		
HPL.SPEC.15.08	Explain the Rasmussen model which describes the guidance of a pilot’s behaviour in different situations.						X	X		
HPL.SPEC.15.09	State the possible problems or risks associated with skill, rule and knowledge-based behaviour.						X	X		
HPL.SPEC.15.10	Define ‘motivation’.						X	X		
HPL.SPEC.15.11	Explain the relationship between motivation and learning.						X	X		
HPL.SPEC.15.12	Explain the problems of over-motivation, especially in the context of the extreme need to achieve.						X	X		
HPL.SPEC.16.00	**Human Error and Reliability**									
HPL.SPEC.16.01	Name and explain the factors that influence human reliability.	X	X	X						
HPL.SPEC.16.02	Define the term ‘situation awareness’.	X	X	X	R	R				
HPL.SPEC.16.03	List the cues that indicate loss of situation awareness and name the steps to regain it.						X	X		
HPL.SPEC.16.04	List the factors that influence one’s situation awareness both positively and negatively and stress the importance of situation awareness in the context of flight safety.						X	X		
HPL.SPEC.16.05	Define the term ‘mental model’ in relation to a surrounding complex situation.						X	X		
HPL.SPEC.16.06	Describe the advantages/disadvantages of mental models.						X	X		
HPL.SPEC.16.07	Explain the relationship between personal ‘mental models’ and the creation of cognitive illusions.						X	X		
HPL.SPEC.16.08	Explain the concept of the ‘error chain’.						X	X		
HPL.SPEC.16.09	Differentiate between an isolated error and an error chain.						X	X		
HPL.SPEC.16.10	Distinguish between the main forms/types of errors (i.e. slips, faults, omissions and violations).						X	X		
HPL.SPEC.16.11	Discuss the above errors and their relevance in flight.						X	X		
HPL.SPEC.16.12	Distinguish between an active and a latent error and give examples.						X	X		
HPL.SPEC.16.13	Distinguish between internal and external factors in error generation.						X	X		
HPL.SPEC.16.14	Identify possible sources of internal error generation.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
HPL.SPEC.16.15	Define and discuss the two errors associated with motor programmes (action slip and environmental capture).						X	X		
HPL.SPEC.16.16	List the three main sources of external error generation in the flight crew compartment.						X	X		
HPL.SPEC.16.17	Give examples to illustrate the following factors in external error generation in the flight crew compartment: — ergonomics — economics — social environment						X	X		
HPL.SPEC.16.18	Name the major goals in the design of human-centred human– machine interfaces.						X	X		
HPL.SPEC.16.19	Define the term ‘error tolerance’.						X	X		
HPL.SPEC.16.20	List and describe the strategies that are used to reduce human error.						X	X		
HPL.SPEC.16.21	Describe the advantage of planning and the anticipation of future actions.						X	X		
HPL.SPEC.17.00	**Decision Making**									
HPL.SPEC.17.01	Define the terms ‘deciding’ and ‘decision-making’.						X	X		
HPL.SPEC.17.02	Describe the major factors on which decision-making should be based during the course of a flight.						X	X		
HPL.SPEC.17.03	Describe the main human attributes with regard to decision making.						X	X		
HPL.SPEC.17.04	Discuss the nature of bias and its influence on the decision making process.						X	X		
HPL.SPEC.17.05	Describe the main error sources and limits in an individual’s decision-making mechanism.						X	X		
HPL.SPEC.17.06	State the factors upon which an individual’s risk assessment is based.	X								
HPL.SPEC.17.07	Explain the relationship between risk assessment, commitment, and pressure of time in decision-making strategies.	X								
HPL.SPEC.17.08	Explain the risks associated with dispersion or channelised attention during the application of procedures requiring a high workload within a short time frame (e.g. a go-around).						X	X		
HPL.SPEC.17.09	Describe the positive and negative influences exerted by other group members on an individual’s decision-making process (risk shift).	X								
HPL.SPEC.17.10	Explain the general idea behind the creation of a model for decision-making based upon:						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
	— definition of the aim — collection of information — risk assessment — development of options — evaluation of options — decision — implementation — consequences — review and feedback									
HPL.SPEC.18.00	**Avoiding and Managing Errors: Cockpit Management**									
	Safety Awareness									
HPL.SPEC.18.01	Justify the need for being aware of not only one's own performance but that of others before and during a flight and the possible consequences or risks.						X	X		
HPL.SPEC.19.00	**Coordination (Multi-Crew Concepts)**									
HPL.SPEC.19.01	Name the objectives of the multi-crew concept.						X	X		
HPL.SPEC.19.02	State and explain the elements of multi-crew concepts.						X	X		
HPL.SPEC.19.03	Describe the concepts of 'standard operating procedures' (SOPs), checklists and crew briefings.	X	X	X	R	R	R	R		
HPL.SPEC.19.04	Describe the purpose of and procedure for crew briefings.	X	X	X						
HPL.SPEC.19.05	Describe the purpose of and procedure for checklists.	X	X	X						
HPL.SPEC.19.06	Describe the function of communication in a coordinated team.	X	X	X						
HPL.SPEC.19.07	Explain the advantages of SOPs.	X	X	X						
HPL.SPEC.19.08	Explain how SOPs contribute to avoiding, reducing and managing threats and errors.						X	X		
HPL.SPEC.19.09	Explain potential threats of SOPs.						X	X		
HPL.SPEC.20.00	**Cooperation**									
HPL.SPEC.20.01	Distinguish between cooperation and coaction.						X	X		
HPL.SPEC.20.02	Define the term 'group'.						X	X		
HPL.SPEC.20.03	Illustrate the influence of interdependence in a group.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
HPL.SPEC.20.04	List the advantages and disadvantages of teamwork.						X	X		
HPL.SPEC.20.05	Explain the term ‘synergy’.						X	X		
HPL.SPEC.20.06	Define the term ‘cohesion’.						X	X		
HPL.SPEC.20.07	Define the term ‘groupthink’.						X	X		
HPL.SPEC.20.08	State the essential conditions for good teamwork.						X	X		
HPL.SPEC.20.09	Explain the function of role and norm in a group.						X	X		
HPL.SPEC.20.10	Name the different role patterns which occur in a group situation.						X	X		
HPL.SPEC.20.11	Explain how behaviour can be affected by the following factors: — persuasion — conformity — compliance — obedience						X	X		
HPL.SPEC.20.12	Distinguish between status and role.						X	X		
HPL.SPEC.20.13	Stress the inherent dangers of a situation where there is a mix of role and status within the flight crew compartment.						X	X		
HPL.SPEC.20.14	Explain the terms ‘leadership’ and ‘followership’.						X	X		
HPL.SPEC.20.15	Describe the trans-flightdeck authority gradient and its affiliated leadership styles (i.e. autocratic, laissez-faire and synergistic).						X	X		
HPL.SPEC.20.16	Name the most important attributes of a positive leadership style.						X	X		
HPL.SPEC.21.00	**Communication**									
HPL.SPEC.21.01	Define the term ‘communication’.						X	X		
HPL.SPEC.21.02	List the most basic components of interpersonal communication.						X	X		
HPL.SPEC.21.03	Explain the advantages of in-person two-way communication as opposed to one-way communication.						X	X		
HPL.SPEC.21.04	Name the importance of non-verbal communication.						X	X		
HPL.SPEC.21.05	Describe the general aspects of non-verbal communication.						X	X		
HPL.SPEC.21.06	Describe the advantages/disadvantages of implicit and explicit communication.						X	X		
HPL.SPEC.21.07	Describe the advantages and possible problems of using ‘social’ and ‘professional’ language in high- and low-workload situations.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
HPL.SPEC.21.08	Name and explain the major obstacles to effective communication.						X	X		
HPL.SPEC.21.09	Explain the difference between intrapersonal and interpersonal conflict.						X	X		
HPL.SPEC.21.10	Describe the escalation process in human conflict.						X	X		
HPL.SPEC.21.11	List the typical consequences of conflicts between crew members.						X	X		
HPL.SPEC.21.12	Explain the following terms as part of the communication practice with regard to preventing or resolving conflicts: — inquiry — active listening — advocacy — feedback — metacommunication — negotiation						X	X		
HPL.SPEC.21.13	Describe the limitations of communication in situations of high workload in the flight crew compartment in view of listening, verbal, non-verbal and visual effects.						X	X		
HPL.SPEC.22.00	**Human Behaviour**									
HPL.SPEC.22.01	Personality, attitude, and behaviour.									
HPL.SPEC.22.02	Describe the factors that determine an individual's behaviour.						X	X		
HPL.SPEC.22.03	Define and distinguish between personality, attitude, and behaviour.						X	X		
HPL.SPEC.22.04	State the origin of personality and attitude.						X	X		
HPL.SPEC.22.05	State that with behaviour good and bad habits can be formed.						X	X		
HPL.SPEC.22.06	Explain how behaviour is generally a product of personality, attitude and the environment to which one was exposed at significant moments (childhood, schooling and training).						X	X		
HPL.SPEC.22.07	State that personality differences and selfish attitude may have effects on flight crew performance.						X	X		
HPL.SPEC.23.00	**Individual Differences in Personality and Motivation**									
HPL.SPEC.23.01	Describe the individual differences in personality by means of a common trait model (e.g. Eysenck's personality factors).						X	X		
HPL.SPEC.24.00	**Self-Concept**									
HPL.SPEC.24.01	Define the term 'self-concept' and the role it plays in any change of personality.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
HPL.SPEC.24.02	Explain how a self-concept of under confidence may lead to an outward show of aggression and self- assertiveness.						X	X		
HPL.SPEC.25.00	**Self-Discipline**									
HPL.SPEC.25.01	Define 'self-discipline' and justify its importance for flight safety.						X	X		
HPL.SPEC.26.00	**Identification of Hazardous Attitudes (error proneness)**									
HPL.SPEC.26.01	Explain dangerous attitudes in aviation: — Anti-authority — macho — impulsivity — invulnerability — complacency — resignation						X	X		
HPL.SPEC.26.02	Describe the personality, attitude, and behaviour patterns of an ideal crew member.						X	X		
HPL.SPEC.26.03	Summarise how a person's attitude influences their work in an unmanned flightdeck						X	X		
HPL.SPEC.27.00	**Human Overload and Underload**									
	Arousal									
HPL.SPEC.27.01	Explain the term 'arousal'.						X	X		
HPL.SPEC.27.02	Describe the relationship between arousal and performance.						X	X		
HPL.SPEC.27.03	Explain the circumstances under which underload may occur and its possible dangers.						X	X		
HPL.SPEC.28.00	**Stress**									
HPL.SPEC.28.01	Explain the term 'stress' and why stress is a natural human reaction.	X	X	X						
HPL.SPEC.28.02	State that the physiological response to stress is generated by the 'fight or flight' response.						X	X		
HPL.SPEC.28.03	Describe the function of the autonomic nervous system (ANS) in stress response.						X	X		
HPL.SPEC.28.04	Explain the relationship between arousal and stress.						X	X		
HPL.SPEC.28.05	State the relationship between stress and performance.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
HPL.SPEC.28.06	State the basic categories of stressors.	X	X	X						
HPL.SPEC.28.07	List and discuss the major environmental sources of stress in the flight crew compartment.						X	X		
HPL.SPEC.28.08	Discuss the concept of ‘break point’ with regard to stress, overload and performance.						X	X		
HPL.SPEC.28.09	Name the principal causes of domestic stress.						X	X		
HPL.SPEC.28.10	State that the stress experienced as a result of particular demands varies among individuals.						X	X		
HPL.SPEC.28.11	Explain the factors that lead to differences in the levels of stress experienced by individuals.						X	X		
HPL.SPEC.28.12	List the factors that influence the tolerance of stressors.						X	X		
HPL.SPEC.28.13	State that stress is a result of perceived demands and perceived ability.						X	X		
HPL.SPEC.28.14	Explain the relationship between stress and anxiety.						X	X		
HPL.SPEC.28.15	Describe the effects of anxiety on human performance.						X	X		
HPL.SPEC.28.16	State the general effect of acute stress on people.						X	X		
HPL.SPEC.28.17	Describe the relationship between stress, arousal and vigilance.						X	X		
HPL.SPEC.28.18	State the general effect of chronic stress and the biological reaction by means of the three stages of the general adaptation syndrome (Selye): alarm, resistance, and exhaustion.						X	X		
HPL.SPEC.28.19	Explain the differences between psychological, psychosomatic, and somatic stress reactions.						X	X		
HPL.SPEC.28.20	Name the typical common physiological and psychological symptoms of human overload.						X	X		
HPL.SPEC.28.21	Describe the effects of stress on human behaviour.						X	X		
HPL.SPEC.28.22	Explain how stress is cumulative and how stress from one situation can be transferred to a different situation.						X	X		
HPL.SPEC.28.23	Explain how successful completion of a stressful task will reduce the amount of stress experienced when a similar situation arises in the future.						X	X		
HPL.SPEC.28.24	Describe the effect of human underload/overload on effectiveness in the flight crew compartment.						X	X		
HPL.SPEC.28.25	List sources and symptoms of human underload.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
HPL.SPEC.29.00	**Fatigue and Stress Management**									
HPL.SPEC.29.01	Explain the term 'fatigue' and differentiate between the two types of fatigue (short-term and chronic fatigue).	X	X	X			R	R		
HPL.SPEC.29.02	Name the causes of short-term and chronic fatigue.	X	X	X			R	R		
HPL.SPEC.29.03	Identify the symptoms and describe the effects of fatigue.	X	X	X			R	R		
HPL.SPEC.29.04	List the strategies that prevent or delay the onset of fatigue and hypovigilance.						X	X		
HPL.SPEC.29.05	List and describe strategies for coping with stress factors and stress reactions.						X	X		
HPL.SPEC.29.06	Distinguish between short-term and long-term methods of stress management.	X	X	X			R	R		
HPL.SPEC.29.07	Give examples of short-term methods of stress management.	X	X	X			X	X		
HPL.SPEC.29.08	Give examples of long-term methods of coping with stress.						X	X		
HPL.SPEC.29.09	Describe the fatigue risk management system (FRMS) as follows: a data-driven means of continuously monitoring and managing fatigue-related safety risks, based upon scientific principles and knowledge as well as operational experience that aims to ensure relevant personnel are performing at adequate levels of alertness.						X	X		
HPL.SPEC.30.00	**Automation**									
	Advantages and Disadvantages									
HPL.SPEC.30.01	Explain the fundamental restrictions of automated flight systems to be lack of creativity in unknown situations, and lack of personal motivation with regard to safety.						X	X		
HPL.SPEC.30.02	List the principal strengths and weaknesses of pilot versus automated flight systems to be creativity, decision-making, prioritisation of tasks, safety attitude versus precision, reliability.						X	X		
HPL.SPEC.31.00	**Automation Complacency**									
HPL.SPEC.31.01	State the main weaknesses in the monitoring of automatic systems to be hypovigilance.						X	X		
HPL.SPEC.31.02	Explain some basic flight crew errors and terms that arise with the introduction of automation: - passive monitoring - blinkered concentration - confusion						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
	- flight mode awareness.									
HPL.SPEC.31.03	Explain how the method of call-outs counteracts ineffective monitoring of automatic systems.						X	X		
HPL.SPEC.31.04	Define ‘complacency’.						X	X		
HPL.SPEC.32.00	**Working Concepts**									
HPL.SPEC.32.01	Explain that the potential disadvantages of automation on crew communication are loss of awareness of input errors, flight modes, failure detection, failure comprehension, status of the unmanned aircraft and unmanned aircraft position.						X	X		

METEOROLOGY

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1A	L1R	L2A	L2R	L3A	L3R	L4A	L4R
MET.SPEC.00.00	**Meteorology**									
MET.SPEC.01.00	**The Atmosphere**									
	Structure of the Atmosphere									
MET.SPEC.01.01	Describe the vertical division of the atmosphere up to flight level (FL) 650, based on the temperature variation with height	X	X	X			R	R		
MET.SPEC.01.02	List the different layers and their main qualitative characteristics up to FL650						X	X		
MET.SPEC.02.00	**Air Temperature**									
MET.SPEC.02.01	Define ‘air temperature’.	X	X	X						
MET.SPEC.02.02	List the units of measurement of air temperature used in aviation meteorology (Celsius, Fahrenheit, Kelvin). *(Refer to Subject 050 10 01 01)*	X	X	X						
MET.SPEC.03.00	**Vertical Distribution of Temperature**									
MET.SPEC.03.01	Describe the mean vertical distribution of temperature up to FL 650.						X	X		
MET.SPEC.03.02	Mention the general causes of the cooling of the air in the troposphere with increasing altitude.						X	X		
MET.SPEC.03.03	Calculate the temperature and temperature deviations (in relation to International Standard Atmosphere (ISA)) at specified levels.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
MET.SPEC.04.00	**Transfer of Heat**									
MET.SPEC.04.01	Explain how local cooling or warming processes result in transfer of heat.						X	X		
MET.SPEC.04.02	Describe radiation.						X	X		
MET.SPEC.04.03	Describe solar radiation reaching the Earth.						X	X		
MET.SPEC.04.04	Describe the filtering effect of the atmosphere on solar radiation.						X	X		
MET.SPEC.04.05	Describe terrestrial radiation.						X	X		
MET.SPEC.04.06	Explain how terrestrial radiation is absorbed by some components of the atmosphere.						X	X		
MET.SPEC.04.07	Explain the effect of absorption and radiation in connection with clouds.						X	X		
MET.SPEC.04.08	Explain the process of conduction.						X	X		
MET.SPEC.04.09	Explain the role of conduction in the cooling and warming of the atmosphere.						X	X		
MET.SPEC.04.10	Explain the process of convection.						X	X		
MET.SPEC.04.11	Name the situations in which convection occurs.						X	X		
MET.SPEC.04.12	Explain the process of advection.						X	X		
MET.SPEC.04.13	Name the situations in which advection occurs.						X	X		
MET.SPEC.04.14	Describe the transfer of heat by turbulence.						X	X		
MET.SPEC.04.15	Describe the transfer of latent heat.						X	X		
MET.SPEC.05.00	**Temperature near the Earth's Surface, Insolation, Surface Effects, Effect of Clouds, Effect of Wind**									
MET.SPEC.05.01	Explain the cooling/warming of the surface of the Earth by radiation.						X	X		
MET.SPEC.05.02	Explain the cooling/warming of the air by molecular or turbulent heat transfer to/from the earth or sea surfaces.						X	X		
MET.SPEC.05.03	Describe qualitatively the influence of the clouds on the cooling and warming of the surface and the air near the surface.						X	X		
MET.SPEC.05.04	Explain the influence of the wind on the cooling and warming of the air near the surfaces.						X	X		
MET.SPEC.06.00	**Atmospheric Pressure**									
	Barometric Pressure, Isobars									

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
MET.SPEC.06.01	Define 'atmospheric pressure'.						X	X		
MET.SPEC.06.02	List the units of measurement of the atmospheric pressure used in aviation (hPa, inches of mercury). *(Refer to Subject 050 10 01 01)*						X	X		
MET.SPEC.06.03	Describe the principle of the barometers (mercury barometer, aneroid barometer).						X	X		
MET.SPEC.06.04	Define isobars and identify them on surface weather charts.						X	X		
MET.SPEC.06.05	Define 'high', 'low', 'trough', 'ridge', 'col'.						X	X		
MET.SPEC.07.00	**Pressure Variation with Height, Contours (Isotypes)**									
MET.SPEC.07.01	Explain the pressure variation with height.						X	X		
MET.SPEC.07.02	Describe quantitatively the variation of the barometric lapse rate. *Remark: An approximation of the average value for the barometric lapse rate near mean sea level (MSL) is 30 ft (9 m) per 1 hPa.*						X	X		
	Reduction of Pressure to QFF (MSL)									
MET.SPEC.07.03	Define 'QFF'.						X	X		
MET.SPEC.07.04	Explain the reduction of measured pressure (QFE) to QFF (MSL).						X	X		
MET.SPEC.07.05	Mention the use of QFF for surface weather charts.						X	X		
	Relationship between surface pressure centres & pressure centres aloft									
MET.SPEC.07.06	Illustrate with a vertical cross section of isobaric surfaces the relationship between surface pressure systems and upper-air pressure systems.						X	X		
MET.SPEC.08.00	**Air Density**									
	Relationship between pressure, temperature and density									
MET.SPEC.08.01	Describe the relationship between pressure, temperature and density.						X	X		
MET.SPEC.08.0	Describe the vertical variation of the air density in the atmosphere.						X	X		
MET.SPEC.09.00	**International Standard Atmosphere (ISA)**									
MET.SPEC.09.01	Explain the use of standardised values for the atmosphere.						X	X		
MET.SPEC.09.02	List the main values of the ISA MSL pressure, MSL temperature, the vertical temperature lapse rate up to FL 650, height and temperature of the tropopause.						X	X		
MET.SPEC.10.00	**Altimetry**									

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
	Terminology and Definitions									
MET.SPEC.10.01	Define the following terms and explain how they are related to each other: height, altitude, pressure altitude, FL, pressure level, true altitude, true height, elevation, QNH, QFE, and standard altimeter setting.						X	X	X	X
MET.SPEC.10.02	Describe the terms 'transition altitude', 'transition level','transition layer', 'terrain clearance', 'lowest usable flight level'.						X	X	X	X
	Altimeter settings									
MET.SPEC.10.03	Name the altimeter settings associated to height, altitude, pressure altitude and FL.						X	X		
MET.SPEC.10.04	Describe the altimeter-setting procedures.						X	X		
	Calculations									
MET.SPEC.10.05	Calculate the different readings on the altimeter when a remote pilot uses different settings (QNH, 1013.25, QFE).						X	X		
MET.SPEC.10.06	Illustrate with a numbered example the changes of altimeter setting and the associated changes in reading when the pilot climbs through the transition altitude or descends through the transition level.						X	X		
MET.SPEC.10.07	Derive the reading of the altimeter of an unmanned aircraft on the ground when the pilot uses the different settings.						X	X		
MET.SPEC.10.08	Explain the influence of the air temperature on the distance between the ground and the level read on the altimeter and between two FLs.						X	X		
MET.SPEC.10.09	Explain the influence of pressure areas on true altitude.						X	X		
MET.SPEC.10.10	Determine the true altitude/height for a given altitude/height and a given ISA temperature deviation.						X	X		
MET.SPEC.10.11	Calculate the terrain clearance and the lowest usable FL for given atmospheric temperature and pressure conditions.						X	X		
MET.SPEC.10.12	State that the 4 %-rule can be used to calculate true altitude from indicated altitude, and also indicated altitude from true altitude (not precise but sufficient due to the approximation of the 4%-rule.) *Remark: The following rules should be considered for altimetry calculations:* *a) All calculations are based on rounded pressure values to the nearest lower hPa.* *b) The value for the barometric lapse rate between MSL and 700 hPa to*						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
	be used is 30 ft/hPa as an acceptable approximation of the barometric lapse rate. *c) To determine the true altitude/height, the following rule of thumb, called the '4 %-rule',* ***must*** *be used: the altitude/height changes by 4 % for each 10 °C temperature deviation from ISA.* *d) If no further information is given, the deviation of the outside-air temperature from ISA is considered to be constantly the same given value in the whole layer.* *e) The elevation of the aerodrome has to be taken into account. The temperature correction has to be considered for the layer between the ground and the position of the unmanned aircraft.*									
	Effect of Accelerated Airflow Due to Topography									
MET.SPEC.10.13	Describe qualitatively how the effect of accelerated airflow due to topography (the Bernoulli effect) affects altimetry.						X	X		
MET.SPEC.11.00	**Wind**									
	Definition and Measurement of Wind									
	Definition and measurement									
MET.SPEC.11.01	Define 'wind' and 'surface wind'.	X	X	X						
MET.SPEC.11.02	State the units of wind directions	X	X	X						
MET.SPEC.11.03	Describe that the reported wind is an average wind derived from measurements with an anemometer at a height of 10 m over 2 min for local routine and special reports and ATS units, and over 10 min for aerodrome routine meteorological reports (METARs) and aerodrome special meteorological reports (SPECIs).						X	X		
MET.SPEC.12.00	**Primary Cause of Wind, Pressure Gradient, Coriolis Force, Gradient Wind**									
MET.SPEC.12.01	Define the term 'horizontal pressure gradient'.						X	X		
MET.SPEC.12.02	Reserved for future									
MET.SPEC.13.00	**General Global Circulation**									
	General Circulation Around the Globe									
MET.SPEC.13.01	Describe the general global circulation.						X	X		
MET.SPEC.14.00	**Local Winds**									

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
MET.SPEC.14.01	Describe and explain anabatic and katabatic winds.	X	X							
MET.SEPC.14.02	Describe mountain and valley winds.	X	X							
MET.SPEC.14.03	Describe the Venturi effect, convergence in valleys and mountain areas.	X	X							
MET.SPEC.14.04	Describe land and sea breezes, and sea-breeze front.	X	X							
MET.SPEC.14.05	Describe that local, low-level jet streams can develop in the evening.						X	X		
MET.SPEC.15.00	**Mountain Waves (standing waves, lee waves)**									
	Origin and Characteristics									
MET.SPEC.15.01	Explain the origin and formation of mountain waves.						X	X		
MET.SPEC.15.02	State the conditions necessary for the formation of mountain waves.						X	X		
MET.SPEC.15.03	Describe the structure and properties of mountain waves.						X	X		
MET.SPEC.15.04	Explain how mountain waves may be identified by their associated meteorological phenomena.						X	X		
MET.SPEC.15.05	Describe that mountain wave effects can exceed the performance or structural capability of unmanned aircraft.						X	X		
MET.SPEC.15.06	Describe that mountain wave effects can propagate from low to high level, e.g. over Greenland and elsewhere.						X	X		
MET.SPEC.16.00	**Turbulence**									
	Description and Types of Turbulence									
MET.SPEC.16.01	Describe turbulence and gustiness.	X	X	X						
MET.SPEC.16.02	List the common types of turbulence (convective, mechanical, orographic, frontal, clear-air turbulence).	X	X	X						
MET.SPEC.17.00	**Formation and Location of Turbulence**									
MET.SPEC.17.01	Explain the formation of convective turbulence, mechanical and orographic turbulence, and frontal turbulence.						X	X		
MET.SPEC.17.02	State where turbulence will normally be found (rough-ground surfaces, relief, inversion layers, cumulonimbus (CB), thunderstorm (TS) zones, unstable layers).						X	X		
MET.SPEC.17.03	Describe and indicate the areas of worst wind shear and CAT.						X	X		
MET.SPEC.18.00	**Clouds and Fog**									

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
MET.SPEC.18.01	Explain cloud formation by adiabatic cooling, conduction, advection and radiation.						X	X		
MET.SPEC.18.02	Describe cloud formation based on the following lifting processes: unorganised lifting in thin layers and turbulent mixing; forced lifting at fronts or over mountains; free convection.						X	X		
MET.SPEC.18.03	List cloud types typical for stable and unstable air conditions.						X	X		
MET.SPEC.18.04	Summarise the conditions for the dissipation of clouds.						X	X		
MET.SPEC.19.00	**Cloud Types and Cloud Classification**									
MET.SPEC.19.01	Describe the different cloud types and their classification.	X	X	X						
MET.SPEC.20.00	**Flying Conditions in each Cloud Type**									
MET.SPEC.20.01	Assess the 10 cloud types for icing and turbulence.						X	X		T
MET.SPEC.21.00	**Fog, Mist, Faze**									
MET.SPEC.21.01	Define ‘fog’, ‘mist’ and ‘haze’ with reference to the WMO standards of visibility range.						X	X		
MET.SPEC.21.02	Explain briefly the formation of fog, mist and haze.						X	X		
MET.SPEC.21.03	Name the factors that generally contribute to the formation of fog and mist.						X	X		
MET.SPEC.21.04	Name the factors that contribute to the formation of haze.						X	X		
MET.SPEC.21.05	Describe freezing fog and ice fog.						X	X		
MET.SPEC.22.00	**Radiation Fog**									
MET.SPEC.22.01	Explain the formation of radiation fog.						X	X		
MET.SPEC.22.02	Describe the significant characteristics of radiation fog, and its vertical extent.						X	X		
MET.SPEC.22.03	Summarise the conditions for the dissipation of radiation fog.						X	X		
MET.SPEC.23.00	**Advection Fog**									
MET.SPEC.23.01	Explain the formation of advection fog.						X	X		
MET.SPEC.23.02	Describe the different possibilities of advection-fog formation (over land, sea and coastal regions).						X	X		
MET.SPEC.23.03	Describe the significant characteristics of advection fog.						X	X		
MET.SPEC.23.04	Summarise the conditions for the dissipation of advection fog.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
MET.SPEC.24.00	**Sea Smoke**									
MET.SPEC.24.01	Explain the formation of sea smoke.						X	X		
MET.SPEC.24.02	Explain the conditions for the development of sea smoke.						X	X		
MET.SPEC.24.03	Summarise the conditions for the dissipation of sea smoke.						X	X		
MET.SPEC.24.04	Explain the formation of frontal fog.						X	X		
MET.SPEC.24.05	Describe the significant characteristics of frontal fog.						X	X		
MET.SPEC.24.06	Summarise the conditions for the dissipation of frontal fog.						X	X		
MET.SPEC.24.07	Summarise the features of orographic fog.						X	X		
MET.SPEC.24.08	Describe the significant characteristics of orographic fog.						X	X		
MET.SPEC.24.09	Summarise the conditions for the dissipation of orographic fog.						X	X		
MET.SPEC.25.00	**Precipitation**									
	Process of Development of Precipitation									
MET.SPEC.25.01	Describe the two basic processes of forming precipitation (The Wegener–Bergeron–Findeisen process, Coalescence).						X	X		
MET.SPEC.25.02	Summarise the outlines of the ice-crystal process (The Wegener– Bergeron–Findeisen process).						X	X		
MET.SPEC.25.03	Summarise the outlines of the coalescence process.						X	X		
MET.SPEC.25.04	Explain the development of snow, rain, drizzle and hail.						X	X		
MET.SPEC.26.00	**Types of Precipitation**									
MET.SPEC.26.01	List and describe the types of precipitation given in the aerodrome forecast (TAF) and METAR codes (drizzle, rain, snow, snow grains, ice pellets, hail, small hail, snow pellets, ice crystals, freezing drizzle, freezing rain).						X	X		
MET.SPEC.26.02	State the ICAO/WMO approximate diameters for cloud, drizzle and rain drops.						X	X		
MET.SPEC.26.03	State that, because of their size, hail stones can cause significant damage to unmanned aircraft.						X	X		
MET.SPEC.26.04	Explain the mechanism for the formation of freezing precipitation.						X	X		
MET.SPEC.26.05	Describe the weather conditions that give rise to freezing precipitation.						X	X		
MET.SPEC.26.06	Distinguish between the types of precipitation generated in convective and stratiform clouds.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
MET.SPEC.26.07	Assign typical precipitation types and intensities to different cloud types.						X	X		
MET.SPEC.26.08	Explain the relationship between moisture content and visibility during different types of winter precipitation (e.g. large vs small snowflakes).						X	X		
MET.SPEC.27.00	**Air Masses and Fronts**									
	Air Masses									
MET.SPEC.27.01	Define the term 'air mass'.						X	X		
MET.SPEC.27.02	Describe the properties of the source regions.						X	X		
MET.SPEC.27.03	Summarise the classification of air masses by source regions.						X	X		
MET.SPEC.27.04	State the classifications of air masses by temperature and humidity at source.						X	X		
MET.SPEC.27.05	State the characteristic weather in each of the air masses.						X	X		
MET.SPEC.27.06	Name the three main air masses that affect Europe.						X	X		
MET.SPEC.27.07	Classify air masses on a surface weather chart.						X	X		
MET.SPEC.27.08	*Remark: Names and abbreviations of air masses used in assessments:* — *first letter: humidity* — *continental (c)* — *maritime (m)* — *second letter: type of air mass* — *arctic (A)* — *polar (P)* — *tropical (T)* — *equatorial (E)* — *third letter: temperature* — *cold (c)* — *warm (w)*						X	X		
MET.SPEC.28.00	**Modifications of Air Masses**									
MET.SPEC.28.01	List the environmental factors that affect the final properties of an air mass.						X	X		
MET.SPEC.28.02	Explain how maritime and continental tracks modify air masses.						X	X		
MET.SPEC.28.03	Explain the effect of passage over cold or warm surfaces.						X	X		
MET.SPEC.28.04	Explain how air-mass weather is affected by the season, the air- mass track and by orographic and thermal effects over land.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
MET.SPEC.28.05	Assess the tendencies of the stability of an air mass and describe the typical resulting air-mass weather including the hazards for aviation.						X	X		
MET.SPEC.29.00	**Fronts**									
MET.SPEC.29.01	Describe the boundaries between air masses (fronts).						X	X		
MET.SPEC.29.02	Define ‘front’ and ‘frontal zone’.						X	X		
MET.SPEC.29.03	Name the global frontal systems (polar front, arctic front).						X	X		
MET.SPEC.29.04	State the approximate seasonal latitudes and geographic positions of the polar front and the arctic front.						X	X		
MET.SPEC.30.00	**Warm Front, Associated Clouds and Weather**									
MET.SPEC.30.01	Define a ‘warm front’.						X	X		
MET.SPEC.30.02	Describe the cloud, weather, ground visibility and aviation hazards at a warm front depending on the stability of the warm air.						X	X		
MET.SPEC.30.03	Explain the seasonal differences in the weather at warm fronts.						X	X		
MET.SPEC.30.04	Describe the structure, slope and dimensions of a warm front.						X	X		
MET.SPEC.30.05	Sketch a cross section of a warm front showing weather, cloud and aviation hazards.						X	X		
MET.SPEC.31.00	**Cold Front, Associated Clouds and Weather**									
MET.SPEC.31.01	Define a ‘cold front’.						X	X		
MET.SPEC.31.02	Describe the cloud, weather, ground visibility and aviation hazards at a cold front depending on the stability of the warm air.						X	X		
MET.SPEC.31.03	Explain the seasonal differences in the weather at cold fronts.						X	X		
MET.SPEC.31.04	Describe the structure, slope and dimensions of a cold front.						X	X		
MET.SPEC.31.05	Sketch a cross section of a cold front showing weather, cloud and aviation hazards.						X	X		
MET.SPEC.32.00	**Warm Sector, Associated Clouds and Weather**									
MET.SPEC.32.01	Describe fronts and air masses associated with the warm sector.						X	X		
MET.SPEC.32.02	Describe the cloud, weather, ground visibility and aviation hazards in a warm sector.						X	X		
MET.SPEC.32.03	Explain the seasonal differences in the weather in the warm sector.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
MET.SPEC.32.04	Sketch a cross section of a warm sector showing weather, cloud and aviation hazards.						X	X		
MET.SPEC.33.00	**Weather behind the Cold Front**									
MET.SPEC.33.01	Describe the cloud, weather, ground visibility and aviation hazards behind the cold front.						X	X		
MET.SPEC.33.02	Explain the seasonal differences in the weather behind the cold front.						X	X		
MET.SPEC.34.00	**Occlusions, Associated Clouds and Weather**									
MET.SPEC.34.01	Define the term ‘occlusion’ and ‘occluded front’.						X	X		
MET.SPEC.34.02	Describe the cloud, weather, ground visibility and aviation hazards in a cold occlusion.						X	X		
MET.SPEC.34.03	Describe the cloud, weather, ground visibility and aviation hazards in a warm occlusion.						X	X		
MET.SPEC.34.04	Explain the seasonal differences in the weather at occlusions.						X	X		
MET.SPEC.34.05	Sketch a cross section of occlusions showing weather, cloud and aviation hazards.						X	X		
MET.SPEC.34.06	On a sketch illustrate the development of an occlusion and the movement of the occlusion point.						X	X		
MET.SPEC.35.00	**Stationary Front, Associated Clouds and Weather**									
MET.SPEC.35.01	Define a ‘stationary front’.						X	X		
MET.SPEC.35.02	Describe the cloud, weather, ground visibility and aviation hazards in a stationary front.						X	X		
MET.SPEC.36.00	**Movement of Fronts and Pressure Systems, Life Cycle**									
MET.SPEC.36.01	Describe the movements of fronts and pressure systems and the life cycle of a mid-latitude depression.						X	X		
MET.SPEC.36.02	State the rules for predicting the direction and the speed of movement of fronts.						X	X		
MET.SPEC.36.03	State the difference in the speed of movement between cold and warm fronts.						X	X		
MET.SPEC.36.04	State the rules for predicting the direction and the speed of movement of frontal depressions.						X	X		
MET.SPEC.36.05	Describe, with a sketch if required, the genesis, development and life cycle of a frontal depression with associated cloud and rain belts.						X	X		
MET.SPEC.37.00	**Changes of Meteorological Elements at a Frontal Wave**									

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
MET.SPEC.37.01	Sketch a plan and a cross section of a frontal wave (warm front, warm sector, and cold front) and illustrate the changes of pressure, temperature, surface, wind and wind in the vertical axis.						X	X		
MET.SPEC.38.00	**Pressure Systems**									
	Location of the Principal Pressure Areas									
MET.SPEC.38.01	Identify or indicate on a map the principal global high-pressure and low-pressure areas in January and July.						X	X		
MET.SPEC.38.02	Explain how these pressure areas are formed.						X	X		
MET.SPEC.38.03	Explain how the pressure areas move with the seasons.						X	X		
MET.SPEC.39.00	**Flight Hazards**									
	Icing									
MET.SPEC.39.01	Summarise the general conditions under which ice accretion occurs on unmanned aircraft (temperatures of outside air; temperature of the airframe; presence of supercooled water in clouds, fog, rain and drizzle; possibility of sublimation).						X	X		
MET.SPEC.39.02	Explain the general weather conditions under which ice accretion occurs in a venturi carburettor.						X	X		
MET.SPEC.39.03	Explain the general weather conditions under which ice accretion occurs on airframe.						X	X		
MET.SPEC.39.04	Explain the formation of supercooled water in clouds, rain and drizzle.						X	X		
MET.SPEC.39.05	Explain qualitatively the relationship between the air temperature and the amount of supercooled water.						X	X		
MET.SPEC.39.06	Explain qualitatively the relationship between the type of cloud and the size and number of the droplets in cumuliform and stratiform clouds.						X	X		
MET.SPEC.39.07	Indicate in which circumstances ice can form on an unmanned aircraft on the ground: air temperature, humidity, precipitation.						X	X		
MET.SPEC.39.08	Explain in which circumstances ice can form on an unmanned aircraft in flight: inside clouds, in precipitation, and outside clouds and precipitation.						X	X		
MET.SPEC.39.09	Explain the influence of fuel temperature, radiative cooling of the unmanned aircraft surface and temperature of the unmanned aircraft surface (e.g. from previous flight) on ice formation.						X	X		
MET.SPEC.39.10	Describe the different factors that influence the intensity of icing: air						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
	temperature, amount of supercooled water in a cloud or in precipitation, amount of ice crystals in the air, speed of the unmanned aircraft, shape (thickness) of the airframe parts (wings, antennas, etc.).									
MET.SPEC.39.11	Explain the effects of topography on icing.						X	X		
MET.SPEC.39.12	Explain the higher concentration of water drops in stratiform orographic clouds.						X	X		
MET.SPEC.40.00	**Types of Ice Accretion**									
MET.SPEC.40.01	Define ‘clear ice’.						X	X		
MET.SPEC.40.02	Describe the conditions for the formation of clear ice.						X	X		
MET.SPEC.40.03	Explain the formation of the structure of clear ice with the release of latent heat during the freezing process.						X	X		
MET.SPEC.40.04	Describe the aspects of clear ice: appearance, weight, solidity.						X	X		
MET.SPEC.40.05	Define ‘rime ice’.						X	X		
MET.SPEC.40.06	Describe the conditions for the formation of rime ice.						X	X		
MET.SPEC.40.07	Describe the aspects of rime ice: appearance, weight, solidity.						X	X		
MET.SPEC.40.08	Define ‘mixed ice’.						X	X		
MET.SPEC.40.09	Describe the conditions for the formation of mixed ice.						X	X		
MET.SPEC.40.10	Describe the aspects of mixed ice: appearance, weight, solidity.						X	X		
MET.SPEC.40.11	Describe the possible process of ice formation in snow conditions.						X	X		
MET.SPEC.40.12	Define ‘hoar frost’.						X	X		
MET.SPEC.40.13	Describe the conditions for the formation of hoar frost.						X	X		
MET.SPEC.40.14	Describe the aspects of hoar frost: appearance, solidity.						X	X		
MET.SPEC.41.00	**Hazards of Ice Accretion, Avoidance**									
MET.SPEC.41.01	State the ICAO qualifying terms for the intensity of icing.						X	X		
MET.SPEC.41.02	Describe, in general, the hazards of icing.						X	X		
MET.SPEC.41.03	Assess the dangers of the different types of ice accretion.						X	X		
MET.SPEC.41.04	Describe the position of the dangerous zones of icing in fronts, in stratiform and cumuliform clouds, and in the different precipitation types.						X	X		
MET.SPEC.41.05	Indicate the possibilities of avoiding dangerous zones of icing:						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
	— in the flight planning: weather briefing, selection of track and altitude; — during flight: recognition of the dangerous zones, selection of appropriate track and altitude.									
MET.SPEC.42.00	**Ice Crystal Icing**									
MET.SPEC.42.01	Describe ice crystal icing.						X	X		
MET.SPEC.42.02	Describe the atmospheric processes leading to high ice crystal concentration. Define the variable ice water content (IWC).						X	X		
MET.SPEC.42.03	Identify weather situations and their relevant areas where high concentrations of ice crystals are likely to occur.						X	X		
MET.SPEC.42.04	Name, in general, the flight hazards associated with high concentrations of ice crystals.						X	X		
MET.SPEC.42.05	Explain how a pilot may possibly avoid areas with a high concentration of ice crystals.						X	X		
MET.SPEC.43.00	**Turbulence**									
MET.SPEC.43.01	Describe the effects of turbulence on an unmanned aircraft in flight.						X	X		
MET.SPEC.43.02	Indicate the possibilities of avoiding turbulence: — in the flight planning: weather briefing, selection of track and altitude; during flight: selection of appropriate track and altitude.						X	X		
MET.SPEC.43.03	Describe atmospheric turbulence and distinguish between turbulence, gustiness and wind shear.						X	X		
MET.SPEC.43.04	Describe that forecasts of turbulence are not very reliable and state that pilot reports of turbulence are very valuable as they help others to prepare for or avoid turbulence.						X	X		
MET.SPEC.44.00	**Wind Shear**									
MET.SPEC.44.01	Define 'wind shear' (vertical and horizontal).						X	X		
MET.SPEC.44.02	Define 'low-level wind shear'.						X	X		
MET.SPEC.45.00	**Weather Conditions for Wind Shear**									
MET.SPEC.45.01	Describe the conditions, where and how wind shear can form (e.g. thunderstorms, squall lines, fronts, inversions, land and sea breeze, friction layer, relief).						X	X		
MET.SPEC.46.00	**Effects on Flight, Avoidance**									

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
MET.SPEC.46.01	Describe the effects of wind shear on flight.									
MET.SPEC.46.02	Indicate the possibilities of avoiding wind shear in flight: — in the flight planning; — during flight.									
MET.SPEC.47.00	**Thunderstorms**									
MET.SPEC.47.01	Conditions for and process of development, forecast, location, type specification.						X	X		
MET.SPEC.47.02	Name the cloud types which indicate the development of thunderstorms.	X	X	X						
MET.SPEC.47.03	Describe the different types of thunderstorms, their location, the conditions for and the process of development, and list their properties (air-mass thunderstorms, frontal thunderstorms, squall lines, supercell storms, orographic thunderstorms).							X		
MET.SPEC.48.00	**Structure of Thunderstorms, Life Cycle**									
MET.SPEC.48.01	Assess the average duration of thunderstorms and their different stages.						X	X		
MET.SPEC.48.02	Describe a supercell storm: initial, supercell, tornado and dissipating stage.						X	X		
MET.SPEC.48.03	Summarise the flight hazards associated with a fully developed thunderstorm.						X	X		
MET.SPEC.48.04	Indicate on a sketch the most dangerous zones in and around a single-cell and a multi-cell thunderstorm.						X	X		
MET.SPEC.49.00	**Electrical Discharges**									
MET.SPEC.49.01	Describe the basic outline of the electric field in the atmosphere.						X	X		
MET.SPEC.49.02	Describe types of lightning, i.e. ground stroke, intra-cloud lightning, cloud-to-cloud lightning, upward lightning.								X	X
MET.SPEC.49.03	Reserved									
MET.SPEC.49.04	Describe the development of lightning discharges.						X	X		
MET.SPEC.49.05	Describe the effect of lightning strike on unmanned aircraft and flight execution.						X	X		
MET.SPEC.50.00	**Development and Effects of Downbursts**									
MET.SPEC.50.01	Define the term ‘downburst’.						X	X		
MET.SPEC.50.02	Distinguish between macroburst and microburst.						X	X		
MET.SPEC.50.03	State the weather situations leading to the formation of downbursts.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
MET.SPEC.50.04	Describe the process of development of a downburst.						X	X		
MET.SPEC.50.05	Give the typical duration of a downburst.						X	X		
MET.SPEC.50.06	Describe the effects of downbursts.						X	X		
MET.SPEC.51.00	**Thunderstorm Avoidance**									
MET.SPEC.51.01	Explain how the pilot can anticipate each type of thunderstorm: through pre-flight weather briefing, observation in flight, use of specific meteorological information, use of information given by ground weather radar and by airborne weather radar.						X	X		
MET.SPEC.51.02	Describe practical examples of flight techniques used to avoid the hazards of thunderstorms.						X	X		
MET.SPEC.52.00	**Tornadoes**									
MET.SPEC.52.01	Define 'tornado'.						X	X		
MET.SPEC.52.02	Describe the formation of a tornado.						X	X		
MET.SPEC.52.03	Describe the typical features of a tornado such as appearance, season, time of day, stage of development, speed of movement, and wind speed.						X	X		
MET.SPEC.52.04	Compare the dimensions and properties of tornadoes and dust devils.						X	X		
MET.SPEC.53.00	**Inversions**									
MET.SPEC.53.01	Compare the flight hazards during take-off and approach associated with a strong inversion alone and with a strong inversion combined with marked wind shear.						X	X		
MET.SPEC.54.00	**Hazards in Mountainous Areas**									
MET.SPEC.54.01	Describe the influence of mountainous area on a frontal passage.						X	X		
MET.SPEC.54.02	Describe the vertical movements, wind shear and turbulence that are typical of mountain areas.						X	X		
MET.SPEC.54.03	Indicate on a sketch of a chain of mountains the turbulent zones (mountain waves, rotors).						X	X		
MET.SPEC.54.04	Explain the influence of relief on ice accretion.						X	X		
MET.SPEC.55.00	**Development and Effect of Valley Inversions**									
MET.SPEC.55.01	Describe the formation of a valley inversion due to katabatic winds.						X	X		
MET.SPEC.55.02	Describe the valley inversion formed by warm winds aloft.						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
MET.SPEC.55.03	Describe the effects of a valley inversion for an unmanned aircraft in flight.						X	X		
MET.SPEC.56.00	**Meteorological Information**									
MET.SPEC.56.01	Demonstrate ability to obtain, interpret and apply meteorological reports and forecasts for operations.	X	X	X						
MET.SPEC.56.02	Define 'gusts' as given in METARs.							X		
MET.SPEC.56.03	Distinguish wind given in METARs and wind given by the control tower for take-off and landing.						X	X		
MET.SPEC.56.04	Define 'visibility'.						X	X		
MET.SPEC.56.05	Describe the meteorological measurement of visibility.						X	X		
MET.SPEC.56.06	Define 'prevailing visibility'.						X	X		
MET.SPEC.56.07	Define 'ground visibility'.						X	X		
MET.SPEC.56.08	List the units used for visibility (m, km, statute mile).						X	X		
MET.SPEC.56.09	Define 'runway visual range'.						X	X		
MET.SPEC.56.11	Describe the meteorological measurement of runway visual range.						X	X		
MET.SPEC.56.12	Indicate where the transmissometers/forward-scatter meters are placed on the aerodrome.						X	X		
MET.SPEC.56.13	List the units used for runway visual range (m, ft).						X	X		
MET.SPEC.56.14	List the different possibilities to transmit information to pilots about runway visual range.						X	X		
MET.SPEC.56.15	Compare ground visibility, prevailing visibility, and runway visual range.						X	X		
MET.SPEC.56.16	Indicate the means of observation of present weather.						X	X		
MET.SPEC.56.17	Indicate the means of observing clouds for the purpose of recording: type, amount, height of base (ceilometers), and top.						X	X		
MET.SPEC.56.18	State the clouds which are indicated in METAR, TAF and SIGMET.						X	X		
MET.SPEC.56.19	Define 'oktas'.						X	X		
MET.SPEC.56.20	Define 'cloud base'.						X	X		
MET.SPEC.56.21	Define 'ceiling'.						X	X		
MET.SPEC.56.22	Name the unit and the reference level used for information about cloud base (ft).						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
MET.SPEC.56.23	Define 'vertical visibility'.						X	X		
MET.SPEC.56.24	Explain briefly how and when vertical visibility is measured.						X	X		
MET.SPEC.56.25	Name the units used for vertical visibility (ft, m).						X	X		
MET.SPEC.56.26	Indicate the means of observation of air temperature (thermometer).						X	X		
MET.SPEC.56.27	Name the units of relative humidity (%) and dew-point temperature (Celsius, Fahrenheit).						X	X		
MET.SPEC.57.00	**Satellite Observations**									
MET.SPEC.57.01	Describe the basic outlines of satellite observations.						X	X		
MET.SPEC.57.02	Name the main uses of satellite pictures in aviation meteorology.						X	X		
MET.SPEC.57.03	Describe the different types of satellite imagery.						X	X		
MET.SPEC.57.04	Interpret qualitatively the satellite pictures to get useful information for flights: — location of clouds (distinguish between stratiform and cumuliform clouds).						X	X		
MET.SPEC.57.06	Interpret qualitatively the satellite pictures in order to get useful information for flights: — location of fronts.						X	X		
MET.SPEC.58.00	**Weather Radar Observations**									
MET.SPEC.58.01	Describe the basic principle and the type of information given by a ground weather radar.						X	X		
MET.SPEC.58.01	Interpret ground weather radar images.						X	X		
MET.SPEC.58.01	Describe the basic principle and the type of information given by airborne weather radar.						X	X		
MET.SPEC.58.01	Describe the limits and the errors of airborne weather radar information.						X	X		
MET.SPEC.58.01	Interpret typical airborne weather radar images.						X	X		
MET.SPEC.59.00	**Unmanned Aircraft Observations and Reporting**									
MET.SPEC.59.01	Describe routine air-report and special air-report (ARS).						X	X		
MET.SPEC.59.02	State the obligation of a pilot to prepare air-reports.						X	X		
MET.SPEC.59.03	Name the weather phenomena to be stated in an ARS.						X	X		
MET.SPEC.60.00	**Weather Charts**									
MET.SPEC.60.01	Decode and interpret significant weather charts (low, medium and high level).						X	X		

Syllabus Reference	Syllabus details and associated Learning Objectives	GVC	L1 A	L1 R	L2 A	L2 R	L3 A	L3 R	L4 A	L4 R
MET.SPEC.60.02	Describe from a significant weather chart the flight conditions at designated locations or along a defined flight route at a given FL.						X	X		
MET.SPEC.61.00	**Surface Charts**									
MET.SPEC.61.01	Recognise the following weather systems on a surface weather chart (analysed and forecast): ridges, cols and troughs; fronts; frontal side, warm sector and rear side of mid-latitude frontal lows; high- and low-pressure areas.						X	X		
MET.SPEC.61.02	Determine from surface weather charts the wind direction and speed.						X	X		
MET.SPEC.62.00	**Information for Flight Planning**									
MET.SPEC.62.01	Describe, decode and interpret the following aviation weather messages (given in written or graphical format): METAR, aerodrome special meteorological report (SPECI), trend forecast (TREND), TAF, information concerning en-route weather phenomena which may affect the safety of unmanned aircraft operations (SIGMET), information concerning en-route weather phenomena which may affect the safety of low-level unmanned aircraft operations (AIRMET), area forecast for low-level flights (GAMET), ARS, volcanic ash advisory information.						X	X		
MET.SPEC.62.02	Describe the general meaning of MET REPORT and SPECIAL REPORT.						X	X		

Appendix C – Remote Pilot Competence

APPLICATION OF KNOWLEDGE

Application of Knowledge (APK)	
Description: Demonstrates knowledge and understanding of relevant information, operating instruction, unmanned aircraft systems and the operating environment.	
Observable Behaviours	
1	Demonstrates practical and applicable knowledge of limitations and systems and their interactions
2	Demonstrates required knowledge of published operating instructions
3	Demonstrates knowledge of the physical environment, the air traffic environment including routings, weather, airports, and the operational infrastructure
4	Demonstrates appropriate knowledge of applicable legislation
5	Knows where to source required information
6	Demonstrates a positive interest in acquiring knowledge
7	Can apply knowledge effectively

APPLICATION OF PROCEDURES & COMPLIANCE WITH REGULATIONS

Application of Procedures & Compliance with Regulations (PCR)	
Description: Identifies and applies procedures in accordance with published operating instructions and applicable regulations, using the appropriate knowledge.	
Observable Behaviours	
1	Identifies the source of operating instructions
2	Follows standard operating procedures (SOPs) unless a higher degree of safety dictates an appropriate deviation
3	Identifies and follows all operating instructions in a timely manner
4	Correctly operates the UAS and associated equipment
5	Complies with applicable regulations
6	Applies relevant procedural knowledge

SITUATIONAL AWARENESS

Situational Awareness (SIT)	
Description: Perceives and comprehends the operational situation of the moment and all of the relevant information available and anticipates what could happen that may affect the operation.	
Observable Behaviours	
1	Identifies and assesses accurately the state of the UAS
2	Identifies and assesses accurately the UAS vertical and lateral position, and its anticipated flight path
3	Identifies and assesses accurately the general environment as it may affect the flight, including the air traffic neighbouring the UAS operation and the meteorological conditions

	that could impact the operation
4	Conducts the operation in accordance with the airspace configuration where the UAS operation is taking place
5	Keeps track of time and energy
6	Maintains awareness of the people involved in or affected by the operation and their capacity to perform as expected
7	Anticipates accurately what could happen, plans, and stays ahead of the situation
8	Develops effective contingency plans based upon potential threats
9	Recognizes and effectively responds to indications of reduced situational awareness

COMMUNICATION

Communication (COM)	
Description: Demonstrates effective verbal, written and nonverbal communications, in normal and abnormal situations.	
Observable Behaviours	
1	Ensures the recipient is ready and able to receive the information
2	Selects appropriately what, when how and with whom to communicate
3	Conveys messages clearly, accurately, and concisely
4	Confirms that the recipient correctly understands important information
5	Listens actively and demonstrates understanding when receiving information
6	Asks relevant and effective questions – Adheres to standard radiotelephony phraseology and procedures
7	Accurately reads and interprets required documentation for the operation of UAS
8	Accurately reads, interprets, constructs and responds to datalink messages
9	Completes accurate reports as required by operating procedures
10	Correctly interprets non-verbal communication
11	Where applicable, uses eye contact, body movement and gestures that are consistent with and support verbal messages

RPA FLIGHT PATH MANAGEMENT AND AUTOMATION

UA Flight Path Management, Automation (FPM)	
Description: Controls the RPA flight path through automation, including appropriate use of flight management system(s) and guidance.	
Observable Behaviours	
1	Controls the RPA through automation with accuracy and smoothness as appropriate to the situation
2	Contains the RPA within the normal flight envelope
3	Maintains the desired flight path during flight using automation
4	Takes appropriate action in case of deviations from the desired RPA trajectory
5	Selects appropriate level and mode of automation in a timely manner considering phase of flight and workload
6	Effectively monitors automation, including engagement and automatic mode transitions
7	Controls the RPA safely in degraded automation using only the relationship between RPA attitude, speed and thrust if applicable

LEADERSHIP, TEAMWORK, AND SELF-MANAGEMENT

Leadership, Teamwork and Self-Management (LTS)	
Description: Demonstrates effective leadership, team working and self-management.	
Observable Behaviours	
1	Understands and agrees with the crew's roles and objectives
2	Creates an atmosphere of open communication and encourages team participation
3	Uses initiative and gives directions when required
4	Admits mistakes and takes responsibility for own performance, detecting and resolving own errors
5	Anticipates and responds appropriately to other crew members' needs
6	Carries out instructions when directed
7	Communicates relevant concerns and intentions
8	Gives and receives feedback constructively
9	Confidently intervenes when important for safety
10	Demonstrates empathy and shows respect and tolerance for other people
11	Engages others in planning and allocates activities fairly and appropriately according to abilities
12	Addresses and resolves conflicts and disagreements in a constructive manner
13	Demonstrates self-control in all situations
14	Self-evaluates the effectiveness of actions

PROBLEM SOLVING AND DECISION MAKING

Problem Solving and Decision Making (PDM)	
Description: Accurately identifies risks and resolves problems. Uses the appropriate decision-making processes.	
Observable Behaviours	
1	Seeks accurate and adequate information from appropriate sources
2	Identifies and verifies what and why things have gone wrong
3	Employs proper problem-solving strategies
4	Perseveres in working through problems without reducing safety
5	Uses appropriate and timely decision-making processes
6	Identifies and considers options effectively
7	Monitors, reviews and adapts decisions as required
8	Identifies and manages risks and threats to the safety of the UAS and people effectively
9	Changes behaviour and responds as needed to deal with the demands of the changing situation

WORKLOAD MANAGEMENT

Workload Management (WLM)	
Description: Manages available resources efficiently to prioritize and perform tasks in a timely manner under all circumstances.	
Observable Behaviours	
1	Plans, prioritizes, and schedules tasks effectively
2	Manages time efficiently when carrying out tasks
3	Offers and accepts assistance, delegates when necessary and asks for help early
4	Reviews, monitors, and crosschecks actions conscientiously
5	Verifies that tasks are completed to the expected outcome
6	Manages and recovers from interruptions, distractions, variations and failures effectively

Annex A to Article 11

Rules for conducting a risk assessment

Due to the size of the AMC and GM for Article 11, it has been included as a set of Annexes to this document.

GM1 Article 11 Annex A – Guidance for the submission of compliance evidence to the CAA

1. Introduction

1.1 This annex is intended to serve as guidance to support an applicant with gathering, presenting, and retaining their compliance evidence as part of their UK SORA application. The term compliance evidence is used to emphasise the goal of providing evidence that demonstrates compliance to a regulation, requirement, or standard.

1.2 An applicant should consider what they are trying to demonstrate with their chosen compliance evidence. For example, if they are aiming to demonstrate compliance with a specific technical standard then the compliance evidence would likely be some form of technical data rather than an operations document. This is not to say that an operations document couldn't be used as evidence, but it would be unlikely that it is specific enough to be considered compliance evidence for a technical standard, and so, on its own, would be unlikely to be accepted as compliance with the overall requirement.

What is a compliance approach?

1.3 In this context a compliance approach is meant as a systematic approach used to ensure an applicant complies with the relevant regulation, requirement or standard. The UK SORA Application Service is designed to support applicants to submit their compliance approach and compliance evidence in a structured format.

What is compliance evidence?

1.4 Compliance evidence is the term used to describe a piece of evidence used to demonstrate compliance with a regulation, requirement or standard. Compliance evidence may take several forms such as:

(i) Flight logs.

(ii) Technical data sheet.

(iii) Flight tests.

(iv) Design information.

1.5 Evidence used to demonstrate compliance should be relevant to the intended regulation, requirement or standard i.e. if the compliance evidence is a section or paragraph within a document then that section must be clearly referenced rather than submitting the entire document as evidence. For example:

(i) Acceptable: Ref: Technical Manual 7602, Section 7, page 16.

(ii) Not Acceptable: Ref: Technical Manual 7602.

Collecting, Presenting and Storing Evidence

1.6 When collecting compliance evidence, it is crucial that all relevant information is included. Any form of compliance evidence submitted to the CAA must be in a legible and understandable format.

1.7 Compliance evidence must be stored for the duration of the authorisation and be available to CAA assessors upon request. Where compliance evidence contains personal data, it is recommended to follow UK Government advice on General Data Protection Regulation (GDPR).

1.8 For each requirement in UK SORA, the Applicant must present compliance evidence to the CAA as follows:

1.9 The Applicant enters a compliance statement into the UK SORA Application Service. A compliance statement is a simple statement (a single sentence typically suffices) which describes the method through which the Applicant has complied with the requirement. For example:

1.10 Requirement (CAA): “Effects of impact dynamics and immediate post impact hazards, critical area or the combination of these results are reduced such that the risk to population is reduced by an approximate 1 order of magnitude (90%).”

(1) Compliance statement (Applicant): "Calculation of the UAS deceleration with parachute deployed combined with flight testing shows that the ground impact is reduced by 1 order of magnitude."

1.11 Provide compliance evidence: the physical report(s) that evidence the compliance statement has been achieved. For example:

(1) Parachute deployment analysis report no.XYZ.pdf

(2) Parachute deployment flight test report no.ABC.pdf

Using the UK SORA annexes

1.12 The CAA has developed a reference system for Applicants to quickly identify requirements that are relevant to their application. Below is some guidance on how to use this system.

Table 14 - Example Requirements

Level of integrity

Criterion	Low (SAIL 2)	Medium (SAIL 3)	High (SAIL 4 to 6)
Technical issue with the UAS	OSO1.L.I	OSO1.L.I OSO1.M.I	OSO1.H.I

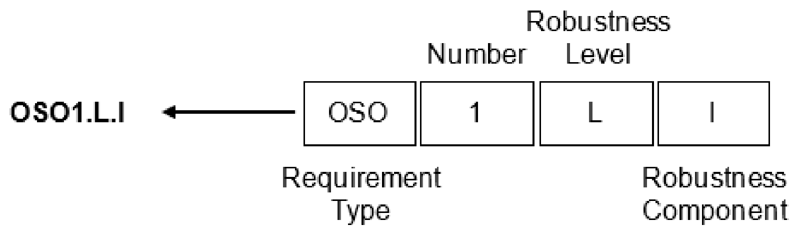
Level of assurance

Criterion	Low (SAIL 2)	Medium (SAIL 3)	High (SAIL 4 to 6)
Technical issue with the UAS	OSO1.L.A	OSO1.M.A OSO1.M.I	OSO1.H.A

Using requirement codes

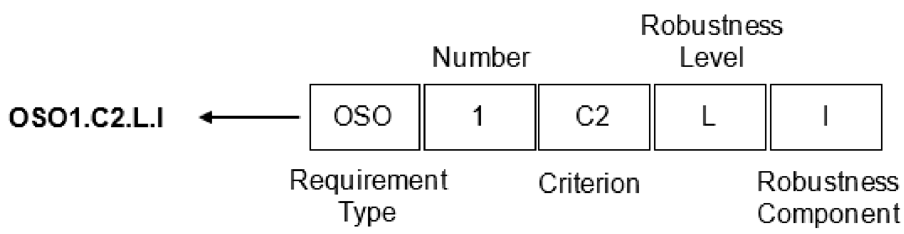
1.13 All UK SORA requirements have a requirement code, which may be used to find AMC and GM. Figure 7 shows an example of a requirement code for SAIL 2 at low integrity with a single criterion.

Figure 7 - Requirement codes single criterion



1.14 Some requirements have several criteria, this is displayed after the requirement number, prefixed by the letter C for example C2 shown below in figure 8.

Figure 8 - Requirement codes multiple criterion



Using the reference system

Integrity requirements

1.15 Requirement codes ending with the letter I (robustness component) represent integrity requirements and must be complied with. Example:

The Applicant **must** meet the following requirements:

(a) Requirement 1.

(b) Requirement 2.

Assurance requirements

1.16 Requirement codes ending with the letter A represent assurance requirements and **must** be complied with. Example:

The Applicant must meet the following requirements:

(a) The Applicant must provide evidence of compliance with the Integrity requirements.

AMC

1.17 Requirement codes prefixed by the letters AMC may be used to demonstrate compliance with the requirement. **AMC.OSO1.L.I** relates to **Low Integrity**. Where AMC relates to a specific requirement or multiple requirements, the corresponding letter is used. For example:

(b) The standard 1234 may be used to demonstrate compliance with the requirement.

GM

1.18 Requirement codes prefixed by the letters GM explain how the Applicant may comply and gives general guidance material relating to the overall requirement. **GM.OSO1.L.A** relates to **Low Assurance**. Where GM relates to a specific requirement or multiple requirements the corresponding robustness letter is used.

Additional Requirements

1.19 As the SAIL level increases the robustness level and the corresponding number of requirements may also increase. Using the tables provided, the Applicant may identify additional requirements. In this example, SAIL 3 has medium integrity requirements **OSO1.M.I** in addition to low.

LEVEL of INTEGRITY
Medium (SAIL 3)
OSO1.L.I **OSO1.M.I**

1.20 Above the additional requirement details section, coloured boxes with the relevant codes display any **lower** robustness requirement for ease of reference. For example:

Lower robustness level requirements to be complied with:

- OSO1.L.I
- OSO1.L.A

1.21 Following the low robustness level requirements, additional requirements are listed in the same format as above.

Annex B to Article 11

Article 11 Annex B – AMC1 Strategic Mitigations for Ground Risk

1. Introduction

1.1 Annex B provides the integrity and assurance requirements for the Applicant's proposed mitigations. The proposed mitigations are intended to reduce the intrinsic Ground Risk Class (iGRC) associated with a given operation. The identification and implementation of the mitigations are the responsibility of the Applicant.

1.2 A proposed mitigation may or may not have a positive effect on reducing the ground risk associated with the operation. In the case where a mitigation is available but does not reduce the ground risk, its level of integrity should be considered "None".

1.3 To achieve a given level of robustness, when more than one criterion exists for that level of robustness, all applicable criteria need to be met, unless specified otherwise.

1.4 If a criterion is not applicable to a mitigation, e.g. passive mitigations do not require training nor activation, the criterion may be ignored.

1.5 Annex B mitigations are primarily applied to the operational volume and ground risk buffer.

1.6 The GRC may not be lowered to a value less than the corresponding value for a controlled ground area.

1.7 A number of requirements, such as those labelled "Technical design", would typically require the support of the UAS or equipment Designer, unless they have already been complied with by the Designer through a SAIL mark certificate. See GM1 to Article 11(6) for further information on RAE-F and SAIL Mark.

1.8 The applicant may claim more points of GRC reduction than indicated in Step 3 of the UK SORA process, when the appropriate orders of magnitude of reduction of the risk to uninvolved people may be demonstrated. Any of these claims should be fulfilled to the high robustness level. For example, a reduction by 3 points to the final GRC may be granted by the CAA for an M2 mitigation if the Applicant may demonstrate a reduction of 3 orders of magnitude of the risk to uninvolved people. This would be achieved by showing a 99.9% reduction of the risk to uninvolved people in Criterion 1, with Criteria 2 and 3 complied with to a high robustness level.

M1A – Strategic mitigation – sheltering

AMC1 Article 11 Annex B. M1A Strategic mitigation – sheltering

M1A Sheltering – Level of integrity

Criterion	Low	Medium	High
Criterion 1 (Evaluation of people at risk)	M1A.C1.L.I	M1A.C1.L.I M1A.C1.M.I	Not applicable
Criterion 2 (Evaluation of penetration hazard)	M1A.C2.L.I	M1A.C2.L.I	Not applicable

M1A Sheltering – Level of assurance

Criterion	Low	Medium	High
Criterion 1 (Evaluation of people at risk)	M1A.C1.L.A	M1A.C1.L.A M1A.C1.M.A	Not applicable
Criterion 2 (Evaluation of penetration hazard)	M1A.C2.L.A	M1A.C2.L.A	Not applicable

Low level of robustness

M1A.C1.L.I

Criterion 1- Evaluation of people at risk

If the applicant claims a reduction in ground risk due to a sheltered operational environment, the applicant **must**:

(a) Only fly over operational environments which generally consist of structures providing shelter.

(b) Verify that they reasonably expect uninvolved people will be located under or inside a structure.

This mitigation may not be applied when only overflying open-air assemblies of people or areas with no shelter.

M1A.C2.L.I

Criterion 2 – Evaluation of penetration hazard

The applicant **must** use a UA that is not expected to penetrate structures and fatally injure people under the shelter.

M1A.C1.L.A

Criterion 1- Evaluation of people at risk

(a) The Applicant **must** provide evidence of compliance with the integrity requirements.

(b) The evidence should be in the form of a report that describes that the operation is in an environment that has structures providing shelter where people are generally expected to be, and the applicant does not fly over large open-air assemblies of people.

M1A.C2.L.A

Criterion 2 – Evaluation of penetration hazard

The applicant **must** submit a declaration of compliance that the UA used is under 25 kg MTOM.

OR

For UA with MTOM higher than 25 kg, the applicant **must** provide compliance evidence that the required level of integrity is achieved. This should be a report detailing testing, analysis, simulation, inspection, design review or through operational experience.

Medium level of robustness

Lower robustness level requirements to be complied with:

- **M1A.C1.L.I**
- **M1A.C2.L.I**
- **M1A.C1.L.A**
- **M1A.C2.L.A**

Additional requirements to be compiled with:

M1A.C1.M.I

Criterion 1- Evaluation of people at risk

(a) Same as low. In addition, the applicant **must** restrict operating times and demonstrate that an even higher proportion of uninvolved people are sheltered, compared to at the low level of robustness.

M1A.C2.M.I

Criterion 2 – Evaluation of penetration hazard

No additional requirements.

M1A.C1.M.A

Criterion 1- Evaluation of people at risk

(a) Same as Low. In addition, the applicant **must** have time-based restrictions in place and provide compliance evidence to support that a higher proportion of people are sheltered.

Medium robustness M1(A) mitigation may not be combined with M1(B) mitigations.

M1A.C2.M.A

Criterion 2 – Evaluation of penetration hazard

No additional requirements.

GM1 Article 11 Annex B. M1A Strategic mitigation – sheltering

GM.M1A

M1(A) mitigation relies on the fact that people spend on average very little time outdoors without protection from structures. Therefore, operators of sufficiently small UAS may expect that a large percentage of the population will be sheltered from potential impacts. For larger UAS, the effectiveness of this sheltering assumption must be demonstrated.

Time-based arguments, such as the claim that flying at night reduces risk because fewer people are outdoors, are not applicable at low robustness. However, these arguments are included at medium robustness.

Sheltering at low robustness is considered a generally applicable mitigation based on the environmental characteristics where the UAS is operated. This mitigation does not involve any additional operational restrictions. To avoid double counting, M1(A) medium robustness mitigations may not be combined with any M1(B) mitigations. In contrast, M1(A) low robustness, which has no operational restrictions, may be combined with M1(B) mitigations.

GM.M1A.C1.L.I

(a) The consideration of this mitigation may vary based on local conditions. The intention is to estimate the proportion of people outside on average and not at a specific time of day or year. There will be times when at specific locations temporarily there are more people exposed, but it should be sufficient to expect that on average the proportion of people exposed outside is below 10%.

GM.M1A.C2.L.I

Guidance on how to evaluate sheltering effect can be found from:

(a) ASSURE UAS Ground Collision Severity Evaluation A4 report section "4.12. Structural Standards for Sheltering (KU)", pages 103 to 111, or

(b) MITRE presentation given during the UAS Technical Analysis and Applications Centre (TAAC) conference in 2016 titled ‘UAS EXCOM Science and Research Panel (SARP) 2016 TAAC Update’ - PR 16-3979.

In general, it may be expected that UAS weighing less than 25 kg are not able to penetrate buildings except in rare cases where the UAS speed or building materials are unusual (tents, glass roofs, etc).

GM.M1A.C1.L.A

(a) For example, a city or town consists generally of structures providing shelter. While it may also include areas that are not sheltered, the mitigation is expected to be provided in most of such cases.

M1B – Strategic mitigation using operational restrictions

AMC1 Article 11 Annex B. M1B Strategic mitigation using operational restrictions

M1B Operational restrictions – Level of integrity

Criterion	Low	Medium	High
Criterion 1 (Evaluation of people at risk)	Not applicable	M1B.C1.M.I	M1B.C1.M.I
Criterion 2 (Impact on at risk population)	Not applicable	M1B.C2.M.I	M1B.C2.M.I M1B.C2.H.I

M1B Operational restrictions – Level of assurance

Criterion	Low	Medium	High
Criterion 1 (Evaluation of people at risk)	Not applicable	M1B.C1.M.A	M1B.C1.M.A M1B.C1.H.I
Criterion 2 (Impact on at risk population)	Not applicable	M1B.C2.M.A	M1B.C2.M.A M1B.C2.H.I

Medium level of robustness

M1B.C1.M.I

Criterion 1- Evaluation of people at risk

The applicant **must** provide space-time based restrictions (e.g., flying over a market square when it is not crowded) to substantiate that the actual density of people during the operation is lower than the iGRC. This **must** be done by:

(a) An analysis or appraisal of characteristics of the location and time of operation.

And/or.

(b) Use of temporal density data (e.g., data from a supplemental data service provider) relevant for the proposed area. This may incorporate real time or historical data.

M1B.C2.M.I

Criterion 2 – Impact on at risk population

The at-risk population **must** be lowered by at least 1 iGRC population band (~90%) using one or more methods described in the Level of Integrity for Criterion 1 above.

M1B.C1.M.A

Criterion 1- Evaluation of people at risk

The applicant **must** provide compliance evidence of the data sources and processes used to claim lowering the density of population at risk.

M1B.C2.M.A

Criterion 2 – Impact of at-risk population

The applicant **must** provide compliance evidence that the required level of integrity is achieved. This is typically achieved by means of analysis, simulation, surveys or through operational experience.

High level of robustness

Lower robustness level requirements to be complied with:

- **M1B.C1.M.I**
- **M1B.C2.M.I**
- **M1B.C1.M.A**
- **M1B.C2.M.A**

Additional requirements to be compiled with:

M1B.C1.H.I

Criterion 1- Evaluation of people at risk

No additional requirements.

M1B.C2.H.I

Criterion 2 – Impact on population

The at-risk population **must** be lowered by at least 2 iGRC population bands (~99%) using one or more methods described in the Level of Integrity for Criterion 1 above.

M1B.C1.H.A

Criterion 1- Evaluation of people at risk

No additional requirements

M1B.C2.H.A

Criterion 2 – Impact on population

No additional requirements

GM1 Article 11 Annex B. M1B Strategic mitigation using operational restrictions

GM.M1B

M1(B) mitigations are intended to reduce the number of people at risk on the ground independently of sheltering. These mitigations are applied pre-flight.

GM.M1B.C1.M.I

Characteristics of the location should be understood as land use that relates to the presence of people, e.g., industrial area, urban park, or shopping centres. Time should be understood as time of day or day of the week that would influence the presence of people, e.g., weekend for industrial plants, night-time, time after opening hours of shops.

M1C – Tactical Mitigations – Ground observation

AMC1 Article 11 Annex B. M1C Tactical Mitigations – Ground observations

M1C Ground observations – Level of integrity

Criterion	Low	Medium	High
Criterion 1 (Procedures)	M1C.C1.L.I	Not applicable	Not applicable
Criterion 2 (Technical means)	M1C.C2.L.I	Not applicable	Not applicable

M1C Ground observations – Level of assurance

Criterion	Low	Medium	High
Criterion 1 (Procedures)	M1C.C1.L.A	Not applicable	Not applicable
Criterion 2 (Technical means)	M1C.C2.L.A	Not applicable	Not applicable

Low level of robustness

M1C.C1.L.I

Criterion 1- Procedures

(a) The applicant **must** implement a procedure for remote crew members to observe the overflown areas during the operation and identify area(s) of less risk on the ground.

(b) The remote pilot **must** reduce the number of people at risk by adjusting the flight path while the operation is ongoing (e.g., flying away from the area with a higher risk on the ground or overflying only the identified area(s) of less risk on the ground).

M1C.C2.L.I

Criterion 2 – Technical means

If the mitigation is achieved using technical means (e.g., camera(s) mounted on the UA or visual ground observers with radios/phones), these **must** provide data of sufficient quality allowing reliable detection of uninvolved people on the ground.

M1C.C1.L.A

Criterion 1- Procedures

(a) The Applicant **must** provide evidence of compliance with the integrity requirements. The procedure should include:

(1) A clear communication plan, which should use standard phraseology.

(2) Backup procedures in event of a technical issue.

M1C.C2.L.A

Criterion 2 – Technical means

The Applicant **must** provide evidence of compliance with the integrity requirements.

GM1 Article 11 Annex B. M1C Tactical Mitigations – Ground observation

GM.M1C

M1(C) mitigation is a tactical mitigation where the remote crew or the system may observe most of the overflown area(s), allowing the detection of uninvolved people in the operational area and manoeuvring the UA, so that the number of uninvolved people overflown during the operation is significantly reduced.

M2 – Effects of UA impact dynamics are reduced

AMC1 Article 11 Annex B. M2 Effects of UA impact dynamics are reduced

M2 Effects of UA impact dynamics are reduced – Level of integrity

Criterion	Low	Medium	High
Criterion 1 (Technical Design)	Not applicable	M2.C1.M.I	M2.C1.M.I M2.C1.H.I
Criterion 2 (Procedures)	Not applicable	M2.C2.M.I	M2.C2.M.I
Criterion 3 (Training)	Not applicable	M2.C3.M.I	M2.C3.M.I

M2 Effects of UA impact dynamics are reduced – Level of assurance

Criterion	Low	Medium	High
Criterion 1 (Technical Design)	Not applicable	M2.C1.M.A	M2.C1.H.A

Criterion	Low	Medium	High
Criterion 2 (Procedures)	Not applicable	M2.C2.M.A	M2.C2.M.A M2.C2.H.A
Criterion 3 (Training)	Not applicable	M2.C3.M.A	M2.C3.M.A

Medium level of robustness

M2.C1.M.I

Criterion 1 – Technical design

(a) Effects of impact dynamics and immediate post-impact hazards, critical area, or the combination thereof, **must** be reduced such that the risk to uninvolved people is reduced by an approximate 1 order of magnitude (90%).

(b) In case of a failure that may lead to a crash, the UAS **must** contain all elements required for the activation of the mitigation.

(c) Any failure of the mitigation itself **must not** adversely affect the safety of the operation.

M2.C2.M.I

Criterion 2 – Procedures

Any equipment used to reduce the effect of the UA impact dynamics **must** be installed and maintained in accordance with the Designer's instructions.

M2.C3.M.I

Criterion 3 – Training

(a) When use of the mitigation requires action from the remote crew, then appropriate training **must** be provided for the remote crew by the operator.

(b) The operator **must** ensure that the personnel responsible (internal or external) for the installation and maintenance of the mitigation measures are qualified for the task.

M2.C1.M.A

Criterion 1 – Technical design

(a) The Applicant **must** provide evidence of compliance with the Integrity requirements.

(b) If compliance evidence is provided through simulation, the validity of the target environment used in the simulation **must** be justified.

M2.C2.M.A

Criterion 2 – Procedures

(a) The installation and maintenance procedures **must** be developed to a standard or means of compliance acceptable to the CAA.

(b) The adequacy of the procedures **must** be demonstrated through either of the following methods:

(1) Dedicated flight test.

(2) Simulation, provided that the representativeness of the simulation is proven valid for the intended purpose with positive results.

(c) If (a), (b) and Integrity requirements are complied with through a SAIL mark certificate, the applicant **must** demonstrate that the procedures developed by the Designer in (a) are followed by the operator.

(d) The Applicant **must** provide evidence of compliance with the Integrity requirements.

M2.C3.M.A

Criterion 3 – Training

(a) The applicant **must** have developed a training syllabus which **must** be competency based.

(b) The operator **must** provide competency-based, theoretical, and practical training for the remote crew.

(c) Personnel responsible for installation and maintenance of the mitigation measures **must** have completed relevant training.

(d) The Applicant **must** provide evidence of compliance with the Integrity requirements.

AMC.M2.C1.M.A

Criterion 1 – Technical design

(a) A UAS with an MTOM less than or equal to 900g and a maximum speed of 19m/s may provide automatic compliance with the requirement.

AMC.M2.C2.M.A

Criterion 2 – Procedures

(b) The following standard may be used to demonstrate compliance with the requirement:

Annex E Paragraph 1.5 provides further information about proposing a standard as an AMC.

High level of robustness

Lower robustness level requirements to be complied with:

- **M2.C1.M.I**
- **M2.C2.M.I**

- **M2.C2.M.A**
- **M2.C3.M.I**
- **M2.C3.M.A**

Additional requirements to be compiled with:

M2.C1.H.I

Criterion 1 – Technical design

(a) Effects of impact dynamics and immediate post-impact hazards, critical area, or the combination thereof, **must** be reduced such that the risk to uninvolved people is reduced by an approximate 2 orders of magnitude (99%).

(b) The activation of the mitigation **must** be automated.

M2.C2.H.I

Criterion 2 – Procedures

No additional requirements.

M2.C3.H.I

Criterion 3 – Training

No additional requirements.

M2.C1.H.A

Criterion 1 – Technical design

The Integrity requirements **must** be complied with to a standard or means of compliance acceptable to the CAA.

M2.C2.H.A

Criterion 2 – Procedures

(a) The flight tests performed to validate the procedures **must** cover the entire flight envelope or be demonstrated to be conservative.

(b) If (a) and Integrity requirements are complied with through a SAIL mark certificate, the Applicant **must** demonstrate that the flight envelope of the intended operation is the same as or contained within the flight envelope considered by the Designer.

M2.C3.H.A

Criterion 3 – Training

No additional requirement.

AMC.M2.C1.H.A

Criterion 1 – Technical design

The following standard may be used to demonstrate compliance with the requirement:

[Standard will be added later]

GM1 Article 11 Annex B. M2 Effects of UA impact dynamics are reduced

GM.M2

(a) M2 mitigation reduces the effect of ground impact after the control of the operation has been lost. This is achieved either through:

(1) Reducing the probability of lethality of the UA's impact, e.g. energy, impulse, energy transfer dynamics, etc., and/or,

(2) Reducing the size of the expected critical area as shown in the table below, e.g. with the use of parachutes, autorotation, frangibility, stalling the UA to slow the descent and increase the impact angle, etc.

The applicant should demonstrate a required total amount of reduction in either or both factors.

(b) The base assumption in SORA for UAS impact lethality before M2 mitigation is applied is that most impacts are lethal, with the following exceptions:

(1) Impacts from a glide of the UA with a characteristic dimension less than or equal to 1 m.

(2) Impacts from a slide of the UA with a total kinetic energy less than 290 Joules.

The critical area of impact is as defined in the table below, based on the maximum characteristic of the UA. Depending on whether the mitigation is passive, manually activated or automatically activated, the Applicant should provide correspondingly adequate evidence and procedures for a given level of robustness. Reduction of the inherent critical area of a UA by way of analysis is conducted as part of Step 2 of the SORA process and is not part of the M2 mitigation process.

(c) Critical area for each characteristic dimension:

Maximum characteristic dimension (m)	1	3	8	20	40
Critical area (m^2)	6.5s	65	650	6500	65,000

(d) Applicants demonstrating M2 mitigation by reduction of the critical area should use the above values as a baseline for comparison in their proposed mitigation. The Applicant may show a corrected critical area and matching population density, in which case the custom critical area value should be used as the baseline against which the mitigation is assessed, and the custom population density value should be used as a limitation in the operation.

GM.M2.C1.M.I

Criterion 1 – Technical design

(a) Examples of immediate post-impact hazards include fire or release of high energy parts.

The reduction in risk detailed here is equivalent to a “System Risk Ratio” which requires that the combination of functional performance (i.e. the reduction in risk when the mitigation functions as intended) and reliability (i.e. the probability that the mitigation functions as intended) meets the requirement.

Latest research on UAS impacts estimates injuries using the Abbreviated Injury Scale (AIS) developed for automotive impact tests and test dummies. An impact that has a 30% chance of causing an injury of AIS level 3 or greater is estimated to have a 10% probability of death.

The SORA methodology only considers fatalities and does not provide guidance on the injury levels or thresholds beyond which an injury should be considered as a fatality. Further Guidance on how to evaluate impact severity measurement may be found in the following documents:

- DOI 10.1007/s10439-017-1921-6 Ranges of Injury risk associated with impact from UAS.
- ASSURE A4 UAS Ground Collision Severity Evaluation
- ASSURE A14 UAS Ground Collision Severity Evaluation

(b) This excludes failures of the mitigation.

If the mitigation is the frangibility of the UAS structure, all elements required for the activation of it are inherently contained within the UAS.

No single failure should lead simultaneously to the loss of control of the operation and loss of the effectiveness of the M2 mitigation.

(c) This includes inadvertent activation of the mitigation.

GM.M2.C1.M.A

Criterion 1 – Technical design

(a) Compliance evidence is typically provided through testing, analysis, simulation, inspection, design review or through operational experience.

Although not required to achieve a medium level of robustness, the use of industry standards is encouraged when developing mitigations used to reduce the effect of ground impact, e.g. CEN prEN 4709-001, ASTM F3389/F3389M, ASTM F3322-18.

GM.M2.C2.M.A

Criterion 2 – Procedures

(a) Designer data is found on the SAIL mark certificate.

GM.M2.C1.H.I

Criterion 1 – Technical design

(a) No single failure should lead simultaneously to the loss of control of the operation and loss of the effectiveness of the M2 mitigation.

The applicant may still implement a manual activation function, additional to the automated function.

Annex C to Article 11

Annex C – GM1 Strategic Mitigation Collision Risk Assessment

Determining the final air risk class

1. Overview

1.1 The initial ARC is a generalised qualitative classification of a UAS operational collision risk before any strategic mitigations are applied. Strategic Mitigation consists of procedures and operational restrictions intended to control the crewed aircraft type, encounter rates or time of exposure prior to take-off. Strategic Mitigations may be used to adjust the final ARC into the residual ARC, which is then used to define Tactical Mitigation Performance Requirements (TMPR) and the Specific Assurance and Integrity Level (SAIL).

1.2 Strategic mitigations are broadly subdivided into two categories:

(a) **Mitigation by operational restriction**, which are mitigations that are controlled by the UAS operator, in that they are not reliant on the cooperation of other airspace users to implement an effective mitigation.

(b) **Mitigation by common rules and structures**, which are mitigations that rely on all aircraft within a certain class of airspace to follow the same structure and rules. All aircraft in the airspace must participate, with the specific ruleset defined by the CAA and / or the ANSP.

1.3 Both of these categories are discussed further below, followed by some generic guidelines on the use of strategic mitigations to reduce an initial ARC assignment to a residual ARC.

Strategic mitigation by operational restriction

1.4 Three types of operational strategic mitigations are considered, each discussed below.

1.5 **SM1 - Operational restriction by boundary** – Limiting the UAS BVLOS operation to a boundary limited volume enables the use of airspace characterisation (discussed further in Annex C paragraphs 1.30 to 1.35) to adjust the expectation of traffic types, density and encounter rates beyond that in the generalised flowchart. For example, the generalised Class G assumption that results in an initial ARC-c assignment is due to the unknown traffic density and the potential for many types of crewed aircraft to be encountered, including many types of GA, Helicopter Emergency Medical Service (HEMS), Police, SAR, military, pipeline / powerline survey aircraft, etc. However, it may be possible to demonstrate that a specific remote rural location has a significantly reduced traffic density and / or encounter type from the generalised Class G assumption, potentially supporting a reduction in the ARC.

1.6 **SM2 - Operational restriction by chronology** – Limiting the UAS BVLOS operation to specific times of the day provides a further opportunity for airspace characterisation (discussed further in Annex C paragraphs 1.30 to 1.35) to adjust the expectation of traffic type, density and encounter rates below that expected for the volume as a whole. For example, it may be possible to demonstrate a reduced number of GA VFR flights during the hours of darkness.

1.7 **SM3 - Operational restriction by time of exposure** – Accepting a higher operational risk only for a limited time. An example of this within crewed aviation is the Minimum Equipment List which allows in certain situations a commercial airline to fly for three to ten days with an inoperative Traffic Collision Avoidance System (TCAS). The safety argument is that three days is a very short exposure time compared to the total life-time risk exposure of the aircraft. This short time of elevated risk exposure is justified to allow for the aircraft to return to a location where proper equipage maintenance may take place. Appreciating this may be a difficult argument for the UAS operation to make, the operator is still free to pursue this line of reasoning for a reduction in collision risk by applying a time of exposure argument. The cumulative impact of such a mitigation must be considered.

Strategic mitigation by common rules and structure

1.8 Several types of operational strategic mitigations are considered, each discussed below.

1.9 **SM4 - Special Use Airspace (SUA)**, including:

1.10 Danger Area (DA) / Temporary Danger Area (TDA) – Airspace of defined dimensions within which activities dangerous to the flight of aircraft may exist at specified times. This structure may be used to provide segregation within Class G airspace and in controlled airspace over the high seas. A TDA typically only lasts 6 months, although under certain circumstances this may be extended up to 12 months.

1.11 Temporary Segregated Area (TSA) – A TSA is a defined volume of airspace, temporarily segregated and allocated for the exclusive use of a particular user during a determined period of time and through which other traffic will not be allowed to transit. This structure may be used to provide segregation within UK controlled airspace.

1.12 Temporary Reserved Area (TRA) – A TRA is airspace that is temporarily reserved and allocated for the specific use of a particular user during a determined period of time and through which other traffic may or may not be allowed to transit in accordance with the air traffic management arrangements notified for that volume of airspace. The use of a TRA for UAS BVLOS is currently enabled by a CAA policy concept as the current approach for trialling a managed form of integration, based on a bespoke ruleset applied by a controlling ANSP, including the potential for equipment carriage, traffic types and traffic density restrictions.

1.13 **SM5 - Other airspace requirements**, including:

1.14 Transponder Mandatory Zone (TMZ) – A TMZ is airspace of defined dimensions wherein the carriage and operation of pressure-altitude reporting transponders is mandatory (unless operating in compliance with alternative provisions prescribed for that particular airspace by the TMZ Controlling authority that will achieve a cooperative electronic conspicuity environment). Deployment of a TMZ creates a ‘recognised traffic environment’, and assuming appropriate surveillance is available then operation within a TMZ removes non-cooperative traffic from the crewed aircraft encounter set that must be considered by a DAA capability. However, a TMZ alone does not alone require two-way radio communications, provide any control of traffic types or density or imply any form of UTM or air traffic service provision.

1.15 Radio Mandatory Zone (RMZ) – A RMZ is airspace of defined dimension where pilots are required to establish two-way radio communication prior to entry (unless in compliance with alternative provisions prescribed for that area). Operation within a RMZ enables real-time two-way interaction with other air traffic via the appropriate ANSP, which potentially enables strategic mitigation assuming appropriate support agreement from the appropriate ANSP.

1.16 All of the above airspace types are established in accordance with the requirements of the CAA’s Airspace Change Process contained within CAP 1616 and promulgated in the Aeronautical Information Publication (AIP). Where a temporary rather than permanent change to the notified airspace design is required, the procedure in should be followed.

1.17 **SM6 - Pre-agreement of any ANSP services to be used in-flight** – Several potential options for ANSP support are listed below, each of which require review and approval of operating procedures and any potential changes to the usual ANSP functional system:

1.18 Procedure based segregation – For example approving UAS BVLOS operation when it is known that other aircraft are not within the area.

1.19 A Basic Service – is a service provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights. This may include weather information, changes of serviceability of facilities, conditions at aerodromes, general airspace activity information, and any other information likely to affect safety. The avoidance of other traffic is solely the pilot's responsibility. Basic Service relies on the pilot avoiding other traffic, unaided by controllers/ FISOs. It is essential that a pilot receiving this service remains alert to the fact that, unlike a Traffic Service and a Deconfliction Service, the provider of a Basic Service is not required to monitor the flight. For these reasons, a DAA system will be required, particularly if this is the sole strategic mitigation.

1.20 Traffic Information - is a surveillance-based service, where in addition to the provisions of a Basic Service, the controller provides specific surveillance derived traffic information to assist the pilot in avoiding other traffic. Controllers may provide headings and/or levels for the purposes of positioning and/or sequencing; however, the controller is not required to achieve deconfliction minima, and the pilot remains responsible for collision avoidance. For these reasons, a DAA system will be required, particularly if this is the sole strategic mitigation.

1.21 Deconfliction Service - is a surveillance-based service where, in addition to the provisions of a Basic Service, the controller will provide specific surveillance derived traffic information and issues headings and/or levels aimed at achieving planned deconfliction minima, or for positioning and/ or sequencing. However, the avoidance of other traffic is ultimately the pilot's responsibility. For these reasons, a DAA system will be required, particularly if this is the sole strategic mitigation. A Deconfliction Service will only be provided to flights under IFR outside controlled airspace, irrespective of meteorological conditions and, as IFR flight is currently only available to certified UAS, is mentioned for awareness of potential future use only.

1.22 Radar Control Service – is provided to all Instrument Flight Rules (IFR) flights in controlled airspace classes A to E. Radar Control Service is a service under which pilots follow mandatory instructions to enable the prescribed separation minima between Air Systems to be maintained. Such mandatory instructions will generally be associated with essential details of conflicting traffic. Pilots will not change heading or level without prior approval of the Radar Controller (except to ensure the safety of the aircraft). As IFR flight is currently not available to civil UAS, radar control service is mentioned for awareness of potential future use only.

1.23 **SM7 - Pre-agreement of any Unmanned Traffic Management (UTM) services to be used in-flight** – Several UTM operational concepts have been proposed with the objective to enable safe and efficient UAS operation within a volume of airspace. A UK CAA policy for UTM is currently under development, which may include one or more of the services listed below. Mitigation via UTM services ahead of CAA UTM policy adoption will be subject to CAA scrutiny on a case-by-case basis. Services that maybe considered include:

(i) Geo-consciousness service – Including provision of mapping data, aeronautical information, meteorological data, etc.

(ii) Common altitude reference provision – Ensuring that altitude or level information is in a format that is harmonised and compatible with existing altitude referencing methods.

(iii) Traffic information service – Using ground infrastructure to detect other air traffic and provide a known or recognised traffic environment as defined in CAP1430, *UK Air Traffic Management Vocabulary*.

1.24 Trajectory deconfliction service – Verifying that the 4D trajectory plans of all aircraft within the area are deconflicted to an appropriate separation minimum. Note that this is distinct from the use of flight plans within crewed aviation, which focus predominantly on airspace capacity and the workload limits of the air traffic controller who provides the required tactical separation and deconfliction services.

(i) Take-off approval service – Validating that an approved deconflicted 4D trajectory is still valid and it is safe to begin the flight.

(ii) Conformance monitoring & alerting service – Based on an approved deconflicted 4D trajectory.

(iii) Conflict monitoring and alerting service – Based on both a surveillance service and an approved deconflicted 4D trajectory.

1.25 Segregation, separation and / or deconfliction instruction or advice service – Using a surveillance capability to maintain separation minima and hence reduce the residual intruder encounter rate.

1.26 **SM8 - NOTAM of intended operation** – Note that while in some locations value may be gained from this approach it is not considered scalable for routine operations. Therefore, the use of NOTAMs may be limited to specific heights, locations or for new or novel operations.

1.27 **SM9 - Military low flying notification** – Military low flying occurs in most parts of the United Kingdom at any height up to 2,000 ft above the surface. However, the greatest concentration is between 250 ft and 500 ft and civil pilots are advised to avoid flying in that height band whenever possible. The Low-Level Civil Aircraft Notification Procedure (CANP) as described within the AIP ENR 1.10 FLIGHT PLANNING allows low level civil aerial operators to notify such activity to military low flying units. Before commencing any low flying sortie, military pilots receive a comprehensive brief on all factors likely to affect their flight, including relevant CANP details.

1.28 **SM10 - Outreach to local flying clubs and pilots** – Airspace characterisation also enables a local flying community in the region of the UAS operational area to be identified, and this may enable coordination and / or direct notification of the UAS operations and vice versa. For example, an agreement could be reached for local flyers to inform the UAS operator of upcoming periods of busier than usual activity, or vice versa.

Description of residual ARCs

1.29 In order to understand the value of different strategic mitigations, a description of the residual ARCs is required. In accordance with the wider SORA methodology, agreement of a residual ARC then results in the assignment of TMPRs that reduce any residual collision risk down to the appropriate target level of safety. Broad descriptions of each residual ARC are as follows:

1.30 **Residual ARC-a**: Encounter rate with other crewed air traffic demonstrated to be negligible, therefore DAA based tactical mitigation of the air risk is not required.

1.31 **Residual ARC-b**: Encounter rate with other crewed air traffic demonstrated to be low and exclusively Type-1 (refer to section 1.112(i) for definition), but not negligible. DAA based tactical mitigation is therefore required but must be supported by one or more additional mitigation layers.

1.32 **Residual ARC-c**: Predominately Type-1 traffic and negligible commercial air transport aircraft, with either an encounter rate that may not be demonstrated to be low enough for ARC-b, or additional supporting strategic mitigations are not available. DAA based tactical mitigation is therefore required and expected to be used routinely rather than occasionally.

1.33 **Residual ARC-d**: Predominately Type-2 traffic (refer to section 1.112(ii) for definition), therefore subject to the highest level of tactical mitigation due to highest severity consequence and highest safety standard airspace. Specific category operations likely to be exceptions (e.g., via certified DAA system) rather than the normal for this ARC.

Generic guidance on the use of strategic mitigations

1.34 This section provides some generic guidance on the application of the strategic mitigations discussed within paragraphs 1.4 to 1.7 and paragraphs 1.8 to 1.15 in order to meet the expectations of the residual ARCs described in paragraphs 1.16 to 1.20. Applicants are encouraged to assess and make use of these strategic mitigations, or others that may be available. However, each application will still be assessed on a case-by-case basis and may not result in credit being given in the form of a reduced residual ARC. Applicants must also consider making use of additional mitigations to further reduce the safety risk to a level that is "as low as reasonably practicable (ALARP).

1.35 Irrespective of the Air Risk Class (ARC), an applicant must initially consider the expected ruleset of the airspace, Section 6 Airspace Classification, proposing changes only if necessary, and with agreement of the ANSP and authority.

1.36 Regarding strategic mitigation by pre-agreement of the use of ANSP services (SM6), it is worth noting that several different levels of service are currently used by crewed aircraft. Within UK airspace the level of service is in accordance with the classification of the airspace. For uncontrolled airspace and for VFR traffic within Class E a range of Flight Information Services may be available as described within CAP 774, including Basic, Traffic, Deconfliction and Procedural Services. ANSP services within both controlled and uncontrolled airspace typically fall into one of the following categories:

1.37 Separation or deconfliction services – These are used to provide structure to the traffic flow, hence reducing the crewed aircraft encounter rate to below the average traffic density of the operating area. Within crewed aviation an ANSP separation or deconfliction service is supported by a cockpit based ‘see-and-avoid’ layer and hence is not typically a single layer mitigation (unless operating under IMC). A UAS under a normal separation or deconfliction service would therefore generally be required to be supported by a tactical DAA capability, with the performance requirement defined by the encounter types and rates within the operating area.

1.38 Traffic Information services – These are typically used to alert a pilot to the presence of other aircraft, supporting visual acquisition (in support of visual deconfliction) rather than providing real-time intruder tracks for deconfliction. A traffic information service therefore typically only provides a secondary mitigation, alerting a remote pilot to potential traffic, and would therefore need to be supported by a tactical DAA capability, with the performance requirement defined by the encounter types and rates within the operating area.

1.39 It must also be noted that, dependent on the specific class of airspace and other services also being provided, the timeliness of an ANSP service may be affected by the current workload of the Air Traffic Controller or Flight Information Service Officer (FISO). Care must therefore be taken when utilising such services without the cockpit see-and-avoid layer upon which airspace safety is premised. Finally, instructions issued by controllers to pilots operating outside controlled airspace are not mandatory; however, the ATS rely upon pilot compliance with the specified terms and conditions so as to promote a safer operating environment for all airspace users.

1.40 Strategic mitigations suitable for residual ARC-a assignment are as follows:

(i) Segregated airspace, e.g., DA, TDA, TSA.

(ii) Atypical air environment.

1.41 Segregation by procedure. This is not the same as tactical 'segregation'- i.e. instructions by the Air Traffic Service Unit, issued in order to provide this 'segregation' to the UAS. These procedures need to be agreed and promulgated before the operation takes place. An example of segregation by procedure, includes using appropriate operating area surveillance and / or contact requirements to enable UA landing ahead of entry by crewed aircraft into the operating area. Additional requirements may need to be met in order to use segregation by procedure, including requirements for the ANSP that may be triggered as a result of the specific procedure, for example, change of use of airspace.

1.42 However, it should be noted that segregation of UA from crewed aircraft is not considered to be a scalable solution, hence the strategic direction of the CAA, as set out within the Airspace Modernisation Strategy (AMS), is towards integration of UA with crewed traffic.

1.43 Strategic mitigations in support of residual ARC-b assignment include:

1.44 TRA Special Use Airspace, in accordance with CAA's current BVLOS airspace policy concept this airspace structure is currently required where a DAA capability is present, but the UAS is unable to fully comply within the accepted ruleset. Establishment of a TRA also enables use of a bespoke ruleset for all participants, e.g., requiring mandatory contact, carriage of EC, or potentially carriage of EC-In to support detection and avoidance of UAS with limited visual signature by crewed aircraft.

1.45 Restriction by boundary and / or chronology, using airspace characterisation to validate a default low encounter rate and the presence of only Type-1 traffic.

1.46 Density control of crewed traffic, allowing crewed aircraft encounters to be controlled to the required level, and limited to Type-1 only. Note that this may be enabled via either crewed aircraft access request (e.g., within a TRA) or an UAS Operating procedure that prohibits BVLOS flights when the traffic density is too high, which relies either on suitable surveillance or mandatory contact requirement ahead of entry, as potentially available within a CTR or TRA (assuming this is part of the bespoke ruleset).

1.47 Separation or deconfliction service, providing a level of structure to the traffic within the airspace to reduce the expected rate of crewed aircraft encounters below the mean for the area (which may already have been artificially reduced traffic density control). It may be argued that a structured/orderly flow of air traffic could reduce the encounter rate, compared to a 'random' flow of air traffic, outside such a structured environment.

1.48 Traffic information service, alerting the remote pilot to the presence of other aircraft, therefore providing a secondary mitigation and enhancement to self-separation.

1.49 Conflict alerting service, alerting the remote pilot to a potential hazard, therefore providing a secondary mitigation and enhancement to self-separation.

1.50 Promulgation of BVLOS UAS activity, for example via NOTAM, CANP and / or outreach to the local flying community, potentially reducing crewed aircraft encounter rate by increasing awareness of UAS and crewed aircraft activity within a specific region.

1.51 Depending on the specificities of the proposed operating area, one or more of the above mitigations may be required to achieve a residual ARC-b assignment. It should be noted that a residual ARC-b assignment provides a limited form of integration of UAS with crewed aircraft, relying on one or more accommodation measures as defined above. Such measures are required to justify a reduction in tactical mitigation performance requirement for DAA below that required for ARC-c, where DAA based tactical mitigation may be the sole replacement for cockpit based ‘see-and-avoid’.

1.52 **Mitigations in support of residual ARC-c** assignment (from initial ARC-d) are required to demonstrate the absence of both IFR traffic and Type-2 traffic. This may be achieved using an operational restriction by boundary and / or chronology supported by airspace characterisation. Dependent on the airspace classification some form of pre-agreement of ANSP support may also be required.

Airspace characterisation

1.53 Airspace characterisation data is expected to be used at several stages within the UK SORA air risk model. This section defines what is meant by airspace characterisation data, discusses different levels of data integrity, then provides some examples of the expected use.

1.54 Airspace characterisation data allows an applicant to account for local specificities in the proposed operating area, providing a level of granularity beyond the generalised air risk model. Examples of airspace characterisation data that support the UK SORA air risk assessment process include the following:

1.55 Types of aircraft, e.g., typical airspeeds & equipment carriage, potentially defined by different height bands.

1.56 Surveillance coverage, e.g., primary, secondary, ADS-B, multilateration, etc.

1.57 Traffic activity for each type, e.g., traffic movements, density of traffic in a given area, actual positions / paths, nominal encounter rates, e.g., total or per traffic type, airprox reports, TCAS events etc.

1.58 Given the potentially safety critical implications of the use of airspace characterisation data it is important to understand the associated level of integrity of the data source and any processing. The data integrity requirement may be expected to increase with the associated ARC. Three distinct data sources and associated levels of integrity are expected:

(i) ANSPs, based on actual movement numbers and primary and secondary radar data which can be expected to provide historical 4D trajectory information.

(ii) Crowd sourced organisation, such as OpenSky.

(iii) Qualitative local area surveys, e.g., via contacting the local flying communities and estimating typical traffic types, patterns and rates.

1.59 Example usage of airspace characterisation data within the air risk model include:

(i) Initial Generalised ARC Flowchart guidance, e.g., demonstrating that a proposed operation avoids known IFR structures and / or known VFR traffic.

(ii) Local estimation of encounter types and rates, e.g., supporting a strategic mitigation of operational restriction by boundary, and / or chronology.

(iii) Definition of intruder aircraft encounter sets, used to navigate the air risk model and to assess tactical mitigations, e.g., DAA systems.

(iv) Quantitative cross check of proposed operation against the Target Level of Safety (TLOS). Quantitative methods are not directly considered within this initial version of the air risk model but will be included in a future update.

1.60 Airspace characterisation should also consider the impact of special events on routine traffic patterns. Such events may expect to be promulgated via NOTAM, but airspace characterisation may allow routine events to be identified in advance.

1.61 Finally, the Air Risk task force within the JARUS Safety and Risk Management group are currently developing an airspace risk characterisation document which will provide guidance for regulators, ANSPs and operators on methods for determining intrinsic air risk via airspace characterisation and encounter rate determination. It is expected that this document may be referenced for further information when available.

Annex D to Article 11

Annex D – GM1 Tactical Mitigation Performance Requirements (TMPR)

1. Introduction

1.1 The target audience for Annex D is the UAS operator who wishes to apply Tactical Mitigation Performance Requirement (TMPR), Robustness, Integrity, and Assurance Levels for their operation. Annex D provides the tactical mitigation(s) used to reduce the risk of a Mid-Air Collision (MAC). The TMPR is driven by the residual collision risk of the airspace. Some of these tactical mitigations may also provide a means of compliance with ICAO Annex 2 section 3.2, codified by the FAA in 14 CFR 91.113, “See & Avoid,” SERA 3201, and additional requirements by various states.

1.2 The Air Risk Model has been developed to provide a holistic method to assess the risk of an air encounter, and to mitigate the risk that an encounter develops in a Mid-Air Collision. The UK SORA Air Risk Model guides the operator, CAA, and/or Air Navigation Service Provider (ANSP) in determining whether an operation may be conducted in a safe manner. This Annex is not intended to be used as a checklist, nor does it provide answers to all the challenges of Detect and Avoid (DAA). The guidance allows an operator to determine and apply a suitable mitigation means to reduce the risk of a Mid-Air Collision (MAC) to an acceptable level. This guidance does not prescriptive requirements but rather objectives to be met at various levels of robustness.

Tactical Mitigations

1.3 Several tactical mitigation options are presented below:

1.4 **TM1 - Operations under VLOS / BVLOS-with-visual-mitigations** – Both VLOS and BVLOS-with-visual-mitigations, following current UK CAA regulations and guidance, are acceptable mitigations for air risk for all ARC levels. The operator is also advised to consider additional means to increase situational awareness with regard to air traffic operating in the vicinity of the operational volume, e.g., via additional tactical mitigations discussed below. In some situations, the CAA and/or ANSP may decide that VLOS does not provide sufficient mitigation for the air risk and may require compliance with additional rules and/or requirements. It is the operator’s responsibility to comply with these rules and requirements. Further information on VLOS UAS operations above 400ft, within controlled airspace, may be found in AMC1 UAS.SPEC.040(1)(b).

1.5 **TM2 - Detect and Avoid (DAA) capability** – A UK CAA Policy Concept for the assurance of DAA capabilities is available in CAP3015. Any applicant wishing to use a DAA capability as a tactical air risk mitigation should contact the CAA via UAVenquires@caa.co.uk to obtain further guidance on the review and approval process.

1.6 **TM3 – Carriage of EC out** – enhancing the detectability of the UA to other participants.

1.7 **TM4 - Monitoring VHF radio** – increasing the situation awareness of a UAS pilot of local air traffic. Note that this mitigation may require some degree of training to understand the monitored radio conversations.

1.8 **TM5 - Monitoring local cooperative traffic** – either via low-cost EC receivers or publicly available aircraft tracking applications to increase the situation awareness of an UAS pilot of local air traffic.

1.9 **TM6 - Anti-collision lighting or high visibility colours on the UA** – used to enhance the visual detectability of the UAS by the pilot of a conflicting crewed aircraft or any ground personnel.

1.10 **TM7 - Local area real-time weather monitoring** – helping to anticipate likelihood of unusual crewed-aircraft traffic patterns.

1.11 Depending on the specificities of the proposed operating area, one or more of the above mitigations may be required in addition to DAA requirements. The applicant is also encouraged to follow the As Low As Reasonably Practicable (ALARP) principle and apply more tactical mitigations than are required to meet the minimum requirement, if reasonably practicable to do so.

Annex E to Article 11

Annex E – AMC 1 Integrity and assurance levels for the Operational Safety Objectives (OSO)

1. Introduction

1.1 Annex E provides Low/Medium/High assessment requirements for the integrity (i.e. the safety gain) and assurance (i.e. the method of proof) of the Operational Safety Objectives (OSO) to be complied with by an Applicant.

1.2 Where more than one criterion exists for a given level of robustness in an OSO, all the criteria need to be met at the required robustness level in order to comply with the OSO.

1.3 A number of OSOs propose an alternative Functional Test Based (FTB) approach to complying with the OSO criteria.

1.4 Where AMC or GM specifies a letter, it is applicable to the related requirement. E.g. GM.OSO3.L.I (a) is guidance material to the requirement OSO3.L.I (a).

1.5 The CAA will adopt standards to be used as AMC in the future and is actively working with standards bodies. The Applicant may propose AMC to certain requirements to the CAA. The Applicant may consult the following documents to identify standards that they wish to propose to the CAA as AMC:

(i) JARUS SORA 2.5 (where comments identify standards to be used as AMC).

(ii) SHEPHERD D2.1-D3.1 – Identification of satisfactory industry standards and justification for unacceptable industry standards.

(iii) SHEPHERD D2.2-D3.2 – Identification of satisfactory industry standards and justification for unacceptable industry standards.

1.6 The CAA has introduced two new policy concepts; CAP 722J - Recognised Assessment Entity for Flightworthiness (RAE(F)) and CAP 722K - SAIL Mark Policy.

1.7 The RAE(F) policy is intended for use by an entity that is, or wishes to be approved, as an RAE(F). An Applicant may use the services of an RAE(F) to demonstrate compliance with several UK SORA requirements. Full details of which UK SORA requirements may be met using an RAE(F) can be found in CAP 722J.

1.8 The SAIL Mark policy is intended for use by the Designer of an UAS and a RAE(F) to understand the requirements, administrative processes and guidance to enable the delivery of a Specific Assurance and Integrity Level (SAIL) Mark certificate for a UAS to be operated within the Specific Category in the United Kingdom.

OSO 1 - Ensure the UAS Operator is competent and/or proven

AMC1 to Article 11 Annex E Operational Safety Objective 1

OSO 1 – Ensure the operator is competent and/or proven.

Level of integrity

Criterion	Low (SAIL 2)	Medium (SAIL 3)	High (SAIL 4 to 6)
Technical issue with the UAS	OSO1.L.I	OSO1.L.I OSO1.M.I	OSO1.H.I

Level of assurance

Criterion	Low (SAIL 2)	Medium (SAIL 3)	High (SAIL 4 to 6)
Technical issue with the UAS	OSO1.L.A	OSO1.M.A	OSO1.H.A

Low level of robustness (SAIL 2)

OSO1.L.I

The applicant **must** have knowledge of the UAS and have the following operational procedures:

(a) UA checklists

(b) technical logbook for each UA

(c) flight crew currency and training log

(d) allocation of responsibilities prior to operating

OSO1.L.A

The Applicant **must** declare and provide evidence of compliance with the Integrity requirements. The detailed evidence of compliance may be assessed by the CAA.

Medium level of robustness (SAIL 3)

Lower robustness level requirements to be complied with:

• OSO1.L.I

The applicant **must** have the following additional procedures:

OSO1.M.I

(a) A method to continuously evaluate whether the operator is operating in accordance with the terms of their operational authorisation (OA) and check whether the mitigations proposed as part of the OA are still appropriate.

(b) Occurrence analysis procedures and reporting to the designer in case of design-related in-service events.

OSO1.M.A

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

AMC.OSO1.M.I

(b) UK Regulation (EU) 2019/947, AMC1 Article 19(2) Safety Information.

High level of robustness (SAIL 4 to 6)

Requirements to be complied with:

OSO1.H.I

The operator **must** have a safety management system in place in accordance with ICAO Annex 19 principles.

OSO1.H.A

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

GM1 Article 11 Annex E. Operational Safety Objective 1

GM.OSO1.L.I

(a) The applicant's UAS knowledge should include monitoring of any related airworthiness/safety directives or recommendations issued by National Aviation Authorities and designer recommendations (Service Bulletin, Service Information Letter, etc.). The UAS operator should produce checklists for every stage of the UAS operation to ensure the UAS is safe to be flown. In addition to standard operating procedures, checklists should be produced for contingency and emergency scenarios and maintenance. Checklists should be accessible to the flight crew and easy to use, to prevent human error. If the flight crew consists of only a single remote pilot, critical checklists must be memorised or made accessible in such a way that it does not detract them from operating the UAS in a safe and legal manner. Further guidance may be found by reviewing:

(1) CAP 676 Guidance on the Design, Presentation and Use of Emergency and Abnormal Checklists

(2) CAP 708, Guidance on the Design, Presentation and Use of Electronic Checklists

(b) A technical logbook should be held for each UAS. The technical logbook is used to record all pertinent information relating to the UAS, including operation activities, maintenance, repairs, and upgrades. The logbook should be kept secure and made available for inspection by the CAA for a period of at least three years.

(c) Flight crew currency should be monitored and maintained by the UAS operator. If a remote pilot falls out of currency, a procedure should be in place to regain currency in a safe environment, by practising flight skills for standard operating procedures and contingency and emergency scenarios. The amount of time for this training should, as a minimum, amount to the same amount of time that the remote pilot has lapsed (i.e. if a remote pilot lapses currency by 1 hour, the training flights should equate to 1 hour or more). Further guidance can be found in AMC/GM to Article 8.

The remote pilot should successfully complete this competence training before being tasked on a UAS operation. This competence training should be recorded in the UAS operator's training log. The training log should be used to record any training that the flight crew undertake, either through an RAE or other similar entity, external or internal training. The logbook should be kept secure and made available for inspection by the CAA. The logbook should be kept for a period of at least three years. The UAS operator is responsible for ensuring compliance with the relevant pilot training, competency and logging requirements in UK Reg (EU) 2019/947, OSO 9 and the Operational Authorisation.

(d) The UAS operator should choose a suitably qualified and competent flight crew prior to each UAS operation. The flight crew should be given a briefing by the remote pilot before the UAS operation commences, to ensure each member of the flight crew understand their role and responsibilities. Allocation of flight crew roles and responsibilities for each UAS operation should be recorded in the technical logbook and the flight crew flight logs. The UAS operator is responsible for ensuring that all nominated personnel are sufficiently competent to conduct the flight and ensuring that all nominated personnel are sufficiently briefed on the tasks that they are required to perform.

OSO 2 – UAS manufactured by competent and/or proven entity

AMC1 Article 11 Annex E. Operational Safety Objective 2

OSO 2 – UAS manufactured by competent and/or proven entity

Level of integrity

Criterion	Low (SAIL 3)	Medium (SAIL 4)	High (SAIL 5, 6)
Technical issue with the UAS	OSO2.L.I	OSO2.L.I OSO2.M.I	OSO2.L.I OSO2.M.I OSO2.H.I

Level of assurance

Criterion	Low (SAIL 3)	Medium (SAIL 4)	High (SAIL 5, 6)
Technical issue with the UAS	OSO2.L.A	OSO2.L.A OSO2.M.A	OSO2.L.A OSO2.M.A OSO2.H.A

Low level of robustness (SAIL 3)

OSO2.L.I

The manufacturing procedures **must** cover:

(a) The specifications of materials used.

(b) The processes necessary to allow for manufacturing repeatability and conformity within acceptable tolerances.

(c) Configuration control.

OSO2.L.A

(a) The manufacturing procedures **must** be developed to a standard or means of compliance acceptable to the CAA.

(b) The Applicant **must** declare and provide evidence of compliance with the Integrity requirements. The detailed evidence of compliance may be assessed by the CAA.

AMC.OSO2.L.A

Annex E paragraph 1.5 provides further information about proposing a standard as an AMC.

Medium level of robustness (SAIL 4)

Lower robustness level requirements to be complied with:

- **OSO2.L.I**
- **OSO2.L.A**

Additional requirements to be complied with:

OSO2.M.I

The manufacturing procedures **must** cover:

(a) The verification of incoming products, parts, materials, and equipment.

(b) Identification and traceability.

(c) In-process and final inspections, and testing.

(d) Control and calibration of tools.

(e) Handling and storage of all products.

(f) Handling of non-conforming items.

OSO2.M.A

The Applicant **must** provide evidence that each UAS is verified to have been manufactured in conformance to its design.

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

AMC.OSO2.M.I

Annex E paragraph 1.5 provides further information about proposing a standard as an AMC.

AMC.OSO2.M.A

The Applicant may use a combination of methods such as (but not limited to) physical inspections and flight testing to demonstrate that each requirement listed in the design specification is satisfied by the finished UAS product.

High level of robustness (SAIL 5 and 6)

Lower robustness level requirements to be complied with:

- **OSO2.L.I**
- **OSO2.L.A**
- **OSO2.M.I**
- **OSO2.M.A**

Additional requirements to be complied with:

OSO2.H.I

The manufacturing procedures **must** cover:

(a) Personnel competence and qualifications.

(b) Supplier control.

OSO2.H.A

The manufacturing procedures and conformity of the UAS to its design **must** be recurrently verified through process or product audit.

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

AMC.OSO2.H.I

Annex E paragraph 1.5 provides further information about proposing a standard as an AMC.

AMC.OSO2.H.A

An audit programme may be established and agreed between the Applicant and the CAA that will allow the CAA to obtain and assess the evidence of conformity during an audit. The frequency of audits may be agreed with the CAA as part of the audit programme.

OSO 3 – UAS maintained by competent and/or proven entity

AMC1 Article 11 Annex E. Operational Safety Objective 3

OSO 3 – UAS maintained by competent and/or proven entity

Level of integrity

Criterion	Low (SAIL 1, 2)	Medium (SAIL 3, 4)	High (SAIL 5, 6)
Criterion	OSO3.L.I	OSO3.L.I OSO3.M.I	OSO3.L.I OSO3.M.I OSO3.H.I

Level of assurance

Criterion	Low (SAIL 1, 2)	Medium (SAIL 3, 4)	High (SAIL 5, 6)
Criterion 1 (Procedure)	OSO3.C1.L.A	OSO3.C1.L.A OSO3.C1.M.A	OSO3.C1.L.A OSO3.C1.M.A OSO3.C1.H.A
Criterion 2 (Training)	OSO3.C2.L.A	OSO3.C2.L.A OSO3.C2.M.A	OSO3.C2.L.A OSO3.C2.M.A OSO3.C2.H.A

Low level of robustness (SAIL 1 and 2)

OSO3.L.I

(a) Operator maintenance requirements and maintenance instructions **must** be defined and adhered to.

(b) Maintenance requirements and instructions **must** include those developed by the UAS Designer where applicable.

(c) The maintenance Personnel **must** be competent and **must** have received an authorisation to carry out maintenance on the UAS.

OSO3.C1.L.A

Criterion 1 – Procedures

(a) The maintenance instructions **must** be documented.

(b) Any maintenance conducted on the UAS **must** be recorded in a maintenance log system.

(c) A list of maintenance Personnel authorised to carry out maintenance on the UAS **must** be established and kept up to date.

(d) The Applicant **must** declare and provide evidence of compliance with the Integrity requirements. The detailed evidence of compliance may be assessed by the CAA.

OSO3.C2.L.A

Criterion 2 – Training

(a) A record of all relevant qualifications, experience and/or training completed by the maintenance staff **must** be established and kept up to date.

(b) The Applicant **must** declare and provide evidence of compliance with the Integrity requirements. The detailed evidence of compliance may be assessed by the CAA.

AMC.OSO3.L.I

(b) The Operator may only use the UAS designer requirements and instructions, or may include additional requirements and instructions over and above those of the UAS Designer.

(c) The maintenance may be performed by an organisation other than the Operator (e.g. use of a third party).

Medium level of robustness (SAIL 3 and 4)

Lower robustness level requirements to be complied with:

- **OSO3.L.I**
- **OSO3.C1.L.A**
- **OSO3.C2.L.A**

Additional requirements to be compiled with:

OSO3.M.I

(a) A maintenance programme **must** be developed which includes scheduled preventative maintenance of the UAS, derived from the UAS Designer's scheduled maintenance requirements and adapted to the specificities of the intended operation.

(b) Maintenance and releases to service **must** be recorded in the maintenance log system.

(c) A maintenance release **must** be accomplished by Personnel that have received maintenance release authorisation for that UAS model.

OSO3.C1.M.A

Criterion 1 – Procedures

(a) The layout of the UAS maintenance programme **must** be developed to a standard or means of compliance acceptable to the CAA.

(b) A list of maintenance Personnel authorised to accomplish maintenance releases **must** be established and kept up to date.

(c) The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

OSO3.C2.M.A

Criterion 2 – Training

(a) Initial training syllabus and training standard including theoretical/practical elements, duration, etc. **must** be defined and commensurate with the authorisation held by the maintenance staff.

(b) For staff holding an authorisation to release to service, the initial training **must** be specific to the UAS type.

(c) All maintenance staff **must** have undergone initial training.

(d) The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

AMC.OSO3.M.I

Annex E paragraph 1.5 provides further information about proposing a standard as an AMC.

High level of robustness (SAIL 5 and 6)

Lower robustness level requirements to be complied with:

- **OSO3.L.I**
- **OSO3.C1.L.A**
- **OSO3.C2.L.A**
- **OSO3.M.I**
- **OSO3.C1.M.A**
- **OSO3.C2.M.A**

Additional requirements to be compiled with:

OSO3.H.I

A maintenance procedure manual **must** be developed which:

(a) Provides information and procedures relevant to the UAS Operator maintenance facility, records, maintenance instructions, maintenance schedule, release to service, tools, material, components, and defect deferrals.

(b) Is followed by the maintenance personnel to carry out maintenance on the UAS.

OSO3.C1.H.A

Criterion 1 – Procedures

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

OSO3.C2.H.A

Criterion 2 – Training

Same as Medium. In addition:

(a) A programme for recurrent training of staff holding an authorization to release to service **must** be established; and

(b) This programme **must** be validated by a competent third party.

(c) The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight. The CAA will validate continuing compliance through oversight.

GM1 Article 11 Annex E. Operational Safety Objective 3

GM.OSO3.L.I

(a) The maintenance requirements are the needs for maintenance on the UAS, e.g. inspection after hard landing, regular check of lighting system. The Operator ensures that these requirements are covered in the maintenance instructions.

The maintenance instructions are the information establishing how to carry out the needed maintenance or repairs. These instructions are followed by the maintenance staff while performing maintenance.

(b) The UAS Designer maintenance instructions are sometimes referred to as Instructions for Continued Airworthiness (ICA).

GM.OSO3.C1.L.A

Criterion 1 – Procedures

(a) The purpose of the maintenance log is to record all the maintenance performed on the UAS and the reason why it was performed, e.g. defects or malfunctions rectification, modification, scheduled maintenance, etc.

The maintenance log may be requested for inspection/audit by the CAA during oversight activities.

OSO 4 – UAS components are designed to an Airworthiness Standard

AMC1 Article 11 Annex E. Operational Safety Objective 4

OSO 4 – UAS components are designed to an Airworthiness Standard

Level of integrity

Criterion	Low (SAIL 4)	Medium (SAIL 5)	High (SAIL 6)
Criterion	OSO4.L.I	OSO4.M.I	OSO4.H.I
Alternative FTB method	OSO4.FT.L.I	Not applicable	Not applicable

Level of assurance

Criterion	Low (SAIL 4)	Medium (SAIL 5)	High (SAIL 6)
Criterion	OSO4.L.A	OSO4.M.A	OSO4.H.A
Alternative FTB method	OSO4.FT.L.A	Not applicable	Not applicable

Low level of robustness (SAIL 4)

OSO4.L.I

The UAS components essential to safe operations **must** be designed to an Airworthiness Design Standard considered adequate by the CAA and/or in accordance with a means of compliance acceptable to the CAA to contribute to the overall safety objective of 10^{-4}/FH for the loss of control of the operation.

OSO4.FT.L.I

The applicant **must** conduct at least 30,000 FTB flight hours meeting one of the set of conditions described in FTB policy.

OSO4.L.A

(a) The Applicant **must** declare and provide evidence of compliance with the Integrity requirements. The detailed evidence of compliance may be assessed by the CAA.

(b) If compliance evidence is provided through simulation, the validity of the target environment used in the simulation **must** be justified.

OSO4.FT.L.A

(a) The FTB flying hours **must** be conducted per a standard or means of compliance acceptable to the CAA.

(b) The Applicant **must** declare and provide evidence of compliance with the Integrity requirements. The detailed evidence of compliance may be assessed by the CAA.

AMC.OSO4.L.I

Annex E paragraph 1.5 provides further information about proposing a standard as an AMC.

AMC.OSO4.FT.L.A

Annex E paragraph 1.5 provides further information about proposing a standard as an AMC.

Medium level of robustness (SAIL 5)

Lower robustness level requirements to be complied with:

• None

Additional requirements to be compiled with:

OSO4.M.I

The UAS components essential to safe operations **must** be designed to an Airworthiness Design Standard considered adequate by the CAA and/or in accordance with a means of compliance acceptable to the CAA to contribute to the overall safety objective of 10^{-5}/FH for the loss of control of the operation.

OSO4.M.A

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

High level of robustness (SAIL 6)

Lower robustness level requirements to be complied with:

• None

OSO4.H.I

The UAS components essential to safe operations **must** be designed to an Airworthiness Design Standard considered adequate by the CAA and/or in accordance with a means of compliance acceptable to the CAA to contribute to the overall safety objective of 10-6/FH for the loss of control of the operation.

OSO4.H.A

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

GM.OSO4

(a) The UAS components essential to safe operations are those whose failure would significantly impair the capability of the Operator to meet the target level of safety for loss of control of the operation.

(b) Starting at SAIL 4, it is considered that the safety objective associated with the SAIL of the operation (e.g. probability of loss of control of the operation below 10^{-4}/FH for a SAIL 4 operation) may not be achieved without UAS components essential to safe operation being designed to an Airworthiness Design Standard, (unless a Functional Test Based (FTB) approach is chosen).

(c) OSO 4 does not duplicate requirements that are addressed by other design related OSOs. OSO 4 aims at ensuring that the UAS as a whole is designed according to an Airworthiness Design Standard (e.g. the design and construction, structure, flight performance are addressed by the standard), whereas other design related OSOs focus on specific systems or functionalities of the UAS and or specific technical disciplines:

(1) OSO 5 (system safety)

(2) OSO 6 (C3 Link)

(3) OSO 7 (UAS conformity check)

(4) OSO 13 (external services)

(5) OSO 18 (automatic protection of the flight envelope)

(6) OSO 20 (HMI)

(7) OSO 23, 24 (environmental conditions).

GM.OSO4.L.I

The Applicant is free to propose their own Airworthiness Design Standard(s) to the CAA. When aspects of an Airworthiness Design Standard are covered by an OSO (e.g. OSO 5), the OSO requirement takes precedence.

GM.OSO4.L.A

(a) Compliance evidence is typically provided through testing, analysis, simulation, inspection, design review or through operational experience.

OSO 5 – UAS is designed considering system safety and reliability

AMC1 Article 11 Annex E. Operational Safety Objective 5

OSO 5 – UAS is designed considering system safety and reliability

Level of integrity

Criterion	Low (SAIL 3)	Medium (SAIL 4)	High (SAIL 5, 6)
Criterion	OSO5.L.I	OSO5.L.I OSO5.M.I	OSO5.H.I

Level of assurance

Criterion	Low (SAIL 3)	Medium (SAIL 4)	High (SAIL 5, 6)
Criterion	OSO5.L.A	OSO5.L.A OSO5.M.A	OSO5.L.A OSO5.M.A OSO5.H.A

Low level of robustness (SAIL 3)

OSO5.L.I

The equipment, systems and installations **must** be designed to minimise hazards in the event of a probable failure of the UAS or of any external system supporting the operation.

OSO5.L.A

(a) A Functional Hazard Assessment and a design and installation appraisal **must** be used to demonstrate that hazards are minimized.

(b) If (a) and Integrity requirements are complied with through a SAIL mark certificate, the Applicant **must** demonstrate that the external systems used for the intended operation have been considered by the Designer in their compliance to the requirements.

(c) The Applicant **must** declare and provide evidence of compliance with the Integrity requirements. The detailed evidence of compliance may be assessed by the CAA.

AMC.OSO5.L.A

Annex E paragraph 1.5 provides further information about proposing a standard as an AMC.

The design and installation appraisal may consist of a written justification which includes functional diagrams, describes how the system works and explains why the Integrity requirement is met.

Medium level of robustness (SAIL 4)

Lower robustness level requirements to be complied with:

- **OSO5.L.I**
- **OSO5.L.A**

Additional requirements to be compiled with:

OSO5.M.I

A strategy **must** be developed for the detection, alerting and management of any failure or combination thereof, which may lead to a hazard.

OSO5.M.A

(a) The safety assessment **must** be developed to a standard or means of compliance acceptable to the CAA.

(b) The strategy for detection of single failures of concern **must** include pre-flight checks.

(c) The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

AMC.OSO5.M.A

Annex E paragraph 1.5 provides further information about proposing a standard as an AMC.

High level of robustness (SAIL 5 and 6)

Lower robustness level requirements to be complied with:

- **OSO5.L.A**
- **OSO5.M.A**

Additional requirements to be compiled with:

OSO5.H.I

(a) A major failure condition **must** be no more frequent than Remote.

(b) A hazardous failure condition **must** be no more frequent than Extremely Remote.

(c) A catastrophic failure condition **must** be no more frequent than Extremely Improbable.

(d) A single failure **must not** result in a catastrophic failure condition.

(e) Software and airborne electronic hardware whose development errors could directly lead to a failure affecting the operation in such a way that it may be reasonably expected that a fatality will occur, **must** be developed to a standard or means of compliance acceptable to the CAA.

OSO5.H.A

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

GM1 Article 11 Annex E. Operational Safety Objective 5

GM.OSO5

(a) OSO 5 ensures that the contribution of the UAS and any external system supporting the operation to the loss of control of the operation inside the operational volume is commensurate with the acceptable level of risk associated with each SAIL. OSO 5 safety objectives are to be considered in conjunction with the containment safety requirements (Step 10) and, when applicable, the ground risk mitigation requirements (Annex B, and in particular M2 Criterion 1 requirements). In combination, these three sets of safety objectives ensure that whatever the SAIL of the operation, the Target Level of Safety (TLOS) is achieved and no single failure is expected to lead to a catastrophic effect.

(b) Note on SAIL 2 operations: some UAS designs may employ novel or complex features which have limited demonstrable operational history. If such features are identified by the CAA or Applicant, the Applicant may be required to comply with OSO 5 requirements at a low level of robustness.

GM.OSO5.L.I

The Integrity requirement correlates with the contribution of the UAS and external systems to the loss of control of the operation, thus the SAIL of the operation. As an example, at SAIL 3, the contribution of the UAS and external systems to the loss of control of the operation rate may be 10-4/FH, assuming a traditional 10% attribution to technical failures.

The term “hazard” should be interpreted as a failure condition which may lead to a major or hazardous event. Catastrophic events are excluded from SAIL 3 to 4 as the TLOS is considered to be met for SAIL 3 to 4 operations per the previous paragraph and, if applicable, Annex B M2 mitigation requirements.

A probable failure is anticipated to occur one or more times in the entire operational life of the UAS.

External systems supporting the UAS operation are defined as systems that are not an integral part of the UAS, but are used to for example:

- Launch / take-off the UAS.
- Undertake pre-flight checks.
- Support operations of the UA within the operational volume (e.g. GNSS, Satellite Systems, Air Traffic Management, UTM).

GM.OSO5.L.A

(a) When developing the Functional Hazard Assessment, the severity of failure conditions (e.g. no safety effect, minor, major, hazardous) should be determined in accordance with the definitions provided in JARUS AMC RPAS.1309 Issue 2.

(b) Designer data is found on the SAIL mark certificate.

GM.OSO5.H.I (a) (b) (c)

Safety objectives may be derived from JARUS AMC RPAS.1309 Issue 2 Table 3 depending on the UAS class.

GM.OSO5.H.I (e)

Development assurance levels for software and airborne electronic hardware may be derived from JARUS AMC RPAS.1309 Issue 2 Table 3 depending on the UAS class.

OSO 6 – C3 link characteristics

AMC1 Article 11 Annex E. Operational Safety Objective 6

OSO 6 – C3 link characteristics (e.g. performance spectrum use) are appropriate

Level of integrity

Criterion	Low (SAIL 2, 3)	Medium (SAIL 4)	High (SAIL 5, 6)
Technical issue with the UAS	OSO6.L.I	OSO6.L.I	OSO6.L.I OSO6.H.I

Level of assurance

Criterion	Low (SAIL 3)	Medium (SAIL 4)	High (SAIL 5, 6)
Technical issue with the UAS	OSO6.L.A	OSO6.M.A	OSO6.M.A OSO6.H.A

Low level of robustness (SAIL 2 and 3)

OSO6.L.I

(a) The performance, RF spectrum usage and environmental conditions for C3 links **must** be adequate to safely conduct the intended operation.

(b) The remote pilot **must** have the means to continuously monitor the C3 performance and to ensure that the performance continues to meet the operational requirements.

OSO6.L.A

The Applicant **must** declare and provide evidence of compliance with the Integrity requirements. The detailed evidence of compliance may be assessed by the CAA.
AMC.OSO6.L.I

(a) The use of unlicensed frequency bands may be acceptable under certain conditions, such as:

(1) The Applicant demonstrates compliance with other RF spectrum usage requirements. Further information on spectrum allocation can be found in Ofcom guidance. And,

(2) The Applicant provides evidence of the use of mechanisms to protect against interference (e.g. FHSS frequency deconfliction by procedure).

(b) This may be demonstrated by monitoring the C2 link signal strength and receiving an alert from the UAS HMI if the signal becomes too low (SAIL 2 and 3 only).

Medium level of robustness (SAIL 4)

Lower robustness level requirements to be complied with:

- **OSO6.L.I**

Additional requirements to be compiled with:

OSO6.M.I

No additional requirements.

OSO6.M.A

(a) The C3 link performance **must** be demonstrated per a standard or means of compliance acceptable to the CAA.

(b) The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

AMC.OSO6.M.A

Annex E paragraph 1.5 provides further information about proposing a standard as an AMC.

High level of robustness (SAIL 5 and 6)

Lower robustness level requirements to be complied with:

- **OSO6.L.I**
- **OSO6.M.A**

Additional requirements to be compiled with:

OSO6.H.I

Licensed frequency bands **must** be used for the C2 link.

OSO6.H.A

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

AMC.OSO6.H.I

Depending on the operation:

The use of non-aeronautical bands (e.g. licensed bands for cellular network) may be acceptable.

The use of bands allocated to the aeronautical mobile service for the use of C2 Link (e.g. 5030 – 5091 MHz) may be required. The use of FSS satellite links may be acceptable. The use of MSS satellite links and particularly AMS(R)S capacity may be required.

GM1 Article 11 Annex E. Operational Safety Objective 6

GM.OSO6

(a) In this OSO, the term “C3 link” encompasses:

(1) The Command and Control (C2) link, and

(2) Any communication link required for the safety of the flight.

(b) To correctly assess the integrity of this OSO, the applicant should identify:

(1) The C3 links performance requirements necessary for the intended operation.

(2) All C3 links, together with their actual performance and Radio Frequency (RF) spectrum usage.

The specification of performance and RF spectrum for a C2 Link is typically documented by the UAS designer in the UAS manual.

Main parameters associated with Required C2 Link Performance (RLP) and the performance parameters for other communication links (e.g. Required Communication Performance (RCP) for communication with ATC) include, but are not limited to the following:

(i) Transaction expiry time

(ii) Availability

(iii) Continuity

(iv) Integrity

The Applicant should refer to ICAO references for definitions, and to JARUS RPAS “Required C2 Link Performance” (RLP) concept.

(3) The RF spectrum usage requirements for the intended operation (including the need for authorization if required).

The UAS operator should ensure that the radio spectrum used for the C3 Link and for any payload communications complies with the relevant Ofcom requirements and that any licenses required for its operation have been obtained. The operator should 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. There are no specific frequencies allocated for use by UAS in the UK, however the most used frequencies are 35 MHz, 2.4 GHz and 5.8 GHz. 35 MHz is a frequency designated for model aircraft use only, with the assumption that clubs and individuals will be operating in a known environment to strict channel allocation rules. It is therefore not considered to be a suitable frequency for more general UAS operations (i.e., not in a club environment). 2.4 GHz is an unlicenced band; although this is considered to be more robust to interference than 35 MHz, operators should act with appropriate caution in areas where it is expected that there will be a high degree of 2.4 GHz activity. 5.8 GHz is another unlicensed band. All operations of radio on a UAS including cellular and satellite communications requires registration with Ofcom.

(4) Environmental conditions that might affect the C3 links performance.

GM.OSO6.L.I

(b) The remote pilot should have continuous and timely access to the relevant C3 information that could affect the safety of flight.

GM.OSO6.M.I

Depending on the intended operation:

(a) The use of licensed frequency bands may be required by the CAA.

(b) The use of non-aeronautical bands (e.g. licensed bands for cellular network) may be acceptable.

GM.OSO6.H.I

The use of licensed frequency bands ensures a minimum level of performance and is not limited to aeronautical licensed frequency bands (e.g. licensed bands for cellular network). Nevertheless, some operations may require the use of bands allocated to the aeronautical mobile service for the use of C2 Link (e.g. 5030-5091 MHz) or MSS satellite link.

In any case, the use of licensed frequency bands requires authorisation.

OSO 7 – Conformity check of the UAS configuration

AMC1 Article 11 Annex E. Operational Safety Objective 7

OSO 7 – Conformity check of the UAS configuration

Level of integrity

Criterion	Low (SAIL 1, 2)	Medium (SAIL 3, 4)	High (SAIL 5, 6)
Criterion	OSO7.L.I	OSO7.L.I	OSO7.L.I

Level of assurance

Criterion	Low (SAIL 1, 2)	Medium (SAIL 3, 4)	High (SAIL 5, 6)
Criterion 1 (Procedures)	OSO7.C1.L.A	OSO7.C1.L.A OSO7.C1.M.A	OSO7.C1.L.A OSO7.C1.M.A OSO7.C1.H.A
Criterion 2 (Training)	OSO7.C2.L.A	OSO7.C2.M.A	OSO7.C2.M.A OSO7.C2.H.A

Low level of robustness (SAIL 1 and 2)

OSO7.L.I

Conformity check procedures **must** be developed which periodically ensures the following:

(a) The UAS intended to be used for the operation is in a condition for safe operation.

(b) The UAS configuration conforms to the UAS design data, including any design limitations, considered under the approved concept of operation.

OSO7.C1.L.A

Criterion 1 – Procedures

(a) The UAS conformity check procedure **must** include the UAS Designer instructions, if available.

(b) The Applicant **must** declare and provide evidence of compliance with the Integrity requirements. The detailed evidence of compliance may be assessed by the CAA.

OSO7.C2.L.A

Criterion 2 – Training

(a) The remote crew **must** be trained to perform the UAS conformity check.

(b) The Applicant **must** declare and provide evidence of compliance with the Integrity requirements. The detailed evidence of compliance may be assessed by the CAA.

Medium level of robustness (SAIL 3 and 4)

Lower robustness level requirements to be complied with:

- **OSO7.L.I**
- **OSO7.C1.L.A**

Additional requirements to be compiled with:

OSO7.M.I

No additional requirements.

OSO7.C1.M.A

Criterion 1 – Procedures

(a) The UAS conformity check procedures **must** make use of checklists.

(b) The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

OSO7.C2.M.A

Criterion 2 – Training

(a) A training syllabus including a UAS conformity check procedure **must** be available.

(b) Evidence of theoretical and practical training **must** be available.

(c) The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

High level of robustness (SAIL 5 and 6)

Lower robustness level requirements to be complied with:

- **OSO7.L.I**
- **OSO7.C1.M.A**
- **OSO7.C2.M.A**

Additional requirements to be compiled with:

OSO7.H.I

No additional requirements.

OSO7.C1.H.A

Criterion 1 – Procedures

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

OSO7.C2.H.A

Criterion 2 – Training

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

GM1 Article 11 Annex E. Operational Safety Objective 7

GM.OSO7

The intent of OSO 7 is that the Operator assures that the configuration of the UAS intended to be used for the operation conforms to the UAS design data considered under the SORA process. This OSO does not describe a pre- or post-flight inspection as part of normal operations, which is addressed in OSO 8.

GM.OSO7.C1.LA

(a) The periodicity of the conformity check should be included in the procedures.

(b) An example of design limitation is the maximum payload mass.

OSO 8 – Operational procedures are defined, validated and adhered to

AMC1 Article 11 Annex E. Operational Safety Objective 8

OSO 8 – Operational procedures are defined, validated and adhered to

Level of integrity

Criterion	Low (SAIL 1)	Medium (SAIL 2)	High (SAIL 3 to 6)
Criterion 1 (Procedures)	OSO8.C1.L.I	OSO8.C1.L.I	OSO8.C1.L.I
Criterion 2 (Human Error)	OSO8.C2.L.I	OSO8.C2.M.I	OSO8.C2.M.I OSO8.C3.H.I
Criterion 3 (Emergency Response Plan)	OSO8.C3.L.I	OSO8.C3.L.I	OSO8.C3.L.I

Level of assurance

Criterion	Low (SAIL 1)	Medium (SAIL 2)	High (SAIL 3 to 6)
Criterion 1 (Procedures)	OSO8.L.A	OSO8.M.A	OSO8.M.A OSO8.H.A
Criterion 2 (Human Error)	OSO8.L.A	OSO8.M.A	OSO8.M.A OSO8.H.A
Criterion 3 (Emergency Response Plan)	OSO8.L.A	OSO8.M.A	OSO8.M.A OSO8.H.A
FTB	OSO8.FT.L.A	OSO8.FT.L.A	OSO8.FT.L.A

Low level of robustness (SAIL I)

OSO8.C1.L.I

Criterion 1 – Procedures

Operational procedures appropriate for the proposed operation **must** be defined and **must** cover the following elements:

(a) Flight planning (to include multiple locations, if applicable).

(b) Pre and post-flight inspections.

(c) Procedures to evaluate environmental conditions before and during the mission (i.e. real-time evaluation) including assessment of meteorological conditions (METAR, TAF, etc.) with a simple recording system.

(d) Procedures to cope with unintended adverse environmental conditions (e.g. when ice is encountered during an operation not approved for icing conditions).

(e) Normal procedures.

(f) Contingency procedures (to cope with abnormal situations).

(g) Emergency procedures (to cope with emergency situations).

(h) Pre-flight procedures including briefing of any involved persons about the potential risks and actions to take in case of misbehaviour of the UA.

(i) Occurrence reporting procedures.

(j) Any relevant change management/modification procedures. Further information on change management within the context of a UK SORA based authorisation, can be found in CAP 722L.

If available, operational procedures provided by the UAS designer should be utilised.

OSO8.C2.L.I

Criterion 2 – Human Error

The operational procedures **must** provide:

(a) A clear distribution and assignment of tasks.

(b) A checklist to ensure staff are adequately performing assigned tasks.

OSO8.C3.L.I

Criterion 3 – Emergency Response Plan

The (ERP) **must**:

(a) Be suitable for the situations.

(b) Effectively mitigate all anticipated hazardous secondary effects after the initial crash.

(c) Clearly delineate Remote Crew member(s) duties during an emergency.

(d) Be easily accessible and practical to use.

(e) Contain a list of anticipated emergency situations with secondary effects.

(f) Contain procedures for each of the identified anticipated emergency (including criteria to identify each of these situations).

(g) List the relevant contacts (e.g. Air Traffic Control, police, fire brigade, first responders).

In addition, the Remote Crew **must** have received training and may execute the procedures effectively under stress.

OSO8.L.A

Criterion 1, 2, and 3

The Applicant **must** declare and provide evidence of compliance with the Integrity requirements. The detailed evidence of compliance may be assessed by the CAA.

OSO8.FT.L.A

Criterion 1, 2, and 3 using FTB method

FUNCTIONAL TEST-BASED METHODS (for SAILs up to IV included)

The applicant has evidence of FTB flight hours proportionate to the risk/SAIL of the operation meeting one of the set of conditions described in GM1 Article 11 Annex E. Functional test based (FTB) methodology which have been executed:

(a) Within the full operational scope/envelope intended by the UAS Operator, and

(b) Following the operational procedures referred to in the operational authorization, then the assurance that the operational procedures are adequate is met at the level corresponding to the SAIL being demonstrated by the functional test-based approach.

Medium level of robustness (SAIL 2)

Lower robustness level requirements to be complied with:

- **OSO8.C1.L.I**
- **OSO8.C3.L.I**

Additional requirements to be compiled with:

OSO8.C2.M.I

Criterion 2 – Human Error

The operational procedures **must** take human error into consideration.

OSO8.M.A

Criterion 1, 2, and 3.

(a) Operational procedures and ERP **must** be developed to standards considered adequate by the CAA and/or in accordance with a means of compliance acceptable to the CAA.

(b) Adequacy of the Contingency and Emergency procedures **must** be proven through:

(1) Dedicated flight tests.

(2) Simulation provided the simulation is proven valid for the intended purpose with positive results.

(c) The Applicant **must** provide evidence of compliance with the Integrity requirements.

OSO8.FT.M.A

No additional requirements.

High level of robustness (SAIL 3 to 6)

Lower robustness level requirements to be complied with:

- **OSO8.C1.L.I**
- **OSO8.C3.L.I**
- **OSO8.C2.M.I**
- **OSO8.M.A**

Additional requirements to be compiled with:

OSO8.C2.H.I

Criterion 2 – Human Error

Same as Medium. In addition, the Remote Crew **must** receive Crew Resource Management (CRM) training.

OSO8.H.A

Same as Medium. In addition:

(a) Flight tests performed to validate the procedures and checklists **must** cover the complete flight envelope or **must** be proven to be conservative.

(b) The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

OSO8.FT.H.A

No addition requirements.

GM1 Article 11 Annex E. Operational Safety Objective 8

GM.OSO8

(a) Operational procedures address normal, abnormal, and emergency situations potentially resulting from technical issues with the UAS or external systems supporting UAS operation, human errors or critical environmental conditions.

(b) Standard Operating Procedures (SOP) are a set of instructions covering policies, procedures, and responsibilities set out by the applicant that supports operational personnel in ground and flight operations of the UA safely and consistently during normal situations.

(c) Contingency Procedures are designed to potentially prevent a significant future event (e.g. loss of control of the operation) that has an increased likelihood to occur due to the current abnormal state of the operation. These procedures should return the operation to a normal state and enable the return to using standard operating procedures or allow the safe cessation of the flight.

(d) Emergency Procedures are intended to mitigate the effect of failures that cause or lead to an emergency condition.

(e) The Emergency Response Plan (ERP) deals with the potential hazardous secondary or escalating effects after a loss of control of the operation (e.g., in the case of ground impact, mid-air collision or flyaway) and is decoupled from the Emergency Procedures, as it does not deal with the control of the UA.

GM.OSO8.C1.L.I

(a) A feasibility study shall initially be conducted as part of the flight planning to identify potential hazards. The feasibility study should comprise of the following:

> (1) Identification of the Area of Operation (AOO), Take-Off and Landing Area (TOLA), holding/loiter areas and emergency landing areas
>
> (2) Identification of the landowner for Take-Off and Landing (TOAL) and any permissions required
>
> (3) Identification of the airspace, the likely amount of air traffic and any permissions required
>
> (4) Identification of public access points
>
> (5) On site hazards
>
> (6) Offsite hazards
>
> (7) Assessment of the proposed operational volume, to ensure the conditions of the SORA and the OA are met.
>
> (8) Identification, and implementation of any procedures needed in relation to ANSP communication. Further information on these requirements can be found in AMC and GM to UAS.SPEC.040(1)(b).

(b) The UAS system shall be assembled and checked it is safe to be flown by the remote pilot. Materials to assist with this include the following:

> (1) Manufacturer's guidance
>
> (2) The user manuals for the UAS, payload and ancillary equipment
>
> (3) In-house procedures and checklists

(c) The following weather conditions shall be checked before flight and monitored throughout the flight:

(1) Wind strength at the operating height

(2) Wind direction

(3) Urban effects (wind shear, vortices, and turbulence)

(4) Precipitation

(5) Visibility

(d) Reserved

(e) Reserved

(f) Reserved

(g) Reserved

(h) The emergency procedures should as a minimum include the following (where applicable):

(1) Abnormal environmental conditions - Visibility

(2) Abnormal environmental conditions - Wind

(3) Air incursion

(4) Air excursion

(5) Control signal loss

(6) Fire

(7) LOC

(8) GNSS signal loss

(9) Ground incursion

(10) Landing gear failure - Fixed wing

(11) Landing gear failure - Multirotor

(12) Loss of control

(13) Power loss - CU

(14) Power loss (partial)

(15) Power loss (full)

(16) Propulsion system loss (full or partial) - Fixed wing

(17) Propulsion system loss (full) - Multirotor

(18) Propulsion system loss (single motor)

(19) Propulsion system loss (multiple motors)

(20) Navigation light failure at night

(21) Pilot incapacitation

(22) Structural failure

(i) The following occurrences shall be reported:

(1) Technical failure:

(i) Technical failure during transfer to/from launch control/mission control stations

(ii) Functional failures

(iii) Loss of C2 Link

(iv) Loss of navigation function CU configuration changes/errors

(v) Loss of communication between remote pilot stations

(vi) Display failures

(vii) Structural failures that resulted in control difficulties or loss of the aircraft

(viii) Airspace infringement

(ix) Any technical failure that resulted in injury to a third party

(2) Human factors

(i) Human error during transfer to/from launch control/mission control stations

(ii) Functional failures of the UAS which led to loss of situational awareness

(iii) Mishandling by the pilot in command including mis-selection of flight parameters via the CU

(iv) Crew resource management failures / confusion

(v) Human errors

(vi) Pilot incapacitation

(vii) Any human error that resulted in injury to a third party

A full list of reportable occurrences may be found in UK Reg (EU) No 2015/1018 (the UK MOR Occurrences Regulation).

(3) Mandatory Occurrence Reporting Scheme (MORS).

All occurrences shall be reported as an MOR within 72 hours in accordance with UK Reg (EU) No 376/2014 (the UK Mandatory Occurrence Reporting Regulation).

MORs are submitted online via ECCAIRS2 web portal: https://aviationreporting.eu/

Any serious accident or incident must also be reported to the Air Accident Investigation Branch:

Air Accidents Investigation Branch

Farnborough House

Berkshire Copse Road

Aldershot HANTS

GU11 2HH

24 hour accident/incident reporting line: +44 (0) 1252 512299

Administration and general enquiries Tel: +44 (0) 1252 510300

Fax: +44 (0) 1252 376999

E-mail: enquiries@aaib.gov.uk

(4) Occurrence investigation.

In the event of an occurrence the UAS operator shall be informed immediately. A full investigation shall be conducted to find out what occurred and why. To aid the investigation, evidence shall be gathered in the form of:

(i) Photographs

(ii) Witness statements

(iii) Digital flight logs

(iv) Onsite paperwork, including the risk assessment

(v) Weather conditions at the time

(5) Occurrence outcome actions

(i) All flight crew will be debriefed about the occurrence to ascertain how and why it happened. The results of the investigation will form the basis of new procedures to prevent the same occurrence happening again. All flight crew will be informed of the investigation outcome and trained in any new procedures.

(j) An operator may wish to make changes to their operation during the course of an OA. These changes may be operational, or technical in nature. Some of these changes may be possible without requiring a new SORA. A change management/modification procedure should be set out to capture how these changes are assessed and logged. Further guidance can be found in CAP 722L.

GM.OSO8.C3.L.I

The Emergency Response Plan (ERP) should be used after an occurrence. The priorities are:

1. Protect uninvolved people
2. Protect property
3. Gather evidence

4. Submit an occurrence report
5. Conduct an investigation
6. Deliver outcome actions to prevent a repeat occurrence

OSO 9 – Remote crew trained and current

AMC1 Article 11 Annex E. Operational Safety Objective 9

OSO 9 – Remote crew trained and current

Level of integrity

Criterion	Low (SAIL 1, 2)	Medium (SAIL 3, 4)	High (SAIL 5, 6)
Criterion 1 (Remote Pilot Competence)	OSO9.C1.L.I	OSO9.C1.L.I	OSO9.C1.L.I
Criterion 2 (Type Training)	OSO9.C2.L.I	OSO9.C2.L.I	OSO9.C2.L.I

Level of assurance

Criterion	Low (SAIL 1, 2)	Medium (SAIL 3, 4)	High (SAIL 5, 6)
Criterion 1 (Remote Pilot Competence)	OSO9.C1.L.A	OSO9.C1.M.A	OSO9.C1.H.A
Criterion 2 (Type Training)	OSO9.C2.L.A	OSO9.C2.M.A	OSO9.C2.H.A

Low level of robustness (SAIL 1 and 2)

OSO9.C1.L.I

Criterion 1 – Remote Pilot Competence

(a) The remote pilot **must** have at least the following theoretical knowledge:

(1) Air law.

(2) Aircraft general knowledge.

(3) Human performance and limitations.

(4) Meteorology.

(5) Operational procedures including:

(i) Airspace

(ii) Navigation

(iii) Flight planning

(b) Other members of the flight crew **must** be competent for their assigned tasks.

OSO9.C2.L.I

Criterion 2 – Type Training

A training programme **must** be developed by the operator. The training **must** be proportional to the risk of the operation but as a minimum **must** cover the following subjects:

(a) UA specific technical knowledge.

(b) Operator specific procedures including.

(1) Operational procedures and ERP.

(2) ERP.

(c) Use of external services, including service limitations and system recovery if any.

OSO9.C1.L.A

Criterion 1 – Remote Pilot Competence

The Applicant **must** declare and provide evidence of compliance with the Integrity requirements. The detailed evidence of compliance may be assessed by the CAA.

OSO9.C2.L.A

Criterion 2 – Type Training

The Applicant **must** declare and provide evidence of compliance with the Integrity requirements. The detailed evidence of compliance may be assessed by the CAA.

AMC.OSO9.C1.L.I

(a) The remote pilot(s) hold a valid remote pilot competence certificate issued by a CAA approved Recognised Assessment Entity.

(b) The privileges and conditions of the certificate are sufficient for the proposed operation in accordance with UK Regulation (EU) 2019/947 Article 8 AMC(1).

AMC.OSO9.C2.L.I

Annex E paragraph 1.5 provides further information about proposing a standard as an AMC.

Medium level of robustness (SAIL 3 and 4)

Lower robustness level requirements to be complied with:

- **OSO9.C1.L.I**
- **OSO9.C2.L.I**

Additional requirements to be compiled with:

- **OSO9.C1.M.A**

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

- **OSO9.C2.M.A**

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

High level of robustness (SAIL 5 and 6)

Lower robustness level requirements to be complied with:

- **OSO9.C1.L.I**
- **OSO9.C2.L.I**

Additional requirements to be compiled with:

- **OSO9.C1.H.A**

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

- **OSO9.C2.H.A**

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

GM1 Article 11 Annex E. Operational Safety Objective 9

GM.OSO9

OSO 9 is divided into two criteria for UK SORA to consider the remote pilot competence framework.

- C1 sets out how the applicant should demonstrate that remote pilots and crew are competent.
- C2 sets out how the applicant should demonstrate the operator has trained its flight crew on the specific UA type and the operator SOPs.

OSO 13 – External services supporting UAS operations are adequate for the operation

AMC1 Article 11 Annex E. Operational Safety Objective 13

OSO 13 – External services supporting UAS operations are adequate for the operation

Level of integrity

Criterion	Low (SAIL 1, 2)	Medium (SAIL 3)	High (SAIL 4 to 6)
Criterion (Deterioration of external services supporting UAS operations)	OSO13.L.I	OSO13.L.I	OSO13.L.I

Level of assurance

Criterion	Low (SAIL 1, 2)	Medium (SAIL 3, 4)	High (SAIL 5, 6)
Criterion (Deterioration of external services supporting UAS operations)	OSO13.L.A	OSO13.M.A	OSO13.M.A OSO13.H.A

Low level of robustness (SAIL 1 and 2)

OSO13.L.I

(a) The applicant **must** ensure that the level of performance for any externally provided service critical for the safety of the flight is adequate for the intended operation.

(b) If the externally provided service requires communication between the Operator and the Service Provider, the applicant **must** ensure there is effective communication to support the service provisions.

(c) Roles and responsibilities between the applicant and the external Service Provider **must** be defined.

OSO13.L.A

(a) The Applicant **must** declare and provide evidence of compliance with the Integrity requirements. The detailed evidence of compliance may be assessed by the CAA.

(b) The supporting evidence **must** demonstrate that the required level of performance for any externally provided service required for the safety of the flight may be achieved for the full duration of the mission.

AMC.OSO13.L.A

Annex E paragraph 1.5 provides further information about proposing a standard as an AMC.

Medium level of robustness (SAIL 3)

Lower robustness level requirements to be complied with:

- **OSO13.L.I**

OSO13.M.A

(a) The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

(b) The applicant **must** have supporting evidence that the required level of performance for any externally provided service required for the safety of the flight may be achieved for the full duration of the mission.

High level of robustness (SAIL 4 to 6)

Lower robustness level requirements to be complied with:

- OSO13.L.I
- OSO13.M.A

OSO13.H.A

The evidence of the externally provided service performance is achieved through demonstrations.

(a) The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

GM1 Article 11 Annex E. Operational Safety Objective 13

GM.OSO13

For the purpose of the UK SORA and this specific OSO, the term “External services supporting UAS operations” encompasses any interaction with an external Service Provider critical for the safety of the flight, e.g.

- Communication Service Provider (CSP),
- Navigation Service Provider (e.g. Global navigation satellite system),
- UTM Service Providers (including surveillance Supplemental Data Service Provider (SDSP), weather SDSP),
- Externally provided electrical power (e.g. in the case where no emergency backup generator is available and the safety of the flight is dependent on continuous power delivery).

The interface between the UAS Operator and the external services may take the form of a Service Level Agreement (SLA).

GM.OSO13.L.I

Supporting evidence may take the form of a Service-Level Agreement (SLA) or any official commitment that prevails between a Service Provider and the applicant on relevant aspects of the service (including quality, availability, responsibilities). As an example, if an applicant uses an external surveillance service they should have evidence available supporting the claim that the service meets performance requirements in Annex D.

OSO 16 – Multi crew coordination

AMC1 Article 11 Annex E. Operational Safety Objective 16

OSO 16 – Multi crew coordination

Level of integrity

Criterion	Low (SAIL 1, 2)	Medium (SAIL 3, 4)	High (SAIL 5, 6)
Criterion 1 (Procedures)	OSO16.C1.L.I	OSO16.C1.L.I	OSO16.C1.L.I
Criterion 2 (Training)	OSO16.C2.L.I	OSO16.C2.L.I OSO16.C2.M.I	OSO16.C2.L.I OSO16.C2.M.I
Criterion 3 (Communication devices)	Not applicable	OSO16.C3.M.I	OSO16.C3.M.I OSO16.C3.H.I

Level of assurance

Criterion	Low (SAIL 1, 2)	Medium (SAIL 3, 4)	High (SAIL 5, 6)
Criterion 1 (Procedures)	OSO16.C1.L.A	OSO16.C1.M.A	OSO16.C1.M.A OSO16.C1.H.A
Criterion 2 (Training)	OSO16.C2.L.A	OSO16.C2.M.A	OS16.C2.M.A
Criterion 3 (Communication devices)	Not applicable	OSO16.C3.M.A	OSO16.C3.M.A OSO16.C3.H.A
Alternative FTB method for Criterion 1	OSO16.FT.L.A	OSO16.FT.L.A	Not applicable

Low level of robustness (SAIL 1 and 2)

OSO16.C1.L.I

Criterion 1 – Procedures

(a) The applicant **must** develop procedure(s) to ensure coordination between the crew members and as a minimum cover:

(1) Definition of crew roles and responsibilities

(2) Assignment of tasks to the crew

(3) Communication plan, including the use of correct aviation phraseology between the remote crew members and third parties where applicable.

OSO16.C2.L.I

Criterion 2 – Training

The applicant **must** conduct Remote Crew training which covers multi crew coordination prior to operating.

OSO16.C1.L.A

Criterion 1 – Procedures

The Applicant **must** declare and provide evidence of compliance with the Integrity requirements. The detailed evidence of compliance may be assessed by the CAA.

The procedure does not need to conform to an industry standard accepted by the CAA, however, it is recommended.

OSO16.C2.L.A

Criterion 2 – Training

The Applicant **must** declare and provide evidence of compliance with the Integrity requirements. The detailed evidence of compliance may be assessed by the CAA.

The procedure does not need to conform to an industry standard accepted by the CAA, however, it is recommended.

OSO16.FT.L.A

Criterion 1 – Procedures

The applicant **must** provide evidence of FTB flight hours proportionate to the risk/SAIL of the operation meeting one of the set of conditions described in the FTB policy.

(a) Within the full operational scope/envelope of the intended operation, and

(b) Following the operational procedures referred to in the OA application.

Medium level of robustness (SAIL 3 and 4)

Lower robustness level requirements to be complied with:

- **OSO16.C1.L.I**
- **OSO16.C2.L.I**

Additional requirements to be compiled with:

OSO16.C1.M.I

Criterion 1 – Procedures

No additional requirements.

OSO16.C2.M.I

Criterion 2 – Training

(a) Same as Low. In addition, the Remote Crew **must** receive Crew Resource Management (CRM) training.

OSO16.C3.M.I

Criterion 3 – Communication devices

(a) The performance of communication devices **must** be adequate to safely conduct the intended operation.

(b) The remote crew **must** have the means to verify the performance of the communication devices at intervals deemed appropriate to ensure the performance continues to meet the operational requirements.

OSO16.C1.M.A

Criterion 1 – Procedures

The Applicant **must** provide evidence of compliance with Integrity requirements, which will be assessed by the CAA. The procedures **must** meet a standard an accepted by the CAA or AMC.

OSO16.C2.M.A

Criterion 2 – Training

The Applicant **must** provide evidence of compliance with Integrity requirements, which will be assessed by the CAA. The procedures **must** meet a standard accepted by the CAA or AMC.

OSO16.C3.M.A

Criterion 3 – Communication devices

(a) The Applicant **must** provide evidence of compliance with Integrity requirements, which will be assessed by the CAA.

(b) If compliance evidence is provided through simulation, the validity of the target environment used in the simulation **must** be justified.

(c) If (a), (b) and Integrity requirements are complied with through a SAIL mark certificate, the Applicant **must** demonstrate that the performance and limitations of the communication devices provided by the Designer are adequate for the intended operation.

OSO16.FT.M.A

Criterion 1 – Procedures

The Applicant **must** comply with the requirements of OSO16.FT.L.A.

High level of robustness (SAIL 5 and 6)

Lower robustness level requirements to be complied with:

- **OSO16.C1.L.I**
- **OSO16.C2.L.I**
- **OSO16.C1.M.A**
- **OSO16.C2.M.I**
- **OSO16.C2.M.A**
- **OSO16.C3.M.I**

- **OSO16.C3.M.A**

Additional requirements to be compiled with:

OSO16.C1.H.I

Criterion 1 – Procedures

No additional requirements.

OSO16.C2.H.I

Criterion 2 – Training

No additional requirements.

OSO16.C3.H.I

Criterion 3 – Communication devices

(a) The communication devices **must** have redundancy.

(b) The communication devices **must** be developed to a standard or means of compliance acceptable to the CAA.

OSO16.C1.H.A

Criterion 1 – Procedures

(a) The applicant **must** perform flight tests to validate that the procedures cover the complete flight envelope or are proven to be conservative.

(b) Evidence of the procedures, flight tests and simulations will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

OSO16.C2.H.A

Criterion 2 – Training

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

OSO16.C3.H.A

Criterion 3 – Communication devices

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

AMC.OSO16.C3.H.I (b)

Annex E paragraph 1.5 provides further information about proposing a standard as an AMC.

GM1 Article 11 Annex E. Operational Safety Objective 16

GM.OSO16

This OSO is only applicable when multiple personnel are directly involved in the flight operation.

GM.OSO16.FT.L.A

The FTB method is an alternative means of compliance with OSO16 Criterion 1 (Procedures) assurance requirements.

Compliance with the requirement provides assurance that the operational procedures are adequate at the level corresponding to the SAIL being demonstrated by the FTB approach.

As an example, if the number of test cycles supporting the FTB flying hours is proportionate to the risk of a SAIL 3 operation (i.e. 3,000 FH), the assurance level for OSO16 Criterion 1 (Procedures) is satisfied at a medium level of robustness.

GM.OSO16.C3.M.A

Criterion 3 – Communication devices

(a) Compliance evidence is typically provided through testing, analysis, simulation, inspection, design review or through operational experience.

(b) Designer data is found on the SAIL mark certificate.

GM.OSO16.C3.H.I

(a) This implies the provision of an extra device to mitigate the risk of failure of the first device.

OSO 17 – Remote crew is fit to operate

AMC1 Article 11 Annex E. Operational Safety Objective 17

OSO 17 – Remote crew is fit to operate

Level of integrity

Criterion	Low (SAIL 1, 2)	Medium (SAIL 3, 4)	High (SAIL 5, 6)
Criterion	OSO17.L.I	OSO17.L.I OSO17.M.I	OSO17.L.I OSO17.M.I OSO17.H.I

Level of assurance

Criterion	Low (SAIL 1, 2)	Medium (SAIL 3, 4)	High (SAIL 5, 6)
Criterion	OSO17.L.A	OSO17.L.A OSO17.M.A	OSO17.L.A OSO17.M.A OSO17.H.A

Low level of robustness (SAIL 1 and 2)

OSO17.L.I

(a) The Applicant **must** have a policy defining the criteria and the means for the remote crew to declare themselves fit before starting their duty and report themselves unfit, if required, during their shift.

(b) Where the certificate of remote pilot competence for any crew member requires a formal medical certificate, the applicant **must** have a procedure to periodically check its validity.

OSO17.L.A

(a) The Applicant **must** declare and provide evidence of compliance with the Integrity requirements. The detailed evidence of compliance may be assessed by the CAA.

AMC.OSO17.L.A

(a) A crew briefing including a record of an 'IMSAFE' check for all crew members is sufficient.

Medium level of robustness (SAIL 3 and 4)

Lower robustness level requirements to be complied with:

- **OSO17.L.I**

- **OSO17.L.A**

Additional requirements to be compiled with:

OSO17.M.I

(a) The maximum flight crew duty period and resting times for the remote crew **must** be defined by the applicant and adequate for the operation.

(b) The Operator defines requirements appropriate for the remote crew to operate the UAS.

OSO17.M.A

The Applicant **must** provide evidence of compliance with Integrity requirements which will be assessed by the CAA including:

(a) Remote crew duty, flight duty and the resting times policy is documented.

(b) Remote crew duty cycles are logged and cover at a minimum:

(1) when the remote crew member's duty day commences,

(2) when the remote crew members are free from duties,

(3) resting times within the duty cycle.

AMC.OSO17.M.A

Annex E paragraph 1.5 provides further information about proposing a standard as an AMC.

High level of robustness (SAIL 5 and 6)

Lower robustness level requirements to be complied with:

- **OSO17.L.A**
- **OSO17.M.A**
- **OSO17.M.I**

Additional requirements to be compiled with:

OSO17.H.I

(a) The remote crew **must** be medically fit for their assigned duties.

(b) The applicant **must** have a Fatigue Risk Management System (FRMS) is in place to manage any escalation in duty/flight duty times.

OSO17.H.A

(a) The applicant **must** use a medical standard(s) considered adequate by the CAA and/or means of compliance acceptable to the CAA.

(b) The FRMS will be assessed by the CAA.

(c) The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

GM1 Article 11 Annex E. Operational Safety Objective 17

GM.OSO17

For this assessment, the expression “fit to operate” should be interpreted as physically and mentally fit to perform duties and discharge responsibilities safely.

Fatigue and stress are contributory factors to human error. Therefore, to ensure vigilance is maintained at a satisfactory level of safety, consideration may be given to the following:

- Remote Crew workload and duty times
- Regular breaks
- Rest periods
- Handover/Take Over procedures
- Personal Protective Equipment (PPE)
- Workplace environment, including ergonomics of the workstation

GM.OSO17.L.I

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

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

Summary of alcohol limits set out within the RTSA 2003

Level of Alcohol	**All UK Nations**
Micrograms per 100 millilitres of breath	9
Micrograms per 100 millilitres of blood	20
Micrograms per 100 millilitres of urine	27

Personnel carrying out support functions that are directly related to the safe operation of the UA while in flight, such as unmanned aircraft observers, or airspace observers, should comply with the same limitations.

GM.OSO17.M.I

Fatigue and stress are contributory factors which are likely to increase the propensity for human error. Therefore, to ensure that vigilance is maintained at a satisfactory level in terms of safety, consideration should be given to the following:

- Crew duty times
- Regular breaks

- Rest periods and opportunity for napping during circadian low periods
- Health and Safety requirements
- Handover/Take Over procedures
- The crew responsibility and task/cognitive workload (including the potential for ‘boredom’)
- Ability to mitigate the effects from non-work areas (e.g. financial pressure causing anxiety)

The work regime across the crew should take this into account. Where required, an effective Fatigue Reporting System should be implemented within the organisation to increase awareness of fatigue or stress risks and mitigate them accordingly.

Further information to support Fatigue Management approaches for safety relevant workers can be found in the ICAO Fatigue Management guidance material (Doc. 9966).

OSO 18 – Automatic protection of the flight envelope from Human Errors

AMC1 Article 11 Annex E. Operational Safety Objective 18

OSO 18 – Automatic protection of the flight envelope from Human Error

Level of integrity

Criterion	Low (SAIL 3)	Medium (SAIL 4)	High (SAIL 5, 6)
Criterion	OSO18.L.I	OSO18.M.I	OSO18.M.I

Level of assurance

Criterion	Low (SAIL 3)	Medium (SAIL 4)	High (SAIL 5, 6)
Criterion	OSO18.L.A	OSO18.M.A	OSO18.M.A OSO18.H.A

Low level of robustness (SAIL 3)

OSO18.L.I

The UAS **must** include an automatic protection of the flight envelope function which prevents a single input from the remote pilot under normal operating conditions from:

(a) Causing the UA to exceed its flight envelope, or,

(b) Preventing the UA from recovering in a timely fashion.

OSO18.L.A

The Applicant **must** declare and provide evidence of compliance with the Integrity requirements. The detailed evidence of compliance may be assessed by the CAA.

AMC.OSO18.L.A

The automatic protection of the flight envelope may have been developed in-house or may be a commercial off-the-shelf equipment not designed to any specific standard.

Medium level of robustness (SAIL 4)

Lower robustness level requirements to be complied with:

- None

Additional requirements to be compiled with:

OSO18.M.I

The UAS **must** include an automatic protection of the flight envelope function which prevents a single or multiple inputs from the remote pilot under any operating conditions from:

(a) Causing the UA to exceed its flight envelope, or,

(b) Preventing the UA from recovering in a timely fashion.

OSO18.M.A

(a) The automatic protection of the flight envelope function **must** be developed to a standard or means of compliance acceptable to the CAA.

(b) The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

AMC.OSO18.M.A

Annex E paragraph 1.5 provides further information about proposing a standard as an AMC.

High level of robustness (SAIL 5 and 6)

Lower robustness level requirements to be complied with:

- **OSO18.M.A**
- **OSO18.M.I**

Additional requirements to be compiled with:

OSO18.H.I

No additional requirements.

OSO18.H.A

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

GM1 Article 11 Annex E. Operational Safety Objective 18

GM.OSO18

UA are designed with a flight envelope that describes their safe performance limits with regard to minimum and maximum operating speeds and operating structural strength.

Automatic protection of the flight envelope is intended to prevent the remote pilot from operating the UA outside its flight envelope. The Applicant may demonstrate that the remote pilot is not in the loop, in which case OSO 18 is not applicable.

The automatic protection function ensures that the UA is operated within an acceptable flight envelope margin even in the case of incorrect remote-pilot control input (human error).

UAS without automatic protection function are susceptible to incorrect remote-pilot control inputs which may result in the loss of the UA if the performance limits of the aircraft are exceeded.

Failures or development errors of the flight envelope protection function are addressed in OSO 5.

GM.OSO18.L.I

An input from the remote pilot causing the UA to exceed its flight envelope or preventing the UA from recovering from a flight envelope exceedance is considered an erroneous input caused by human error.

GM.OSO18.M.I

The multiple inputs should be considered as happening simultaneously or during the time period when the UA is recovering from the first input.

“Any operating conditions” means that both normal and abnormal (including emergency) operating conditions should be considered.

OSO 19 – Safe recovery from Human Error

AMC1 Article 11 Annex E. Operational Safety Objective 19

OSO 19 – Safe recovery from Human Error

Level of integrity

Criterion	Low (SAIL 3)	Medium (SAIL 4, 5)	High (SAIL 6)
Criterion	OSO19.L.I	OSO19.M.I	OSO19.M.I

Level of assurance

Criterion	Low (SAIL 3)	Medium (SAIL 4, 5)	High (SAIL 6)
Criterion	OSO19.L.A	OSO19.M.A	OSO19.H.A

Low level of robustness (SAIL 3)

OSO19.L.I

The systems detecting and/or recovering from human errors **must** be developed to industry's best practices.

OSO19.L.A

(a) The Applicant **must** declare and provide evidence of compliance with the Integrity requirements. The detailed evidence of compliance may be assessed by the CAA.

(b) If compliance evidence is provided through simulation, the validity of the target environment used in the simulation **must** be justified.

Medium level of robustness (SAIL 4 and 5)

Lower robustness level requirements to be complied with:

- **OSO19.L.A**

Additional requirements to be compiled with:

OSO19.M.I

The systems detecting and/or recovering from human errors **must** be developed to a standard or means of compliance acceptable to the CAA.

OSO19.M.A

(a) The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

(b) Compliance evidence may include testing, analysis, simulation2 , inspection, design review or through operational experience.

High level of robustness (SAIL 6)

Lower robustness level requirements to be complied with:

- **OSO19.L.A**
- **OSO19.M.I**

Additional requirements to be compiled with:

OSO19.H.I

No additional requirements.

OSO19.H.A

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

OSO 20 – Human Factors evaluation

AMC1 Article 11 Annex E. Operational Safety Objective 20

OSO 20 – A Human Factors evaluation has been performed and the HMI found appropriate for the mission

Level of integrity

Criterion	Low (SAIL 2, 3)	Medium (SAIL 4, 5)	High (SAIL 6)
Criterion	OSO20.L.I	OSO20.L.I	OSO20.L.I OSO20.H.I

Level of assurance

Criterion	Low (SAIL 2, 3)	Medium (SAIL 4, 5)	High (SAIL 6)
Criterion	OSO20.L.A	OSO20.L.A OSO20.M.A	OSO20.M.A OSO20.H.A
Alternative FTB method	OSO20.FT.L.A	OSO20.FT.L.A (SAIL 4 only)	Not applicable

Low level of robustness (SAIL 2 and 3)

OSO20.L.I

(a) The UAS information and control interfaces **must** be clearly and succinctly presented and **must not** confuse, cause unreasonable fatigue, or contribute to remote crew error that could adversely affect the safety of the operation.

(b) If an electronic means is used to support the remote crew members in their role to maintain awareness of the position of the unmanned aircraft, its HMI:

(1) **Must** be sufficient to allow the remote crew members to determine the position of the UA during operation.

(2) **Must** not degrade the remote crew members' ability to scan the airspace visually where the UA is operating for any potential collision hazard.

(3) **Must** not degrade the remote crew members' ability to maintain effective communication with the remote pilot at all times.

OSO20.L.A

(a) The Applicant **must** conduct a human factors evaluation of the UAS to demonstrate that the HMI is appropriate for the mission.

(b) The HMI evaluation **must** be based on inspection or analysis.

(c) If (a), (b) and Integrity requirements are complied with through a SAIL mark certificate, the Applicant **must** demonstrate that the HMI is appropriate for the intended operation.

(d) The Applicant **must** declare and provide evidence of compliance with the Integrity requirements. The detailed evidence of compliance may be assessed by the CAA.

OSO20.FT.L.A

The applicant **must** provide evidence of FTB flight hours proportionate to the risk/SAIL of the operation meeting one of the set of conditions described in the FTB policy.

(a) Within the full operational scope/envelope of the intended operation, and

(b) Following the operational procedures and the remote crew training referred to in the OA application.

AMC.OSO20.L.A

Annex E paragraph 1.5 provides further information about proposing a standard as an AMC.

Medium level of robustness (SAIL 4 and 5)

Lower robustness level requirements to be complied with:

- **OSO20.L.I**

Additional requirements to be compiled with:

OSO20.M.I

No additional requirements.

OSO20.M.A

(a) The Applicant **must** conduct a human factors evaluation of the UAS to demonstrate that the HMI is appropriate for the mission.

(b) The HMI evaluation **must** be based on demonstrations or simulations.

(c) If compliance evidence is provided through simulation, the validity of the target environment used in the simulation **must** be justified.

(d) If (a), (b), (c) and Integrity requirements are complied with through a SAIL mark certificate, the Applicant **must** demonstrate that the HMI is appropriate for the intended operation.

(e) The Applicant **must** provide evidence of compliance with Integrity requirements, which will be assessed by the CAA.

OSO20.FT.M.A

The Applicant **must** comply with the requirements of OSO20FT.L.A (SAIL IV only).

AMC.OSO20.M.A

Annex E paragraph 1.5 provides further information about proposing a standard as an AMC.

High level of robustness (SAIL 6)

Lower robustness level requirements to be complied with:

- **OSO20.L.I**
- **OSO20.M.A**

Additional requirements to be compiled with:

OSO20.H.I

The Human factors evaluation **must** include:

(a) An appraisal to verify that the remote crew workload remains acceptable in both normal and emergency situations.

(b) An appraisal of the efficiency of the emergency procedures in terms of efficacy of the actions and the expected potential latencies.

(c) An analysis to verify the correct prioritisation of alarms in an emergency situation.

OSO20.H.A

(a) The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

(b) The CAA may request to witness the HMI evaluation.

GM1 Article 11 Annex E Operational Safety Objective 20

GM.OSO20.L.A (c)

This may take the form of a report explaining the rationale behind the choice of UAS and aspects of the HMI that make it suitable for the intended operation.

GM.OSO20.FT.L.A

The FTB method is an alternative means of compliance with OSO 20 assurance requirements.

Compliance with the requirement provides assurance that the operational procedures are adequate at the level corresponding to the SAIL being demonstrated by the FTB approach.

As an example, if the number of test cycles supporting the FTB flying hours is proportionate to the risk of a SAIL III operation (i.e. 3,000 FH), the assurance level for OSO 20 is satisfied at a low level of robustness.

GM.OSO20.M.A (d)

This may take the form of a report explaining the rationale behind the choice of UAS and aspects of the HMI that make it suitable for the intended operation.

GM.OSO20.H.I (c)

In an emergency situation, multiple failures may lead to multiple alarms that distract and prevent the remote pilot from determining the appropriate response. If this is the case, alarms of lesser importance might be minimised or ignored by design or procedure.

OSO 23 – Environmental conditions

AMC1 Article 11 Annex E. Operational Safety Objective 23

OSO 23 – Environmental conditions for safe operations defined, measurable and adhered to

Level of integrity

Criterion	Low (SAIL 1, 2)	Medium (SAIL 3, 4)	High (SAIL 5, 6)
Criterion	OSO23.L.I	OSO23.L.I	OSO23.L.I

Level of assurance

Criterion	Low (SAIL 1, 2)	Medium (SAIL 3, 4)	High (SAIL 5, 6)
Criterion	OSO23.L.A	OSO23.M.A	OSO23.H.A

Low level of robustness (SAIL 1 and 2)

OSO23.L.I

(a) Environmental condition for safe operations **must** be defined and reflected in the flight manual or equivalent document.

(b) The defined environmental conditions **must** include those provided by the UAS Designer, if available.

OSO23.L.A

The Applicant **must** declare and provide evidence of compliance with the Integrity requirements. The detailed evidence of compliance may be assessed by the CAA.

Medium level of robustness (SAIL 3 and 4)

Lower robustness level requirements to be complied with:

- **OSO23.L.I**

Additional requirements to be compiled with:

OSO23.M.I

No additional requirements.

OSO23.M.A

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

High level of robustness (SAIL 5 and 6)

Lower robustness level requirements to be complied with:

- OSO23.L.I

Additional requirements to be compiled with:

OSO23.H.I

No additional requirements.

OSO23.H.A

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

GM1 Article 11 Annex E. Operational Safety Objective 23

GM.OSO23

Environmental conditions include meteorological conditions such as wind, rain, and icing, as well as external factors that may interfere with the performance of systems such as High-Intensity Radiated Field (HIRF).

OSO 24 – UAS designed and qualified for adverse conditions

AMC1 Article 11 Annex E. Operational Safety Objective 24

OSO 24 – UAS designed and qualified for adverse environmental conditions

Level of integrity

Criterion	Not applicable	Medium (SAIL 3)	High (SAIL 4,5, 6)
Criterion	Not applicable	OSO24.M.I	OSO24.H.I

Level of assurance

Criterion	Not applicable	Medium (SAIL 3)	High (SAIL 4,5, 6)
Criterion	Not applicable	OSO24.M.A	OSO24.H.A
Alternative FTB method	Not applicable	OSO20.FT.M.A	OSO24.FT.M.A (SAIL IV only)

Medium level of robustness (SAIL 3)

OSO24.M.I

The UAS **must** be designed to perform as intended in the environmental conditions defined in the flight manual or equivalent document.

OSO24.M.A

(a) The Applicant **must** provide evidence of compliance with the Integrity requirements.

(b) If compliance evidence is provided through simulation, the validity of the target environment used in the simulation **must** be justified.

(c) If (a), (b) and Integrity requirements are complied with through a SAIL mark certificate, the Applicant **must** demonstrate that the environmental conditions of the intended operation have been considered by the Designer.

OSO24.FT.M.A

The applicant **must** provide evidence of FTB flight hours proportionate to the risk/SAIL of the operation, meeting one of the set of conditions described in the FTB policy.

(a) Within the full operational scope/envelope of the intended operation, and

(b) Following the operational procedures and the remote crew training referred to in the OA application.

High level of robustness (SAIL 4, 5 and 6)

Lower robustness level requirements to be complied with:

- None

Additional requirements to be compiled with:

OSO24.H.I

The UAS **must** be developed to a standard or means of compliance acceptable to the CAA.

OSO24.H.A

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

OSO24.FT.H.A

The Applicant **must** comply with the requirements of OSO24FT.M.A (SAIL 4 only).

AMC.OSO24.H.I

Annex E paragraph 1.5 provides further information about proposing a standard as an AMC.

GM1 Article 11 Annex E. Operational Safety Objective 24

GM.OSO24

In order to comply with the integrity requirements of OSO24, the Applicant should determine:

- Credit may be taken for equipment's environmental qualification testing, e.g. by answering the following questions:
    - o Is a Declaration of Design and Performance (DDP) available to the Applicant, stating the environmental qualification levels to which the equipment was tested?
    - o Did the environmental qualification tests follow a standard considered adequate by the CAA (e.g. RTCA DO-160 "Environmental Conditions and Test Procedures for Airborne Equipment")?
    - o Are the environmental qualification tests appropriate and sufficient to cover all environmental conditions expected to be encountered during the operations?
    - o If the tests were not performed following a recognised standard, were the tests performed by an organisation or entity qualified or having experience in performing environmental type tests (e.g. RTCA DO-160)?
- Whether the suitability of the equipment to operate in the expected environmental conditions may be determined from either in-service experience or relevant test results?
- Any limitations which may affect the suitability of the equipment to operate in the expected environmental conditions.

The lowest integrity level should be considered where the UAS equipment only has achieved partial environmental qualification and/or a partial demonstration by similarity and/or where parts have no environmental qualification at all.

GM.OSO24.M.I

As an example, if a UAS is proposed to be operated in raining conditions, the UAS design is not required to comply with DO-160 waterproof requirements to demonstrate its suitability to operate in such conditions. The UAS may be operated in raining conditions, as long as they are representative of the environmental conditions which the UAS is designed for.

GM.OSO24.M.A

(a) Compliance evidence is typically provided through testing, analysis, simulation, inspection, design review or through operational experience.

(b) Designer data is found on the SAIL mark certificate.

GM.OSO.FT.24.M.A

The FTB method is an alternative means of compliance with OSO 24 assurance requirements.

Compliance with the requirement provides assurance that the operational procedures are adequate at the level corresponding to the SAIL being demonstrated by the FTB approach.

As an example, if the number of test cycles supporting the FTB flying hours is proportionate to the risk of a SAIL 3 operation (i.e. 3,000 FH), the assurance level for OSO 24 is satisfied at a medium level of robustness.

COR – Containment requirements

AMC1 Article 11 Annex E. Containment requirements

COR – Containment requirements

Level of integrity

Criterion	Low (SAIL 2, 3)	Medium (SAIL 4, 5)	High (SAIL 6)
Criterion 1 (Operational volume containment)	COR.C1.L.I	COR.C1.L.I	COR.C1.H.I
Criterion 2 (End of flight upon exit of the operational volume)	COR.C2.L.I	COR.C2.L.I	COR.C2.L.I
Criterion 3 (Definition of the ground risk buffer)	COR.C3.L.I	COR.C3.M.I	COR.C3.M.I
Criterion 4 (Ground risk buffer containment)	Not applicable	COR.C4.M.I	COR.C4.M.I

Level of assurance

Criterion	Low (SAIL 2, 3)	Medium (SAIL 4, 5)	High (SAIL 6)
Criterion 1 (Operational volume containment)	COR.C1.L.A	COR.C1.L.A COR.C1.M.A	COR.C1.M.A COR.C1.H.A
Criterion 2 (End of flight upon exit of the operational volume)	COR.C2.L.A	COR.C2.L.A COR.C2.M.A	COR.C2.M.A COR.C2.H.A
Criterion 3 (Definition of the ground risk buffer)	COR.C3.L.A	COR.C3.L.A COR.C3.M.A	COR.C3.M.A COR.C3.H.A
Criterion 4 (Ground risk buffer containment)	Not applicable	COR.C4.L.A COR.C4.M.A	COR.C4.H.A

Low level of robustness (SAIL 2 and 3)

COR.C1.L.I

Criterion 1 – Operational volume containment

(a) No probable single failure of the UAS or any external system supporting the operation **must** lead to operation outside of the operational volume (qualitative approach), or,

(b) The probability of the failure condition “UA leaving the operational volume” **must** be less than 10-3/FH (quantitative approach).

COR.C2.L.I

Criterion 2 – End of flight upon exit of the operational volume

When the UA leaves the operational volume, an immediate end of the flight **must** be initiated through a combination of procedures and/or technical means.

COR.C3.L.I

Criterion 3 – Definition of the final ground risk buffer

A ground risk buffer **must** be defined which adheres at least to the 1:1 principle, unless the Applicant is able to demonstrate the applicability of a smaller buffer.

COR.C1.L.A

Criterion 1 – Operational volume containment

(a) The compliance evidence **must** at least include a design and installation appraisal which shows that:

(1) The design and installation features, including independence claims, comply with the low integrity requirements.

(2) Particular risks relevant to the intended operation have been addressed and do not violate any independence claim.

(b) If compliance evidence is provided through simulation, the validity of the target environment used in the simulation **must** be justified.

(c) If (a), (b) and Integrity requirements are complied with through a SAIL mark certificate, the Applicant **must** demonstrate that the following aspects considered by the Designer are relevant to the intended operation:

(1) External systems.

(2) The operational volume is the same as or contains the operational volume considered by the Designer.

(3) Particular risks.

(d) The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

COR.C2.L.A

Criterion 2 – End of flight upon exit of the operational volume

(a) The adequacy of the procedures to initiate an immediate end of the flight **must** be tested.

(b) If (a) and Integrity requirements are complied with through a SAIL mark certificate, the Applicant **must** demonstrate that the procedures developed by the Designer in (a) are followed by the Operator.

(c) The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

(d) If compliance evidence is provided through simulation, the validity of the target environment used in the simulation **must** be justified.

COR.C3.L.A

Criterion 3 – Definition of the final ground risk buffer

(a) The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

(b) If compliance evidence is provided through simulation, the validity of the target environment used in the simulation **must** be justified.

(c) If (a), (b) and Integrity requirements are complied with through a SAIL mark certificate, the Applicant **must** demonstrate that the ground risk buffer is the same as or contains the ground risk buffer defined by the Designer.

AMC.COR.C3.L.I

Criterion 3 – Definition of the final ground risk buffer

A smaller than 1:1 ground risk buffer value may be demonstrated by the Applicant for a rotary wing UA using a ballistic methodology approach.

AMC.COR.C1.L.A

Criterion 1 – Operational volume containment

The design and installation appraisal may consist of a written justification which includes functional diagrams, describes how the system works and explains why the Integrity requirement is met.

Medium level of robustness

Lower robustness level requirements to be complied with:

- **COR.C1.L.I**
- **COR.C1.L.A**
- **COR.C2.L.I**
- **COR.C3.L.A**

Additional requirements to be compiled with:

COR.C1.M.I

Criterion 1 – Operational volume containment

No additional requirements.

COR.C2.M.I

Criterion 2 – End of flight upon exit of the operational volume

No additional requirements.

COR.C3.M.I

Criterion 3 – Definition of the final ground risk buffer

The ground risk buffer **must** be developed considering the following aspects:

(a) Probable single failures (including the projection of high energy parts such as rotors and propellers) which may lead to operation outside of the operational volume.

(b) Meteorological conditions.

(c) UA behaviour when activating a technical containment measure.

(d) UA performance.

COR.C4.M.I

Criterion 4 – Ground risk buffer containment

(a) No single failure of the UAS or any external system supporting the operation **must** lead to operation outside of the ground risk buffer.

(b) Software and airborne electronic hardware whose development errors could directly lead to operations outside of the ground risk buffer, **must** be developed to a standard or means of compliance acceptable to the CAA.

COR.C1.M.A

Criterion 1 – Operational volume containment

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

COR.C2.M.A

Criterion 2 – End of flight upon exit of the operational volume

(a) The adequacy of the procedures **must** be demonstrated through either of the following methods:

(1) Dedicated flight test.

(2) Simulation, provided that the simulation is proven valid for the intended purpose with positive results.

(b) If compliance evidence is provided through simulation, the validity of the target environment used in the simulation **must** be justified.

(c) The Applicant must provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

If (a), (b) and Integrity requirements are complied with through a SAIL mark certificate, the Applicant **must** demonstrate that the procedures developed by the Designer in (a) are followed by the Operator.

COR.C3.M.A

Criterion 3 – Definition of the final ground risk buffer

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

COR.C4.M.A

Criterion 4 – Ground risk buffer containment

(a) The compliance evidence **must** at least include a design and installation appraisal which shows that:

(1) The design and installation features, including independence claims, comply with the low integrity requirements.

(2) Particular risks relevant to the intended operation have been addressed and do not violate any independence claim.

(b) If compliance evidence is provided through simulation, the validity of the target environment used in the simulation **must** be justified.

(c) If (a), (b) and Integrity requirements are complied with through a SAIL mark certificate, the Applicant **must** demonstrate that the following aspects considered by the Designer are relevant to the intended operation:

(1) External systems.

(2) The operational volume is the same as or contains the operational volume considered by the Designer.

(3) The ground risk buffer is the same as or contains the ground risk buffer defined by the Designer.

(4) Particular risks.

(d) The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

AMC.COR.C4.M.I

Criterion 4 – Ground risk buffer containment

(a) One of the following methods may be used to demonstrate compliance with the requirement:

(1) An independent flight termination system which initiates the end of the flight when exiting the operational volume.

(2) A secondary independent emergency flight control system which ends the flight in a controlled manner.

(3) A tether which prevents the UA from exiting the ground risk buffer.

(4) A fail-safe health monitoring system which is triggered in the event of a critical feature failure (e.g. navigation).

(b) Annex E paragraph 1.5 provides further information about proposing a standard as an AMC.

AMC.COR.C4.M.A

Criterion 4 – Ground risk buffer containment

The design and installation appraisal may consist of a written justification which includes functional diagrams, describes how the system works and explains why the Integrity requirement is met.

High level of robustness

Lower robustness level requirements to be complied with:

- **COR.C1.L.A**
- **COR.C2.L.I**
- **COR.C2.M.A**
- **COR.C3.M.I**
- **COR.C3.L.A**
- **COR.C4.M.I**
- **COR.C4.M.A**

Additional requirements to be compiled with:

COR.C1.H.I

Criterion 1 – Operational volume containment

No remote single failure of the UAS or any external system supporting the operation **must** lead to operation outside of the operational volume (qualitative approach), or,

The probability of the failure condition "UA leaving the operational volume" **must** be less than 10^{-4}/FH (quantitative approach).

COR.C2.H.I

Criterion 2 – End of flight upon exit of the operational volume

No additional requirements.

COR.C3.H.I

Criterion 3 – Definition of the final ground risk buffer

No additional requirements.

COR.C4.H.I

Criterion 4 – Ground risk buffer containment

No additional requirements.

COR.C1.H.A

Criterion 1 – Operational volume containment

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

COR.C2.H.A

Criterion 2 – End of flight upon exit of the operational volume

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

COR.C3.H.A

Criterion 3 – Definition of the final ground risk buffer

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

COR.C4.H.A

Criterion 4 – Ground risk buffer containment

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

AMC.COR.C1.H.I

Criterion 1 – Operational volume containment

A tether which prevents the drone from exiting the operational volume may be used to demonstrate compliance with the requirement.

GM1 Article 11 Annex E. Containment requirements

GM.COR

Determination of containment requirements addresses the risk posed by an operational loss of control that may infringe on areas adjacent to the operational volume and buffers. The level of risk inherent to the adjacent area and adjacent airspace drives the level of containment robustness to be achieved by containment design features and operational procedures.

The following section provides the containment requirements for the following 3 levels of robustness: low, medium and high.

GM.COR.C1.L.I

Criterion 1 – Operational volume containment

A probable failure is anticipated to occur one or more times in the entire operational life of the UAS.

GM.COR.C3.L.I

Criterion 3 – Definition of the final ground risk buffer

The 1:1 principle refers to applying a ground risk buffer that is as wide as the maximum height of the operational volume.

The 1:1 rule may not be sufficient to meet the target level of safety for some UA configurations (e.g., fixed-wing UA, UA equipped with a parachute). In such cases, the CAA may require defining the ground risk buffer based on a ballistic methodology approach, a glide trajectory, representative flight tests, and/or a combination thereof.

GM.COR.C1.L.A

Criterion 1 – Operational volume containment

(a) Particular risks are physical risks/hazards which originate from a source external to the UAS. Particular risks are able to effect:

(1) Both UAS structures and systems.

(2) One or more UAS sections, and even the entire UAS.

(3) One or more aircraft functions.

(4) One or more aircraft systems.

(5) One or more aircraft system installations.

(b) In other words, a particular risk may violate an independence claim made in the design (e.g. through claiming separation or redundancy of 2 or more systems or functions), which would not be captured by a hazard assessment performed within the boundaries of the UAS.

(c) Examples of particular risks are: hail, ice, snow, bird strike, lightning strike, high intensity radiated fields (e.g. electro-magnetic interference). More details on particular risk may be found in SAE ARP4761A.

(d) If the design and installation appraisal is developed by the Designer, the Designer should develop a set of assumptions for the particular risks which the UAS is expected to be exposed to in the conditions in which the UAS will be cleared to operate. The Designer should then use these assumptions in their compliance evidence data.

(e) Designer data is found on the SAIL mark certificate.

(f) Compliance evidence is typically provided through testing, analysis, simulation, inspection, design review or through operational experience.

GM.COR.C2.L.A

Criterion 2 – End of flight upon exit of the operational volume

(b) Designer data is found on the SAIL mark certificate.

(c) Compliance evidence is typically provided through testing, analysis, simulation, inspection, design review or through operational experience.

GM.COR.C3.L.A

Criterion 3 – Definition of the final ground risk buffer

(a) Compliance evidence is typically provided through testing, analysis, simulation, inspection, design review or through operational experience.

(b) Designer data is found on the SAIL mark certificate.

GM.COR.C3.M.I

Criterion 3 – Definition of the final ground risk buffer

(a) A probable failure is anticipated to occur one or more times in the entire operational life of the UAS.

(b) One example of a meteorological condition is the maximum sustained wind.

GM.COR.C2.M.A

Criterion 2 – End of flight upon exit of the operational volume

Compliance evidence is typically provided through testing, analysis, simulation, inspection, design review or through operational experience.

(c) Designer data is found on the SAIL mark certificate.

GM.COR.C4.M.I

Criterion 4 – Ground risk buffer containment

(a) See GM.CORC1.L.A (a).

(b) Designer data is found on the SAIL mark certificate.

(c) Compliance evidence is typically provided through testing, analysis, simulation, inspection, design review or through operational experience.

GM.COR.C1.H.I

Criterion 1 – Operational volume containment

A remote failure is unlikely to occur in the entire operational life of a single UAS but is anticipated to occur several times when considering the total operational life of a number of UAS of that type.

The quantitative requirement to achieve a high level of integrity is a reduction by a factor of 10 of the likelihood of exiting the operational volume, when compared with the quantitative requirement to achieve a low or medium level of integrity.

COT – Containment requirements (tether)

AMC1 Article 11 Annex E. Containment requirements (tether)

COT – Containment requirements (Tethered operations)

Level of integrity

Criterion	Low (SAIL 2, 3)	Medium (SAIL 4, 5)	High (SAIL 6)
Criterion 1 (Technical design)	COT.C1.L.I	COT.C1.L.I	COT.C1.L.I
Criterion 2 (Procedures)	COT.C2.L.I	COT.C2.L.I	COT.C2.L.I

Level of assurance

Criterion	Low (SAIL 2, 3)	Medium (SAIL 4, 5)	High (SAIL 6)
Criterion 1 (Technical design)	COT.C1.L.A	COT.C1.L.A	COT.C1.L.A
Criterion 2 (Procedures)	COT.C2.L.A	COT.C2.M.A	COT.C2.M.A COT.C2.H.A

Low level of robustness

COT.C1.L.I

Criterion 1 – Technical design

(a) The length of the tether **must** be adequate to contain the UA within the operational volume.

(b) The strength of the line **must** be compatible with the ultimate loads during the operation.

(c) The strength of the tether attachment points **must** be compatible with the ultimate loads expected during the operation.

(d) It **must not** be possible for the tether to be cut by a rotating propeller.

COT.C2.L.I

Criterion 2 – Procedures

Procedures **must** be developed to install and periodically inspect the condition of the tether.

COT.C1.L.A

Criterion 1 – Technical design

(a) The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA.

(b) Compliance evidence **must** include the tether material specifications.

(c) If compliance evidence is provided through simulation, the validity of the target environment used in the simulation **must** be justified.

(d) If (a), (b), (c) and Integrity requirements are complied with through a SAIL mark certificate, the Applicant **must** demonstrate that:

(1) The length of the tether is adequate to contain the UA within the intended operational volume.

(2) The ultimate loads considered by the Designer will not be exceeded during the intended operation.

COT.C2.L.A

Criterion 2 – Procedures

(a) The Applicant **must** provide evidence of compliance with Integrity requirements, which will be assessed by the CAA.

(b) If simulation is used to demonstrate the adequacy of the procedures, the simulation **must** be proven valid for the intended purpose with positive results.

(c) If (a), (b) and Integrity requirements are complied with through a SAIL mark certificate, the Applicant **must** demonstrate that the procedures provided by the Designer are followed by the Operator.

Medium level of robustness

Lower robustness level requirements to be complied with:

- **COT.C1.L.I**
- **COT.C1.L.A**
- **COT.C2.L.I**
- **COT.C3.L.A**

Additional requirements to be compiled with:

COT.C1.M.I

Criterion 1 – Technical design

No additional requirements.

COT.C2.M.I

Criterion 2 – Procedures

No additional requirements.

COT.C1.M.A

Criterion 1 – Technical design

The Applicant **must** provide evidence of compliance with Integrity requirements, which will be assessed by the CAA.

COT.C2.M.A

Criterion 2 – Procedures

(a) The procedures **must** be developed to a standard or means of compliance acceptable to the CAA.

(b) The adequacy of the procedures **must** be demonstrated through either of the following methods:

(1) Dedicated flight test.

(2) Simulation, provided that the simulation is proven valid for the intended purpose with positive results.

(c) The Applicant **must** provide evidence of compliance with Integrity requirements, which will be assessed by the CAA.

AMC.COT.C2.M.A

Criterion 2 – Procedures

Annex E paragraph 1.5 provides further information about proposing a standard as an AMC.

High level of robustness

Lower robustness level requirements to be complied with:

- **COT.C1.L.I**
- **COT.C1.L.A**
- **COT.C2.L.I**
- **COT.C2.L.A**
- **COT.C2.M.A**

Additional requirements to be compiled with:

COT.C1.H.I

Criterion 1 – Technical design

No additional requirements.

COT.C2.H.I

Criterion 2 – Procedures

No additional requirements.

COT.C1.H.A

Criterion 1 – Technical design

The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

COT.C2.H.A

Criterion 2 – Procedures

(a) The flight tests performed to validate the procedures **must** cover the entire flight envelope or be demonstrated to be conservative.

(b) If (a) and Integrity requirements are complied with through a SAIL mark certificate, the Applicant **must** demonstrate that the flight envelope of the intended operation is the same as or contained within the flight envelope considered by the Designer.

(c) The Applicant **must** provide evidence of compliance with the Integrity requirements, which will be assessed by the CAA. The CAA will validate continuing compliance through oversight.

GM1 Article 11 Annex E. Containment requirements (tether)

GM.COT

This section provides the containment requirements which address the specific use of a tether, for the following 3 levels of robustness: low, medium and high.

This section is an alternative to COT – Containment requirements.

GM.COT.C1.L.I

Criterion 1 – Technical design

(b) Ultimate loads are the maximum loads expected to be exerted by the UAS on the tether during the operation, including all possible nominal and failure scenarios, and multiplied by a safety factor of 1.5.

GM.COT.C2.L.I

Criterion 2 – Procedures

(a) Designer procedures should be followed by the Operator where available.

GM.COT.C1.L.A

Criterion 1 – Technical design

(a) Compliance evidence is typically provided through testing or operational experience.

(b) Designer data is found on the SAIL mark certificate.

GM.COT.C2.L.A

Criterion 2 – Procedures

(c) Designer data is found on the SAIL mark certificate.

GM.COT.C2.H.A

Criterion 2 – Procedures

(b) Designer data is found on the SAIL mark certificate.

GM1 Article 11 Annex E. Functional test based (FTB) methodology

GM.FTB

(a) The FTB methodology is used in the following situations:

(1) For the **UAS Designer** to conduct an FTB design appraisal, which demonstrates the UAS operational reliability.

(2) For the **UAS Operator** to take credit from the FTB design appraisal conducted by the UAS Designer to show compliance with the relevant OSOs. This has the benefit for the UAS Operator going through the OA process to provide automatic compliance with a number of OSOs, in particular when the Operator does not have a fully established relationship with the Designer or does not have access to the UAS design data.

(3) For the **UAS Operator** to demonstrate safe and successful operations over time in order to expand their operational approval, based on the concept of "reliability growth model".

(4) The FTB methodology is not considered feasible for UAS operations with a SAIL above V.

These three approaches are detailed in the following sections.

(b) The UAS Designer may use the FTB methodology to conduct an FTB design appraisal, which demonstrates the UAS operational reliability. The following aspects should be considered in applying the FTB methodology:

(1) Functional testing should be conducted, which may be divided into two types:

(i) 'Functional tests' are operational test cycles that are fully representative of end-state operations, with test points that verify safe operation at the operational limits and corners of the UA envelope.

(ii) 'Induced failure tests', which typically address demand-based systems, i.e. systems that are not continuously active and are triggered only under certain failure conditions. These tests are required where functional tests alone are not sufficient to demonstrate operational reliability, e.g. to cover likely failures.

(c) Although ASTM F3478-20 is not an officially accepted standard, it provides useful guidance for the development and deployment of an FTB campaign. Topics discussed in ASTM F3478-20 include:

(1) Development of operational flight tests, as well as specific (ground) testing to verify underlying system parameters statistically, e.g. component and UA MTBF, operational hazard rates, parachute reliability. Both the UAS Designer and the competent authority need to understand the assumptions made when attributing a distribution type to a system parameter (e.g. exponential, normal, Weibull, gamma distributions).

(i) Any infringement or loss of control occurring during the test campaign will require a root cause analysis. If design modifications are necessary following the investigation, an analysis is performed to assess whether the FTB flying hours performed prior to the modification may still be considered valid. Some tests or the entire FTB campaign might have to be reconducted.

(ii) UAS Designers and competent authorities should be cognisant of the systems, such as software or airborne electronic hardware-based systems that do not allow accurate analysis under operational time or demand-based testing. These systems should use system-specific analyses (e.g. multiple condition/decision coverage, model checking, development assurance, design and analysis) appropriate to the SAIL level.

(d) The CAA may grant a specific flight test authorisation to conduct the functional and induced failure tests needed to complete the FTB campaign.

(e) The UAS Operator may take credit from the FTB design appraisal conducted by the UAS Designer to show compliance with the relevant OSOs. To do so, the following conditions need to be met:

(1) The functional tests performed by the Designer cover the full operational scope/envelope intended by the Operator.

(2) The functional tests performed by the Designer have been executed following the operational procedures and the remote crew training referred to in the operational authorisation, which meet the integrity assurance of the associated OSOs.

(3) The Operator’s maintenance instructions are established based on the Designer’s instructions and requirements which were used for maintenance, repair, or replacement of UAS sub-systems during the functional tests performed by the Designer.

(4) Any deviation in the UAS configuration from the configuration used by the Designer during the FTB campaign are confirmed by the Designer to not impair the validity of the FTB design appraisal.

(5) The minimum number of test cycles has been achieved for the corresponding SAIL, with no failure occurrence:

(i) 30 hours for SAIL 1;

(ii) 300 hours for SAIL 2;

(iii) 3000 hours for SAIL 3; and

(iv) 30000 hours for SAIL 4

Note: this allows achieving a factor of 95% confidence in the reliability of the operation per a binomial/Poisson distribution.

(6) The functional tests performed by the Designer have been executed by the Designer according to principles or standards considered adequate by the CAA, including the following:

(i) The functional tests have been executed using an acceptable sample size of UAS.

(ii) Safe life limits for UAS sub-systems sensitive to wear-out conditions based on the maximum cycles and hours demonstrated by one or more fleet leader UAS (i.e. the UAS with the longest time and/or cycles compared to other UAS used during the FTB campaign) have been derived by the Designer and captured in the FTB design appraisal limitations.

Note: induced failure tests may also help demonstrate compliance with the following OSOs:

(iii) OSO 5 and Containment requirements: safety and reliability / safe design (e.g. induced failure tests with no loss of control or containment as pass-fail criteria).

(iv) OSO 6: C3 link performance appropriate for the operation (e.g. if the distance from a C2 radio transmitter/receiver is a critical factor, then the demonstration of the maximum allowable range from the transmitter/receiver in the most likely worst-case conditions is needed).

(v) OSO 18: Automatic protection of the flight envelope from human errors.

(f) The UAS Operator may use the FTB methodology to demonstrate safe and successful operations over time in order to expand their operational approval, based on the concept of “reliability growth model”, as follows:

(1) The UAS Operator should operate with a low SAIL approval and then, through operational experience, gather sufficient operational data to justify an increase in the SAIL based upon the increase in operational reliability demonstrated. This approach is only valid under representative operating conditions, without requesting additional strategic or tactical mitigations.

(i) The CAA may accept accumulation of FTB hours between Operators if the UAS configuration, operational procedures, training, etc. are demonstrated to be equivalent.

(ii) This method does not cover expanded operating conditions, which would require additional testing and/or analysis to be performed by the UAS Designer.

(iii) As an example, the Operator may start operating with a SAIL 2 operational approval to fly over a population density of up to 500 people per km². As they demonstrate 3,000 hours of operation with no loss of control, they may be approved by the CAA to operate at SAIL 3 under the exact same operating conditions, with an allowable maximum population density increased to 5,000 people per km².

(iv) The UAS Operator should demonstrate that:

(A) the next population band does not introduce new hazards. If new hazards are introduced, they should be mitigated through test or analysis.

(B) The conditions listed in (e) have been met, in particular the minimum number of test cycles required for the desired SAIL per (e)(5).

(C) any UAS configuration differences compared to the initial configuration do not impair the validity of the argument.

GM1 Article 16(1) – UAS Operations in the Framework of Model Aircraft Clubs and Associations

APPLICATION GUIDANCE

An application for an Article 16 authorisation will need to include a risk assessment. ~~It is advised to use the risk assessment guidance described in GM1 Article 11, as a basis for the risk assessment.~~ This should include the following (this list is not exhaustive):

[…]