Acceptable Means of Compliance and Guidance Material to Commission Implementing Regulation (EU) 2019/947 — Issue 1, Amendment 3

Annex to ED Decision 202X/XXX/R

'AMC and GM to Regulation (EU) 2019/947 — Issue 1, Amendment 3'

This document shows deleted, new or amended text as follows:

— deleted text is ~~struck through~~;

— new or amended text is highlighted in blue;

— an ellipsis '[…]' indicates that the rest of the text is unchanged.

Note to the reader

In amended, and in particular in existing (that is, unchanged) text, 'Agency' *is used interchangeably with* 'EASA'. *The interchangeable use of these two terms is more apparent in the consolidated versions. Therefore, please note that both terms refer to the* 'European Union Aviation Safety Agency (EASA)'.

The following abbreviations are added to the LIST OF ABBREVIATIONS

ATZ	aerodrome traffic zone
CAA	civil aviation authority
COTS	commercial off-the-shelf
CSP	comprehensive safety portfolio
FTB	functional test-based
FTS	flight termination system
HF	human factors
iGRC	intrinsic ground risk class
RCM	remote crew member
SLA	service-level agreement
SMS	safety management system
S&A	see and avoid
TLOS	target level of safety
UTM	UAS traffic management
VHL	very high-level airspace

GM1 Article 11 is amended as follows:

GM1 AMC1 Article 11 Rules for conducting an operational risk assessment

ED Decision 2023/012/R

GENERAL

The operational risk assessment required by Article 11 of the UAS Regulation may be conducted using the methodology described in AMC1 Article 11. This methodology is basically the specific operations risk assessment (SORA) developed by JARUS. With Decision 2024/xxx/R SORA version 2.5 was introduced. Decision 2019/021/R, introducing SORA version 2.0, has not been repealed in order to allow those UAS operators, that are finalising an application for an operational authorisation, to still be allowed to apply using SORA 2.0. Each MS will define for how long they will accept applications using SORA 2.0. Other methodologies might be used by the UAS operator as alternative means of compliance.

[…]

AMC1 Article 11 is replace by the following:

AMC1 Article 11 Rules for conducting an operational risk assessment (SORA)

SPECIFIC OPERATIONS RISK ASSESSMENT (SORA) (SOURCE JARUS SORA V2.5)

Edition November 2024

Section 0 Executive Summary (GUIDANCE)

S0.1 The SORA approach

The Specific Operations Risk Assessment (SORA) process is intended to provide a risk-proportionate method to determine the required evidence and assurances needed for an Unmanned Aircraft System (UAS) to be acceptably safe within the "Specific" category of UAS Operations as defined in Article 3(b) of Regulation (EU) 2019/947.

The SORA provides structure and guidance to both the competent authority and the applicant to support an application to operate a UAS in a given operational environment. The benefit of this process is that both the applicant and competent authority can allocate their available resources and time proportionally to the risk of the UAS operation.

The SORA uses a holistic safety risk management process to evaluate the risks related to a given UAS operation and then provide proportionate provisions that a UAS operation should meet to ensure a target level of safety (TLOS) is met. This TLOS is defined for people and aircraft uninvolved in the UAS operation and is commensurate with existing manned aviation levels of safety to these same stakeholders. These values were chosen 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[1] and Section 1.2.1 in Annex F[2] version 2.5):

i. for ground risk - less than one fatality per million hours (1E-6 fatalities per hour) (See Annex F[2] Section 1.2.1 for more details),

ii. for air risk - less than one mid-air collision per 10 million flight hours (1E-7 mid-air collisions per flight hour) for operations that primarily occur under self-separation and see-and-avoid (primarily uncontrolled airspace). For operations that occur with separation provided by an air navigation service provider (primarily controlled airspace), the TLOS is one mid-air collision per billion flight hours (1E-9 mid-air collisions per flight hour).

The SORA has been developed using assumptions expected to be both credible and conservative across a wide range of UAS Operations.

Under the specific category, different UAS operations will have different levels of inherent risk and thus will need to demonstrate varying levels of ability to maintain control of the operation to meet the TLOS. To do this, the SORA has developed the specific assurance and integrity levels (SAIL), which maps the maximum allowable loss of control rate to operational, organisational, personnel, design, and manufacturing risk controls that aim to ensure that an operation meets the TLOS. This means a

---

[1] jar_04_doc_amc_rpas_1309_issue_2_2.pdf (jarus-rpas.org)

[2] http://jarus-rpas.org/wp-content/uploads/2024/06/SORA-v2.5-Annex-F-Release.JAR_doc_29pdf.pdf

UAS operating in a high-risk environment (example: over a large city near an airport) would have to demonstrate more to the competent authority than the same UAS operating in a low-risk environment (example: at a closed test range and below 30 m).

S0.2 The SORA methodology

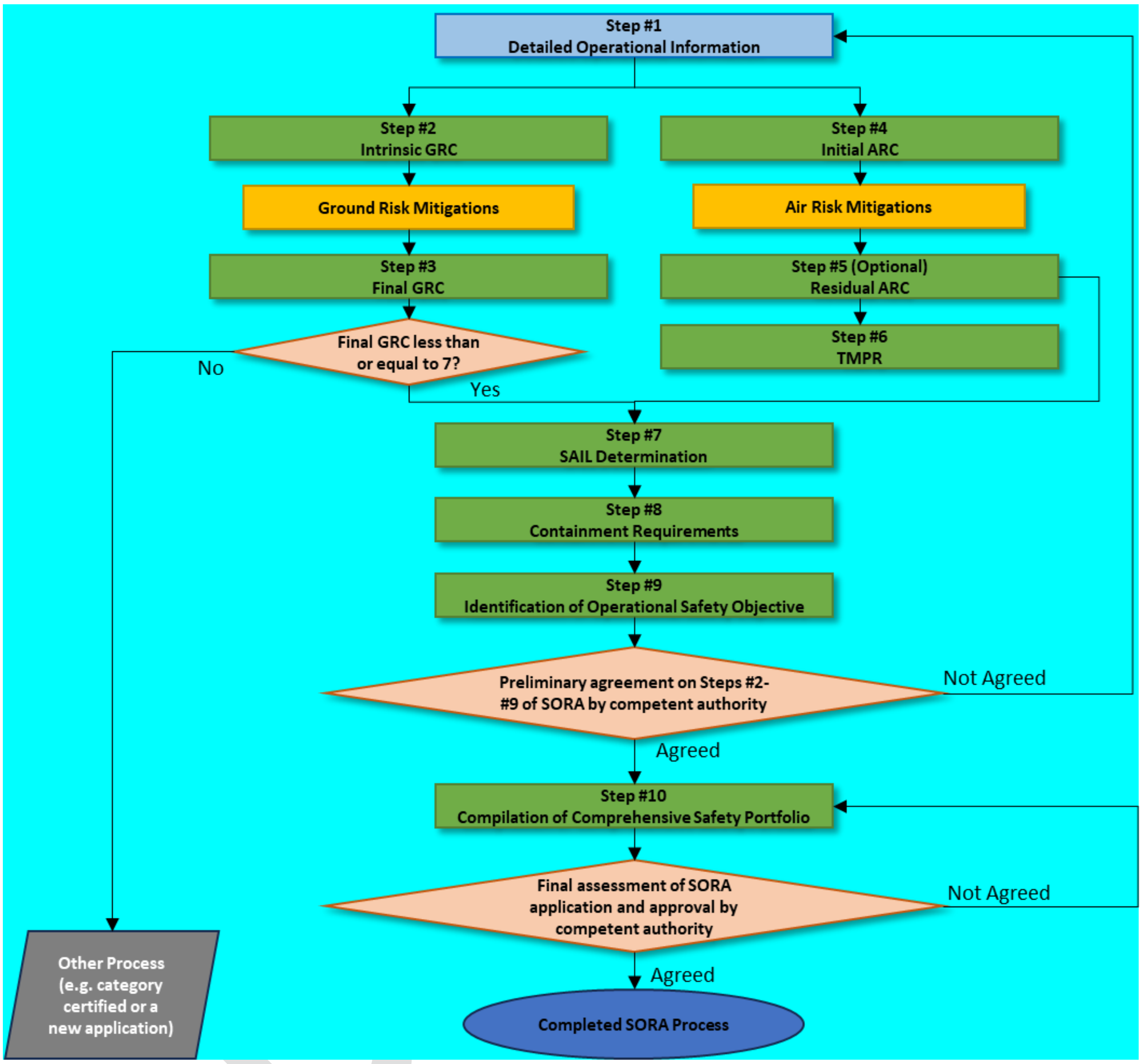


Figure 1 — The SORA process

Note: If UAS operations are conducted across different environments, some steps may need to be repeated for each particular environment.

The SORA methodology consists of ten systematic steps:

Step #1: Documentation of the proposed operation(s)

This is a preparatory step which is intended to ensure the applicant has sufficient information to complete Steps #2 to #9 of the SORA process. This information should enable the subsequent steps of the SORA process to be completed successfully.

Step #2: Intrinsic ground risk class (iGRC)

The intrinsic ground risk class is determined by the UA characteristics (maximum characteristic dimension and maximum speed) as well as the at-risk population density in the operational volume and ground risk buffer.

Step #3: Final ground risk class

The final ground risk class is determined based on any mitigation measures put in place, as described in Annex B, which may have a significant effect on the likelihood of a fatality after loss of control of the operation, including:

i. strategic mitigations intended to reduce the risk before flight,

ii. tactical mitigations intended to reduce the risk during flight,

iii. mitigations intended to reduce the effect of a ground impact.

A final GRC higher than 7 is out of the scope of SORA and should be handled in the certified category.

Step #4: Initial air risk class (ARC)

The determination of air risk class is done in Steps #4 & #5. In Step #4, the initial ARC is assessed based on an expected generalised encounter rate in the airspace identified in Step #1. The parameters that define the four categories of ARC (a, b, c, d) are: if the airspace is atypical (e.g., segregated), altitude, controlled by air traffic versus uncontrolled, airport versus non-airport environment, and airspace over urban versus rural environments.

Step #5: Residual air risk class

The residual ARC is obtained after applying any relevant strategic mitigation measures in order to lower the initial air risk class. Two types of strategic mitigation measures, as described in Annex C, exist in the SORA. Air risk mitigations are either operational restrictions (e.g., boundaries, time of operation) which are controlled by the UAS operators, or by the structure and associated rules of the airspace which are controlled by the relevant authorities (e.g. UTM, U-space).

Step #6: Tactical mitigation performance requirement (TMPR) and robustness levels

Tactical mitigation requirements on the operation are then applied in Step #6 to mitigate any remaining unacceptable residual risk of a mid-air collision with manned air traffic after the strategic mitigations have been applied.

Tactical mitigation performance requirements (TMPR) address the functions of detect, decide, command, execute and feedback Loop (see Annex D to AMC1 to Article 11), for each residual air risk class.

Step #7: SAIL determination

A SAIL (scaled from I to VI) is then assigned to the operation described Step #1 based on the final GRC and residual ARC.

Step #8: Containment provisions

The containment provisions aim to ensure that the target level of safety can be met for both ground and air risk in the adjacent area.

There are three possible levels of robustness for containment: low, medium and high; each with a set of safety provisions described in Annex E to AMC1 to Article 11 as a function of UA characteristics, SAIL, average population density in the defined adjacent area and the presence of outdoor assembly within 1 km of the outer limit of the operational volume.

Step #9: Identification of Operational Safety Objectives (OSO)

The SAIL level identifies levels of integrity and assurance (low, medium, high) to be met for each operational safety objective (OSO) according to criteria provided in Annex E to AMC1 to Article 11.

For the assigned SAIL, the UAS operator is required to show compliance with each of the 17 OSOs, at the defined robustness level (for lower SAILs, some OSOs are classified as 'NR' (not required) in table 14. Even if in this case the UAS operator is not required to show compliance to the competent authority, the UAS operator is expected to still consider them, at least with low level of integrity). The OSOs cover, but are not limited to: the UAS designer, UAS operator or other organisations involved in maintenance, related services and training, UAS technical aspects, deterioration of external systems supporting UAS operations, human machine interface, human error, adverse operating conditions.

Step #10: Comprehensive Safety Portfolio

The comprehensive safety portfolio (CSP) is a suite of documents showing compliance with the provisions resulting from the SORA steps for the proposed operation. If the comprehensive safety portfolio does not provide appropriate evidence as determined by the SORA process at the given SAIL, changes to the proposed operation (e.g., reduction of the intrinsic risk of the operation), additional mitigation measures, possible UAS design changes, or further analysis/evidence may be needed.

Annex A to AMC1 to Article 11 provides guidance and templates on how to provide relevant information to the competent authority as part of the SORA process.

Section 1 Introduction (GUIDANCE)

S1.1 Preface

The SORA provides a methodology to guide both the applicant and the competent authority in determining whether a UAS operation can be conducted in a safe manner. The document should not be used as a checklist, nor be expected to provide answers to all the potential challenges related to the UAS operation. The SORA is a guide that allows an operator to identify the risk and, if needed, reduce it to an acceptable level by tailoring their mitigations to the operation. This involves meeting or exceeding the target level of safety (TLOS) regardless of the complexity of the UAS operation, UA size, or the area of operation. The TLOS of operations under the specific category covered by SORA is equivalent to that of the category open and certified categories. For this reason, it does not contain prescriptive provisions but rather safety objectives to be met at various levels of robustness commensurate with risk.

S1.2 Purpose of the document

(a) The purpose of the SORA is to propose a methodology of risk assessment to support an application for authorization to operate a UAS within the specific category.

(b) Due to the operational differences and expected increase in level of risk of the operating environment, the specific category cannot automatically take credit for the safety and performance data demonstrated with the large number of UAS operating in the open category. Therefore, the SORA provides a consistent approach to assess the additional risks associated with the expanded operations not covered by the open category.

(c) This methodology is proposed as an acceptable means to evaluate the safety risks and determine the acceptability of a proposed UAS operation within the specific category.

(d) The methodology is based on the principle of a holistic system safety risk-based assessment model used to evaluate the risks of a given operation. The model considers the most common safety threats associated with a specified hazard, the relevant design, and the proposed operational mitigations for a specific UAS operation(s). The SORA then helps to evaluate the risks systematically and determine any needed limitations required for safe operation. This method allows the applicant to determine acceptable risk levels and to validate that those levels are complied with by the proposed operations. The competent authority may also apply this methodology to gain confidence that the UAS operator can conduct the operation safely.

(e) The methodology, related processes, and values proposed in this document are intended to guide an applicant when performing a risk assessment of an intended operation to obtain an operational authorisation by the competent authority. At the same time, this material is intended to support the competent authority while assessing the completeness and acceptability of an application to operate in the specific category.

S1.3 Applicability

(a) The methodology presented in this document is aimed at evaluating the safety risks involved with the operation of one or multiple UAS of any type and size. In the case of multiple simultaneous UA operating relative to each other, such as displays for entertainment, it is recommended to examine common mode failures and adapt the application of the SORA as needed in consultation with the competent authority.

(b) The methodology is designed to be applicable to all levels of automation.

(c) Safety risks associated with collisions between UA and manned aircraft are in the scope of the methodology. The risk of collision between two UA will be addressed in future revisions of the document. It is expected that multiple simultaneous operations and concurrent high-volume operators have a deconfliction strategy for their own UA.

(d) The carriage of dangerous goods on board the UAS (e.g., weapons, munitions of war, explosives, hazardous medical samples) that present additional hazards are excluded from the scope of this methodology and might require additional safety considerations (e.g., demonstration of the ability to contain the dangerous good).

(e) Privacy, environmental and financial aspects are excluded from the applicability of this methodology.

(f) In addition to performing the SORA process, the UAS operator should also ensure compliance to all other regulatory applicable to the UAS operation that are not necessarily addressed by the SORA, i.e., the SORA does not preclude any additional regulatory requirements implemented by the competent authority.

(g) The SORA can be used to get operational authorisation for UAS operations conducted in multiple locations. In that situation, the UAS operator needs to provide a SORA that is applicable to all these areas to show that the SORA provisions will be met for all flights performed under the operational authorisation. If an applicant can demonstrate to have sufficient procedures in place to correctly allocate operational volumes, buffers, adjacent areas and airspaces, a generic location authorisation could be considered as described in GM2 UAS.SPEC.030(2).

S1.4 SORA documents

SORA is made of the following documents:

Main Body (AMC1 to Article 11): describing the SORA risk assessment process;

Annex A to AMC1 to Article 11: guidelines for the applicant on collecting and presenting system and operation information for a specific UAS operation to the authority;

Annex B to AMC1 to Article 11: integrity and assurance levels for the mitigations used to reduce the intrinsic ground risk class;

Annex C to AMC1 to Article 11: air risk strategic mitigations;

Annex D to AMC1 to Article 11: air risk tactical mitigations;

Annex E to AMC1 to Article 11: integrity and assurance levels for the operational safety objectives (OSO);

Annex F[3]: Theoretical basis for ground risk classification and containment provisions;

Annex I to AMC1 to Article 11: glossary.

[3] http://jarus-rpas.org/wp-content/uploads/2024/06/SORA-v2.5-Annex-F-Release.JAR_doc_29pdf.pdf

Section 2. Key concepts and definitions (GUIDANCE)

S.2.1 Risk in the context of SORA

(a) The definition of "risk" as provided in the SAE ARP 4754B / EUROCAE ED-79B: "the combination of the frequency (probability) of an occurrence and its associated level of severity" is used.

(b) The consequence of an occurrence will be designated as a harm of some type.

(c) Many different categories of harm can arise from any given occurrence. This document will focus on occurrences of harm (e.g., an UAS crash) that are short-lived and usually give rise to potential loss of life. Chronic events (e.g., toxic emissions over a period of time), are explicitly excluded from this assessment. The categories of harm in this document are the potential for:

i. fatal injuries to third parties on the ground[4];

ii. hazard to third parties in the air.

(d) As the SORA only addresses safety risk, it is acknowledged that the competent authorities, when appropriate, may consider additional categories of harm (e.g., cybersecurity, privacy, disruption of a community, environmental damage, financial loss, etc.).

(e) Fatal injury is a well-defined condition and known by the competent authorities. Therefore, the risk of under-reporting fatalities is almost non-existent. The quantification of the associated risk of fatality is straightforward. The usual means to measure fatalities are by the number of deaths within a particular operating time interval (e.g., fatal accident rate per million flying hours), or the number of deaths for a specified circumstance (e.g., fatal accident rate per number of take-offs).

(f) Damage to critical infrastructure is a more complex condition and different countries may have differing sensitivities to this harm. Therefore, the quantification of the associated risks may be difficult and subject to national specificities, thus it is not addressed within the SORA and should be subject to a separate risk assessment. This should be done in cooperation with the organization responsible for the infrastructure, as they are most knowledgeable of the threats.

S.2.2 Semantic model in the context of SORA

(a) The semantic model is a key aspect to understanding the SORA and introduces concepts and common terms for all users of the SORA.

(b) To facilitate effective communication of all aspects of the SORA, the methodology requires standardized use of terminology for phases of operation[5], procedures, and operational volumes. The semantic model shown in Figure 2, provides a consistent use of terms for all SORA users. Figure 3 provides a graphical representation of the model and a visual reference to further aid the reader in understanding the SORA terminology.

---

[4] Risk to involved persons should be mitigated through appropriate procedures. Involved persons should accept the risk of the UAS operation by informed consent.

[5] An operation may be a single flight or, multiple sequential and/or simultaneous flights, that are assessed under a single SORA process.

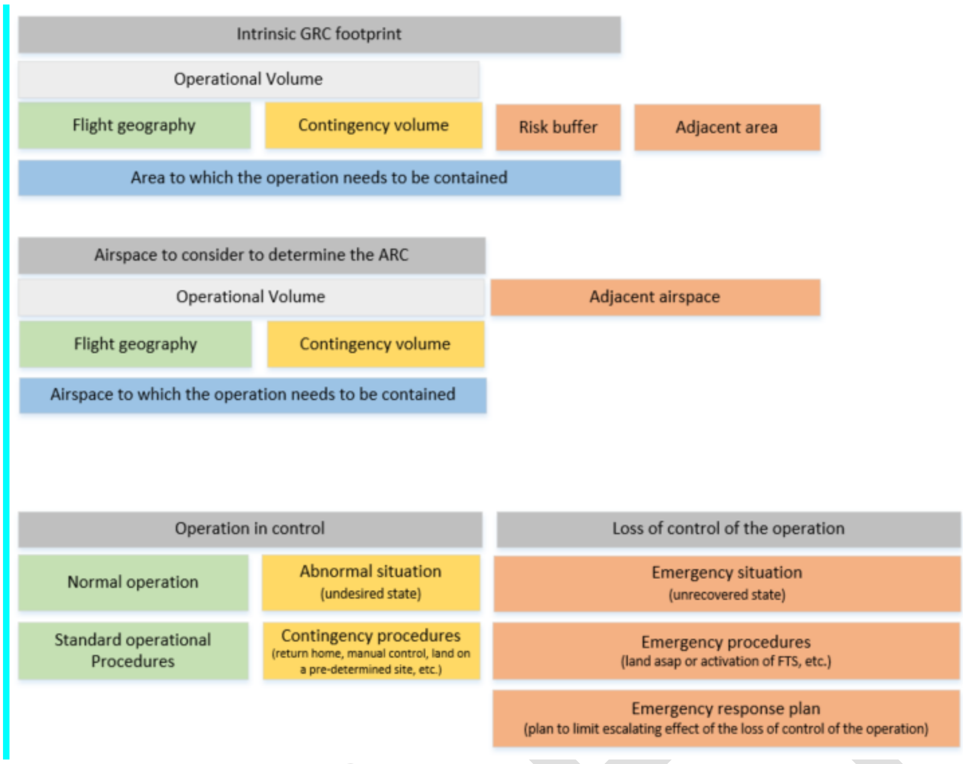


Figure 2 - SORA semantic model

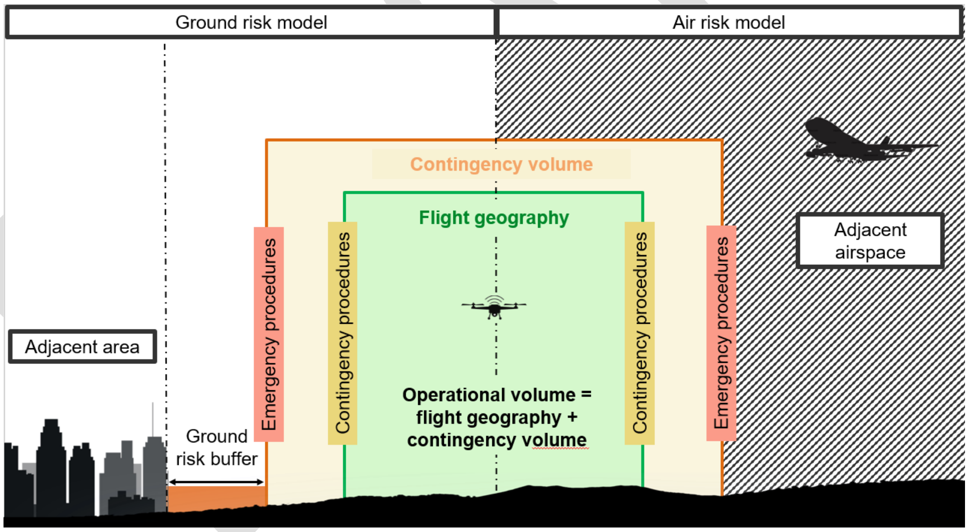


Figure 3 - Graphical Representation of SORA Semantic Model

(c) The SORA considers two states of the operation – in control and loss of control. The SAIL score of the operation is inversely proportional to the acceptable loss of control rate of the operation to meet the safety objectives. The higher the SAIL score, the higher the level of integrity and assurance of the operational safety objectives becomes, which should result in a decreased loss of control rate for the operation.

S2.2.1 The operational volume

(a) The operational volume is defined as the volume in which the operation is intended to take place safely.

(b) It is made up of the flight geography and the contingency volume.

(c) The operational volume is the basis to determine the air risk class (ARC) of an operation.

(d) The main SORA process is applied to the operational volume and ground risk buffer. To protect the adjacent area and airspace the UAS operation should be contained within the operational volume.

S.2.2.2 The flight geography

(a) The flight geography is the volume where the UAS operates in normal operations.

(b) Depending on the type of the operation, the flight geography can 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 some specific conditions.

(c) Whenever a particular flight requires the UA to traverse or loiter/hold at a specific point of interest, this point shall be included inside the flight geography. Refer to chapter A.5 of Annex A for additional information.

(d) The flight geography should include trajectories and volumes required for diversions to alternate destinations and operational procedures (e.g., in case of loss of C2 Link or miss-approach).

S2.2.3 The contingency volume

(a) The contingency volume surrounds the flight geography. The outer limit of the contingency volume is equivalent to the outer limit of the operational volume.

(b) Entry into this volume is always considered an abnormal situation and requires the execution of appropriate contingency procedures to return the UA to the flight geography.

(c) The outer boundary of the flight geography should include sufficient margins for system and operational errors (e.g., deviation from planned trajectory, map error and latency).

(d) It should be noted that an abnormal situation may also occur inside the flight geography.

S.2.2.4 The ground risk buffer

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

(b) If the UA exits the contingency volume during a loss of control of the operation, it is expected to safely terminate the operation within the ground risk buffer.

(c) The appropriate 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 identified containment provisions of the SORA.

(d) The footprint of the operational volume plus the ground risk buffer is the area used to determine the ground risk class (GRC).

S.2.2.5 The adjacent area

(a) The adjacent area represents the ground area adjacent to the ground risk buffer where it is reasonably expected a UA may crash after a loss of control situation resulting in a flyaway.

(b) While the adjacent area inner limit starts at the outer limit of the ground risk buffer, the outer limit of the adjacent area is calculated starting from the inner limit of the ground risk buffer.

(c) The size of the adjacent area depends on the UA performance. Authorities should notice and prevent cases where an applicant tries to include in the operational volume areas which are not intended for use but are only there for manipulation of the composition of the adjacent area.

S.2.2.6 The adjacent airspace

(a) The adjacent airspace corresponds to the airspace where it is reasonably expected that a UA may fly after a loss of control situation resulting in a flyaway.

(b) The adjacent airspace is the airspace adjacent to the operational volume.

S.2.3 States of the operation

S.2.3.1 Operation in control

(a) An operation is considered in control, when the remote crew is able to continue the management of the current flight situation, such that no persons on the ground or in the air onboard manned aircraft are put in immediate danger.

(b) This holds true for both normal and abnormal situations, however the safety margins in the abnormal situation are reduced. In the abnormal state, it is the remote crews' duty to try to return the operation back into the controlled state by executing contingency procedures as soon as practical.

(c) Normal operation

Utilises standard operating procedures, a set of instructions covering policies, procedures and responsibilities set out by the UAS operator that supports operational personnel in ground and flight UAS operations safely and consistently.

(d) Abnormal situation

i. An abnormal situation is an undesired state where it is no longer possible to continue the flight using standard operating procedures, but the safety of the aircraft, persons on the ground or in the air is not in immediate danger. In this case contingency procedures should be applied.

ii. 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 controlled state and allow the return to using standard operating procedures or allow the safe cessation of the flight.

S.2.3.2 Loss of control of the operation

(a) Loss of control of the operation is a state that corresponds to situations:

i. when the outcome of the situation highly relies on providence, or

ii. which could not be handled by a contingency procedure.

(b) In the context of the semantic model, this includes situations where a UA has exited the operational volume and is potentially operating over or in an area that may be characterised by a different level of ground or air risk.

(c) The 'loss of control' state is also entered, if a UA does not follow the predefined route and the remote pilot is unable to control it, it crashes or if an unplanned flight termination sequence is executed, even if this happens inside the operational volume.

(d) Emergency procedures are executed in case of loss of control of the operation. They are 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 lead to an emergency condition (e.g. flight termination system). Emergency procedures should be activated as soon as the UA reaches the boundary of the operational volume. However, as soon as the remote crew identifies a failure condition where the UA cannot be recovered through contingency procedures (e.g., loss of propulsion), the remote crew may initiate the emergency procedures when the UAS is in the operation volume. Emergency procedures deal with affecting the UA to either:

i. return to a state where the operation is 'in control', or

ii. minimize hazards until the flight has ended.

(e) Emergency response plan (ERP)

i. The ERP deals with the potential hazardous secondary or escalating effects after a loss of control of the operation (e.g., timely intervention of emergency services).

ii. It is different from the emergency procedures, as it does not deal with the control of the UA.

iii. The ERP is used for coordinating all activities needed to respond to incidents and accidents.

(f) Containment is a feature consisting of technical and operational mitigations that are meant to contain the flight of the UA within the defined operational volume and ground risk buffer and reduce the likelihood of a loss of control of the operation resulting in a flyaway.

S.2.4 Robustness

(a) To properly understand the SORA process, it is important to introduce the key concept of robustness.

(b) Robustness is the term used to describe the combination of two key characteristics of a risk mitigation or operational safety objective: the level of integrity (i.e., how good the mitigation/objective is at reducing risk), and the level of assurance (i.e., the degree of certainty with which the level of integrity is ensured).

(c) The activities used to substantiate the level of integrity and assurance are detailed in the Annexes B, C, D and E to AMC1 to Article 11. These annexes provide either guidance material or reference industry standards and practices where applicable.

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

	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

Table 1 – Robustness, integrity and assurance matrix

(e) For example, if an applicant demonstrates a medium level of integrity with a low level of assurance the overall robustness will be considered as low as the robustness is equal to the lowest level of either integrity or assurance.

(f) Any given risk mitigation or operational safety objective will have different provisions for the different levels of robustness. The SORA contains three levels of robustness: low, medium and high, commensurate with risk.

(g) Guidance for the level of assurance is provided below. An applicant is required in all cases achieve the level of integrity and perform, produce or obtain any necessary evidence required.

i. In a low level of assurance the applicant declares that the required level of integrity has been achieved. The competent authority will validate[6] the compliance statement and may decide to review the evidences at a later stage (e.g. during oversight).

ii. In a medium level of assurance the applicant has supporting evidence that the required level of integrity has been achieved. This is typically achieved by means of testing or operational data. The competent authority will validate[6] the compliance statement and the existence of the evidence. The competent authority may decide to review the evidences at a later stage (e.g. during oversight).

iii. In a high level of assurance the achieved integrity is verified[7] to be acceptable by the competent authority or by an entity that is designated[8] by the competent authority.

(h) The specific criteria defined in the SORA Annexes take precedence over the criteria defined in paragraph (g) above.

(i) To accommodate national specificities that cannot and should not be standardised, the competent authorities might require different activities to substantiate the level of robustness. National specificities could include nationally sensitive infrastructure, protection of environmental areas, etc.

S2.5 Roles and responsibilities

a. While performing an assessment using the SORA process several key actors might be required to interact in different phases of the process. The main actors applicable to the SORA are described in this section.

---

[6] Refer to definition I.153 in Annex I to AMC to Article 11.

[7] Refer to definition I.154 in Annex I to AMC to Article 11.

[8] An entity designated by the competent authority should be understood in the meaning of a qualified entity as described in Article 69 of Regulation (EU) 2018/1139. The competent authority may give to the designated entity the privilege to issue a certificate or the operational authorisation.

b. Applicant – The applicant is the party seeking an operational authorisation. The applicant should substantiate the safety of the operation by performing the SORA. Supporting material for the assessment may be provided by third parties (e.g., the designer of the UAS or equipment, UTM service providers, etc.).

c. UAS operator – The UAS operator is an applicant that has obtained an operational authorisation from the competent authority. The operational authorisation allows the UAS operator to perform a series of flights, provided that they are performed in accordance with the scope and limitations of the operational authorisation, based on the SORA compliance demonstration. The UAS operator is responsible for the safe operation of the UAS. Hence the compliant execution of the procedures, training and other applicable programs as well as the observation of the limits and other requirements of the applicable concept of operations are the UAS operator's obligation.

d. UAS design and production organisation – The UAS design and production organisation is the party that designs and produces the UAS. In some cases, a UAS may be equipped with one or more components (e.g., parachute) designed and produced by an entity other than the UAS manufacturer and installed by a UAS component integrator (that may be also the same entity designing the component or a different one or the UAS operator itself). It may be expected that sometimes the design and production of the UAS or components are carried out by two different organisations. The design and production organisation has unique design evidence (e.g., system performance, system architecture, software/hardware development documentation, test/analysis documentation, etc.) that they may choose to make available to one or many UAS operator(s) or to the competent authority or to EASA to help substantiate the operator's SORA safety case. Alternatively, a design and production organisation may utilise the SORA to target design objectives for specific or generalised operations, tailored to the relevant SAIL. To obtain airworthiness approval(s), these design objectives could be complemented by use of Light UAS certification specifications (CS) or industry consensus standards if they are found acceptable by EASA.

e. Competent authority – The competent authority that is referred to throughout this AMC is the authority designated by the Member State in accordance with Article 17 of Regulation (EU) 2019/947 to assess the safety case of UAS operations and to issue the operational authorisation in accordance with Article 12 of the same regulation. The competent authority may accept an applicant's submission of an operations manual with an associated SORA based risk assessment. Through the SORA process, the applicant may need to consult with the competent authority to ensure consistent application or interpretation of individual steps. The competent authority should also have oversight of the UAS operator in accordance with point h of article 18 of Regulation (EU) 2019/947. The competent authority may decide to make use of 'recognised entities' for reviewing supporting evidence for mitigations and operational safety objectives of an application when required. In this case the competent authority keeps the responsibility when issuing an operational authorisation based on the recommendation provided by the 'recognised entity'. As alternative a competent authority may use a 'designated entity', also referred as 'qualified entity' in accordance with Article 69 of Regulation (EU) 2018/1139. In this case the 'designated entity' may receive the privilege to issue the operational authorisation.

According to Regulation (EU) 2018/1139 (the EASA 'Basic Regulation'), EASA is the competent authority in the European Union to verify compliance of the UAS design and its components with the applicable rules, while the authority that is designated by the Member State is the competent authority to verify compliance with the operational requirements and compliance of the personnel's competency with those rules. The following elements are related to the UAS design:

— the OSOs marked in Table 14 as those for which the designer is expected to develop the evidences;

— M2 mitigation: criterion #1;

— verification of the system to contain the UAS to avoid an infringement of the adjacent areas on the ground and/or adjacent airspace in accordance with Step#8 of the SORA process.

If the UAS operation is classified as SAIL V and VI, compliance with the design provisions defined by SORA (i.e. design-related OSOs, mitigation means linked with the design and containment function) should be demonstrated through a type certificate (TC) issued by EASA according to Annex I (Part 21) to Regulation (EU) No 748/2012[9], as defined in Article 40(1)(d) of Regulation (EU) 2019/945[10]. For the other OSOs and mitigation means, the competent authority may verify compliance.

If the UAS operation is classified as SAIL IV, compliance with the design-related SORA provisions (i.e. design-related OSOs, mitigation means linked with the design and containment function) should be demonstrated through a DVR[11] issued by EASA. Evidence of compliance with the other OSOs and mitigations (not related to design) will be provided to the competent authority according to the level of robustness of the OSOs, that will assess them as part of the application for the operational authorisation.

If the UAS operation is classified as SAIL I, II or III, the competent authority may accept a declaration submitted by the UAS operator for the compliance with all OSOs and mitigations related to design. The competent authority may check the statements of the UAS operator, in particular with regard to the claimed level of integrity and robustness of the UAS for the considered SAIL.

Despite the SAIL, when the claimed level of robustness of the mitigation means M2 or of containment is high, the competent authority should require the UAS operator to use a UAS with a DVR issued by EASA limited to compliance with those mitigation means[12].

f. Air navigation service provider (ANSP) – 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 can be safely conducted in the particular airspace that they

---

9 Commission Regulation (EU) No 748/2012 of 3 August 2012 laying down implementing rules for the airworthiness and environmental certification of aircraft and related products, parts and appliances, as well as for the certification.

10 Commission Delegated Regulation (EU) 2019/945 of 12 March 2019 on unmanned aircraft systems and on third-country operators of unmanned aircraft systems (OJ L 152, 11.6.2019, p. 1) (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32019R0945).

11 https://www.easa.europa.eu/sites/default/files/dfu/guidelines_design_verification_uas_medium_risk.pdf

12 If the UAS has a DVR covering the full design, this may cover also the mitigation means.

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 (thus being integrated in the airspace) or should be managed as a contained hazard (for example through segregation)[13].

g. U-space service provider – U-space service providers are entities that provide services to support safe and efficient use of airspace. These services may support an operator's compliance with their safety obligation and risk analysis.

h. Remote pilot in command (RPIC) – The remote pilot that is designated by the UAS operator as being in command and charged with the safe conduct of the flight. Some UAS operations may require employing more than one remote pilot with different tasks, however in this case only one is responsible as remote pilot in command. For some UAS operations, there might be more than one remote pilot. In any case, at every moment of the operation, there shall be only one remote pilot in command (i.e. the one having the authority to cancel or delay any or all flight operations, being responsible of the safety of the flight). This might be the case for the following examples:

   I. multiple remote pilots, all having similar tasks (one is acting as RPIC, the others are acting as "backup" remote pilots);

   II. operations where different persons in the remote crew may control some functions of the UAS (e.g. airspace observers in a drone light show may activate the flight termination system). A RPIC having the overall responsibility of the flight should be identified.

   III. long flights where different remote pilots may be in command for a defined leg of the flight. The operator should have clear handover procedures indicating at any time who is the RPIC.

i. Remote crew – The remote crew includes all UAS operator personnel involved in the operation of the UAS, with duties essential to the safe operation of the UAS. The remote pilot in command is part of the remote crew.

j. Maintenance staff – Ground personnel in charge of maintaining the UAS before and after flight in accordance with UAS maintenance instructions.

[13] The role of ANSP as a function is distinct from that of the aviation regulator or the function of safety oversight.

Section 3. The SORA walkthrough

Section 3 describes to the operator how to complete the required SORA's steps.

S3.1 Introduction to the SORA walkthrough (GUIDANCE)

(a) This section describes how the SORA process is detailed in the document. The intent is to provide both an applicant and a competent authority with clear guidance in terms of what is expected from the SORA process.

(b) Following headers are applied:

i. **Task Description:** is a recommendation to be followed by the applicants completing the SORA process.

ii. **Outcome:** is what is achieved when the task description has been completed.

iii. **Instructions:** is material provided to applicants to better identify and understand the steps contained in the task description.

S3.2 Before starting the SORA process

S3.2.1 Outcome (GUIDANCE)

Determine whether the operator should carry out the SORA process.

S3.2.2 Task description (PROCEDURE)

(a) Before starting the SORA process, the following aspects should be verified:

i. if the UAS operator uses a tethered aircraft for which Regulation (EU) 2019/947 does not apply[14];

ii. if the operation falls under the open category;

iii. if the UAS operation is covered by STS 01 or STS 02 as defined by the Appendix 1 to Regulation (EU) 2019/947 and the UAS used bear a class identification label C5 or C6;

iv. if the UAS operation is covered by one of the PDRAs published by EASA as AMC to Article 11 to Regulation (EU) 2019/947

v. if the operation falls under the certified category;

vi. if the operation is subject to specific no-go criteria from the competent authority.

(b) If none of the above cases apply, the SORA process should be applied.

---

[14] According to Annex I of Regulation 2018/1139, the EU regulation is not applicable when the Uas operator uses a tethered aircraft with:
(a) no propulsion system, where the maximum length of the tether is 50 m, and where:
(i) the MTOM of the aircraft, including its payload, is less than 25 kg, or
(ii) in the case of a lighter-than-air aircraft, the maximum design volume of the aircraft is less than 40 m3;
(b) a MTOM of no more than 1 kg.
In this case national regulations apply.

S3.3 The SORA process phases (GUIDANCE)

(a) As part of the SORA, it is critical to review the steps and to validate the assumptions and derivations made throughout this process. The SORA process has a natural break point after Step #9 (see Figure 4), from which the SORA process can be split into two phases.

i. Phase 1 focuses on the derivation of safety requirements and proposed means of compliance, and

ii. Phase 2 focuses on compliance with the derived safety from Phase 1.

(b) The phases ensure there is a review of the first phase outputs for the applicant to determine if any adjustments to the proposed operation are required before undertaking the second phase. This approach should minimise unnecessary iterations in the operational procedures, remote crew requirements, and system(s) design in the proposed operations and mitigations.

(c) An additional benefit of the phases is that it provides an engagement point with the competent authority. This is intended to support reaching a preliminary agreement that Phase 1 has been undertaken correctly, and that the derived requirements and proposed means of compliance for Phase 2 are appropriate.

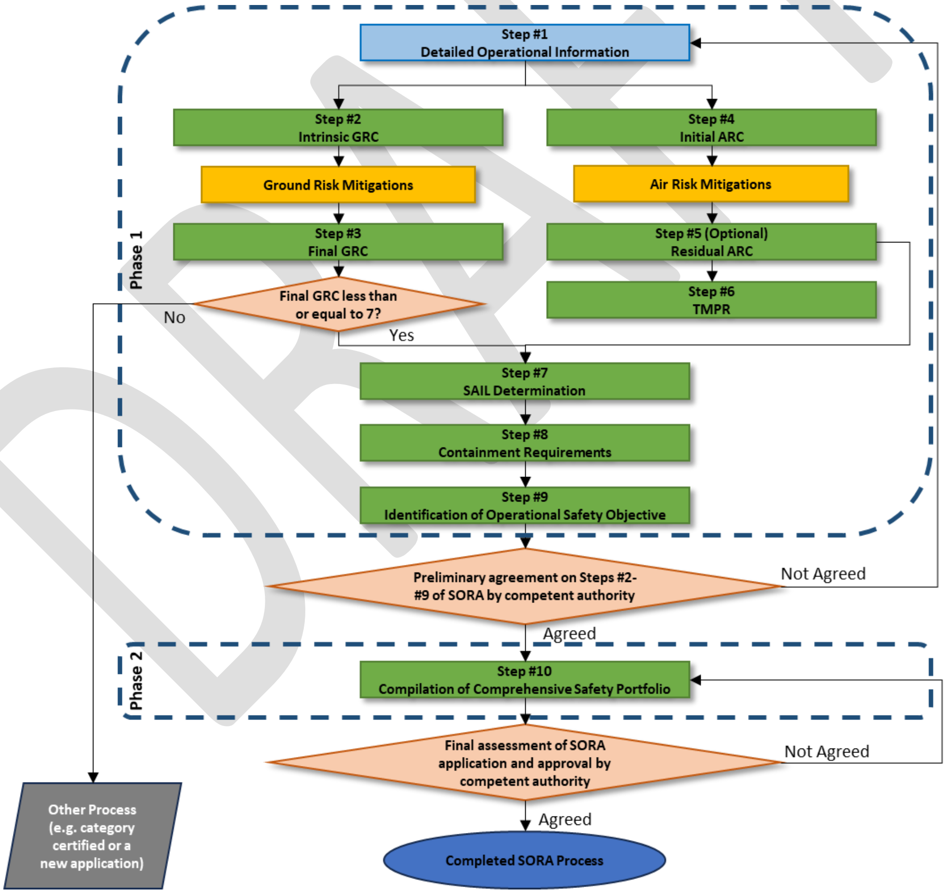


Figure 4 – The SORA process phases

S3.3.1 Phase 1 (Requirements derivation) (GUIDANCE)

(a) The purpose of Phase 1 is to derive all relevant safety requirements based on the proposed operation which should result in a document suite that sufficiently describes the proposed operation(s). This should include the relevant information, safety claims and derived requirements of Step #1 to Step #9. The applicant should collect explanations, but not the entire justification, of the means by which the applicant will demonstrate compliance with any safety claims and derived in Phase 1. This can assist both the applicant and competent authority in ensuring any means of compliance proposed is valid and will result in satisfying the safety claims or . This may take the form of an initial **compliance matrix** (an example is provided in, Chapter A.4 of Annex A to AMC 1 to Article 11).

(b) The results of this phase may be the basis for a pre-application evaluation by the competent authority. The competent authority may or may not be able to provide a formal agreement until the submission and review of final compliance evidence (covered in Phase 2).

(c) It is recommended that the applicant contacts the competent authority as early as possible in order to present the available information and reach a common initial understanding and in-principle agreement on the safety claims, in particular the final GRC, residual ARC, and SAIL.

S3.3.2 Phase 2 (Compliance with requirements) (GUIDANCE)

(a) Phase 2 occurs after the completion of Step #9. This phase is a final set of iterations to complete the SORA process. This should result in a SORA Comprehensive Safety Portfolio (CSP), which collects the work done in all previous steps of the SORA into a comprehensive, justified document suite showing compliance with the SORA provisions.

(b) If completed correctly, the CSP should provide all the necessary claims, arguments and evidence to support the assessment and approval of the proposed operation.

Section 4. The SORA process

S4.1 Step #1 – Documentation of the proposed operation(s)

S4.1.1 Introduction (GUIDANCE)

Step #1 provides an opportunity for an applicant to collect and present contextual information on the proposed operation and the intended safety claims made during Phase 1 of the SORA process.

S4.1.2 Outcome(GUIDANCE)

A sufficiently detailed operational concept, that allows the applicant to continue through the SORA process.

S4.1.3 Task description (PROCEDURE)

(a) Compile operational, technical, and organisational information. This may include:

i. Various maps, figures, diagrams and other information detailing the operational volume, ground risk buffers, adjacent area, and adjacent airspace to facilitate the determination of:

A. the intrinsic ground risk class (i.e., population density maps, land use information),

B. the initial air risk class (i.e., airspace use information, aerodromes, and airspace charts), and

C. the adjacent areas.

ii. Information on the operational, technical, and organisational elements of:

A. the operation and functions during flight, including intended flight profiles, states, and modes that provide safety throughout the nominal, contingency, and emergency phases of flight,

B. any ground and air risk mitigations (strategic and tactical) used to reduce the intrinsic ground risk or initial air risk.

(b) A description of the contingency volume and ground risk buffers, and how they were determined.

(c) The applicant may use Chapter A3 of Annex A to AMC1 to Article 11to assist in understanding the type of data that needs to be presented and any other information that supports the risk assessment to the authority.

S4.2 Step #2 – Determination of the intrinsic ground risk class (iGRC)

S4.2.1 Introduction (GUIDANCE)

(a) In this step the UAS operator is required to assess the intrinsic ground risk of the operational volume and ground risk buffer.

(b) No ground risk mitigations will be applied at this step, this may be completed in Step #3.

S4.2.2 Outcome (GUIDANCE)

Calculation and documentation of the intrinsic ground risk class.

S4.2.3 Task description (PROCEDURE)

iGRC footprint

(a) Identify the maximum characteristic dimension and the maximum speed of the UA.

(b) Identify the iGRC footprint:

i. Identify the flight geography;

ii. calculate the contingency volume;

iii. calculate the initial ground risk buffer (the final ground risk buffer calculation will be completed in Step #8);

(c) Identify the highest population density within the iGRC footprint.

(d) Identify the iGRC of the footprint using Table 2 for fixed wing, rotorcraft – helicopter, rotorcraft – gyroplane, VTOL capable aircraft (including multirotor)[15].

[15] In case of lighter than air configurations the UAS operator may propose a GRC class based on the model defined in Annex F, available at http://jarus-rpas.org/wp-content/uploads/2024/06/SORA-v2.5-Annex-F-Release.JAR_doc_29pdf.pdf.

Intrinsic UAS Ground Risk Class						
Maximum UA characteristic dimension		1m	3m	8m	20m	40m
Maximum speed		*25 m/s*	*35 m/s*	*75 m/s*	*120 m/s*	*200 m/s*
Maximum iGRC population density (people/km²)	**Controlled ground area**	1	1	2	3	3
	< 5	2	3	4	5	6
	< 50	3	4	5	6	7
	< 500	4	5	6	7	8
	< 5,000	5	6	7	8	9
	< 50,000	6	7	8	9	10
	> 50,000	7	8	**Not part of SORA**		

A UA with a take off mass less than or equal to 250g and having a maximum speed less than or equal to 19 m/s is considered to have an iGRC of 1 regardless of population density.

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 assemblies of people, see Annex B for additional details.

Table 2 - Intrinsic ground risk class (GRC) determination

(e) For UA with a maximum characteristic dimension greater than 40m the iGRC should be calculated following the guidance in Appendices A and B in Annex F[16].

S4.2.4 Instruction (GUIDANCE)

Intrinsic UA characteristics

(a) For maximum UA characteristic dimension examples refer to definition I.141 of Annex I to AMC 1 to Article 11.

(b) Maximum speed:

  i. The maximum speed is conservatively defined as the maximum possible commanded airspeed of the UA, as defined by the designer,

  ii. This is not the mission specific maximum commanded airspeed of the UA as reducing the mission airspeed may not necessarily reduce the impact area. Mitigations that limit airspeed below the maximum speed value during an impact can be accounted for in Annex B to AMC 1 Article 11, part of Step #3.

16 http://jarus-rpas.org/wp-content/uploads/2024/06/SORA-v2.5-Annex-F-Release.JAR_doc_29pdf.pdf

Identification of the iGRC

(a) The iGRC is found at the intersection of the applicable maximum population density and the left most column matching both criteria, the maximum UA characteristic dimension and the maximum speed in Table 2.

(b) The applicant can provide substantiation to the competent authority for a different iGRC. See Annex F[17] Appendix A for further guidance.

(c) Operations that do not have a corresponding iGRC (i.e., grey cells on the table) are outside the scope of the SORA methodology. Applicants falling in these categories should consider the certified category.

(d) In the event that population density values are not available or not accurate the UAS operator may use qualitative descriptors for the iGRC table, the following approximations can be used as guidance:

Quantitative Population Value (people/km^2)	Qualitative Descriptors	Area Description
Controlled ground area	Controlled ground / Extremely remote	Areas that are controlled where unauthorized people are not allowed to enter. Hard to reach areas (mountains, remote deserts, etc), large bodies of water away from expected boat traffic, where it is reasonably expected that people will rarely be present.
< 5	Remote	Areas where people may be, such as forests, deserts, large farm parcels, etc. Areas where there is approximately 1 small building every km^2.
< 50	Lightly populated	Areas of small farms. Residential areas with very large lots (~ 4 acres or 16,000 m^2).
< 500	Sparsely populated / Residential lightly populated	Areas comprised of homes and small businesses with large lot sizes (~1 acre or 4,000 m^2).
< 5,000	Suburban / Low density metropolitan	Areas of single-family homes on small lots, apartment complexes, commercial buildings, etc. Can contain multistorey buildings, but generally most should be below 3-4 stories.
< 50,000	High density metropolitan	Areas of mostly large multistorey buildings. The downtown area of most cities. Areas of dense skyscrapers.
> 50,000	Assemblies of people	The densest areas in the largest cities. Large gatherings of people such as professional sporting events, large concerts, etc.

Table 3 - correspondence between quantitative and qualitative assessment of the iGRC

17 http://jarus-rpas.org/wp-content/uploads/2024/06/SORA-v2.5-Annex-F-Release.JAR_doc_29pdf.pdf

iGRC Footprint

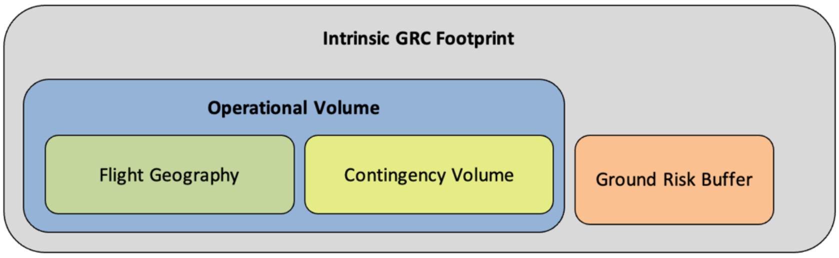


Figure 5 - Visualisation of the intrinsic GRC Footprint

(a) The applicant needs to have defined the area at risk when conducting the operation, which is defined as the intrinsic GRC footprint. This is composed of the operational volume plus the ground risk buffer as shown in Figure 5.

(b) The operational volume is composed of the flight geography and the contingency volume (refer respectively to points S2.2.3, S2.2.4 and S2.2.5 for additional information). To determine the operational volume the applicant should consider the position keeping capabilities of the UAS in 4D space (latitude, longitude, height and time). In particular, the accuracy of the navigation solution, the flight technical error of the UAS, the path definition error (e.g., map error) and latencies should be accounted for in this determination.

(c) The iGRC footprint is used to determine the population density. It is expected that for many flight operations, the iGRC footprint may cover segments with different population densities. The segment with the highest population density should be used when determining the iGRC.

Ground risk buffer

(a) An appropriate initial ground risk buffer could be defined:

i. with a 1-to-1[18] principle, or

ii. a different ground risk buffer value may be proposed by the applicant using the principles outlined in Section 4, Criteria 3 of Annex E of AMC 1 to Article 11.

(b) Cases where the final ground risk buffer may be different than the initial one could include:

i. Medium and high level of containment,

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

Controlled ground area

(a) A controlled ground area is defined as the intended UAS operational area where only involved persons (if any) are present.

(b) Controlled ground areas are a way to strategically mitigate the ground risk; the assurance that there will be no uninvolved persons in the iGRC footprint is under the full responsibility of the UAS operator. The competent authority may request evidence on how the UAS operator will ensure control of the area during operation.

---

[18] For an explanation of the 1:1 rule, see AMC1 UAS.OPEN.030(1). Please note that in this AMC the 1:1 rule is applied to evaluate the distance from people. For the evaluation of the size of the ground risk buffer.

Non-typical cases

(a) 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 Annex F[19] Section 1.8 for further guidance.

(b) 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 Annex F[19] Section 1.8. The UAS operator should choose the column that matches the critical area calculated for the UA that is used, as identified in Table B.8 of Annex B to AMC 1 to Article 11. An automatic tool to calculate the critical area of a UA is available on the EASA website[20].

Population density information

(a) Determining the population density to calculate the iGRC in Step #2 should be done using maps with appropriate grid size based on the operation. Competent Authorities should designate specific maps to be used for determining population densities.

(b) If there are no available population density maps acceptable to the NAA, 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 heights of the operational volume:

Max. Height (AGL) of the OV		Suggested Optimal Grid Size (meter x meter)
Feet	Meters	
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

Table 4 - Suggested grid size for authoritative maps

(c) The authority designated map should be at the suggested optimal grid size. If mapping products do not exist at the suggested optimal grid size, the authority should use the closest grid size available. If the closest grid size available is smaller than the suggested optimal grid size, then the map should be smoothed to the suggested optimal grid size.

(d) If the applicant identifies inaccuracies in the designated static population density map, they can provide alternative data that demonstrates the correction in the estimated average population density of the area (i.e., using other mapping products, satellite imagery, on-site inspections, local knowledge of the area, etc.). If accepted by the competent authority, the applicant can

[19] http://jarus-rpas.org/wp-content/uploads/2024/06/SORA-v2.5-Annex-F-Release.JAR_doc_29pdf.pdf
[20] https://www.easa.europa.eu/en/domains/drones-air-mobility/operating-drone/critical-area-assessment-tool-caat

use the alternative data to determine the iGRC. Use of time-based restriction arguments (e.g., flying at night) for reduction of people at risk on the ground are addressed in SORA Step#3.

(e) Additional information can be found in Annex F[21] Section 3.2.

S4.3 Step #3 – Final Ground Risk Class (GRC) determination (optional)

S4.3.1 Introduction (GUIDANCE)

(a) The intrinsic risk of a person being struck by the UA during a loss of control of the operation can be reduced by means of acceptable mitigations.

(b) In this step, the UAS operator may identify ground risk mitigations and reduce the GRC of the operation.

S4.3.2 Outcome (GUIDANCE)

(a) Identification of the mitigations applied to reduce the iGRC for the iGRC footprint;

(b) Identification of the applicable mitigation provisions;

(c) Determination of the final GRC by subtracting the credit derived by the mitigations from the iGRC;

(d) Collection of information and references used to substantiate the application of the ground risk mitigation(s).

S4.3.3 Task description (PROCEDURE)

(a) 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:

	Level of Robustness		
Mitigations for ground risk	**Low**	**Medium**	**High**
M1(A) - Strategic mitigations - Sheltering	**-1**	**-2**	**N/A**
M1(B) - Strategic mitigations - Operational restrictions	**N/A**	**-1**	**-2**
M1(C) - Tactical mitigations - Ground observation	**-1**	**N/A**	**N/A**
M2 - Effects of UA impact dynamics are reduced	**N/A**	**-1**	**-2**

Table 5 - Mitigations for Final GRC determination

(b) Identify in Annex B to AMC 1 Article 11 the provisions needed to comply with in order to receive appropriate credit for the mitigation.

(c) In case a M2 mitigation that affects the UA descent behaviour is used, assess if the size of the ground risk buffer defined in Step #2 is still valid.

(d) Determine the final GRC by applying the appropriate correction to the iGRC.

[21] http://jarus-rpas.org/wp-content/uploads/2024/06/SORA-v2.5-Annex-F-Release.JAR_doc_29pdf.pdf

S4.3.4 Instruction (GUIDANCE)

Ground risk mitigations

(a) Step #3 is an optional step.

(b) 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 has particular relevance for technical mitigations (e.g., parachute).

(c) The Final GRC determination is based on the availability and correct application of the mitigations to the operation. 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. Annex B to AMC1 Article 11 provides additional details on the robustness of each mitigation. Competent authorities may define or accept additional mitigations and the relative correction factors.

(d) A quantitative approach to mitigations allows a reduction in the iGRC by 1 point if the mitigation reduces the at-risk population to the next lowest iGRC population band. This is in most cases approximately a factor of 10 (90% reduction) compared to the risk that is assessed before the mitigation means are applied. Such quantitative criteria may be used to validate the risk reduction that is claimed when applying Annex B to AMC1 Article 11 .

(e) In rare situations, iGRC reductions larger than the ones shown in Table 5 may be possible. Refer to Annex B to AMC1 Article 11 for further guidance.

(f) When applying all the M1 mitigations, the final GRC cannot be reduced to a value lower than the lowest value in the applicable column in Table 2. This is because it is not possible to reduce the number of people at risk below that of a controlled ground area.

(g) In case the mitigation influences the descent behaviour of the UA, for example by using a parachute, the ground risk buffer size should be redefined using the updated assumptions including the effects of the mitigation means.

(h) Additional information can be found in Chapter A.3 if Annex A to AMC1 Article 11, for guidance on presenting the data supplementing the risk assessment to the competent authority.

Multiple partial mitigations

For situations where multiple partial mitigations do not meet the criteria within Annex B individually but when taken together achieve cumulative order(s) of magnitude reductions, the competent authority may accept a reduction of the final GRC score.

What if the final GRC is greater than 7?

If the final GRC is greater than 7, the operation is considered to have more risk than the SORA is designed to support. The applicant may discuss options available with the competent authority, such as using the certified category or a new application (as stated in Figure 1).

S4.4 Step #4 – Determination of the initial Air Risk Class (ARC)

S4.4.1 Introduction to the air risk process (GUIDANCE)

(a) The SORA uses the operational airspace defined in Step 1 as the baseline to evaluate the intrinsic risk of mid-air collision with manned aircraft and for determining the initial air risk class (ARC). The initial ARC may be modified/lowered by applying strategic and tactical mitigation means. An example of strategic mitigations to reduce collision risk may be by operating during certain times or within certain boundaries. After applying strategic mitigations any residual risk of mid-air collision is addressed by means of tactical mitigations.

(b) Tactical mitigations take the form of detect and avoid systems or alternate collaborative means, such as ADS-B, systems transmitting on SRD 860 frequency band, U-Space services[22] or operational procedures. Depending on the residual risk of mid-air collision, the tactical mitigation performance requirement(s) may vary.

(c) As part of the SORA process, the UAS operator should cooperate with the relevant service provider for the airspace (e.g., ANSP or U-Space service provider) and obtain the necessary authorisations. Additionally, generic local authorisations or local procedures allowing access to a certain portion of airspace may be used if available. The competent authority or ANSP may impose additional strategic or tactical mitigations on airspace authorisations, taking into account uncertainties related to UA reliability, conspicuity, and other factors.

(d) The SORA recommends that, irrespective of the results of the risk assessment, the operator pay particular attention to all features that may increase the detectability of the UA in the airspace. Therefore, technical solutions that improve the electronic conspicuousness or detectability of the UAS are recommended.

S.4.4.2 Outcome (GUIDANCE)

(a) Identification of the risk of collision between the UA and a manned aircraft;

(b) Documentation of information and references used to determine the initial ARC of the operational volume.

S.4.4.3 Task description (PROCEDURE)

Operational volume

(a) Identify the vertical limit of the operational volume:

i. Identify the vertical limit of the flight geography;

ii. Identify and document the contingency procedures in case the UA will exceed the height of the flight geography;

iii. Evaluate the maximum height the UA will travel above the limit of the flight geography when applying the contingency procedures before it enters again in the flight geography.

(b) Check if there are official airspace collision risk maps available. The competent authority, ANSP, or U-space service provider, may elect to directly map the airspace collision risks using airspace characterization studies. These maps would directly show the initial/residual air risk class (ARC)

[22] Some U-Space services could also be used as strategic mitigations.

for a particular airspace. If the competent authority, ANSP, or U-space service provides an air collision risk map (static or dynamic), the applicant should use that service to determine the initial/residual ARC and go directly to section S4.5 “Application of strategic mitigations” to reduce the initial ARC, provided that a further reduction is still possible.

(c) If point b is not applicable, identify the initial ARC of the operational volume using the decision tree found in Figure 6.

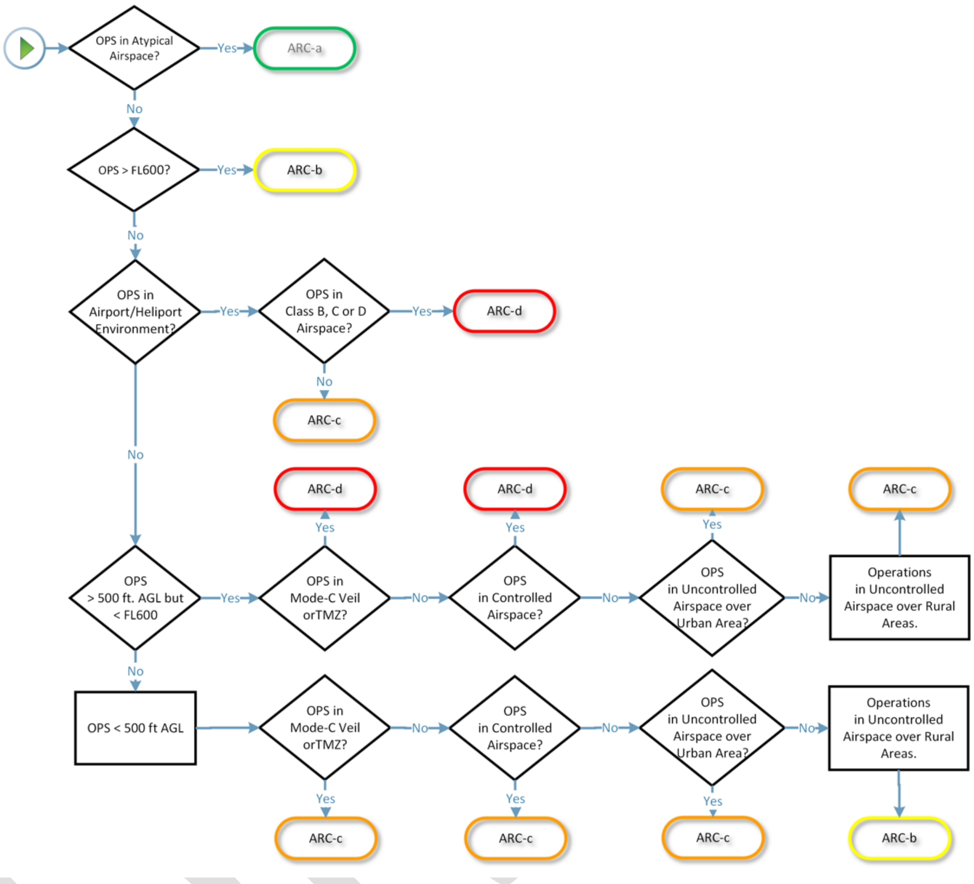


Figure 6 - ARC assignment process

S4.4.4 Instruction (GUIDANCE)

Identification of the initial ARC

(a) As seen in Figure 6, the airspace is categorized into 12 aggregated collision risk categories. These categories were characterized by altitude, controlled versus uncontrolled airspace, airport/heliport versus non-airport/non-heliport environments, airspace over urban versus rural areas, and lastly atypical (e.g., segregated) versus typical airspace. The categories correspond to the airspace encounter classes (AECs), which provide a further qualitative delineation of unmitigated collision risk that is elaborated in Annex C.

(b) During the UAS operation, the operational volume may span many different airspace environments. The applicant needs to do an air risk assessment for the entire range of the operational volume. An example scenario of operations in multiple airspace environments is provided at the end of Annex C to AMC1 Article 11.

(c) The ARC is a qualitative classification of the rate at which a UAS would typically encounter a manned aircraft within that volume of airspace. The ARC is an initial assignment of the aggregated collision risk for the airspace, before mitigations are applied. Actual collision risk of a specific local operational volume could be much different and can be addressed in the application of strategic mitigations to reduce the ARC section (this step is optional, see section S4.5).

(d) Although the unmitigated risk captured by the initial ARC is conservative, there may be situations where that conservative assessment may not suffice. It is important that both the competent authority and operator take great care to understand the operational volume and under what circumstances the definitions in Figure 6 could be invalidated. In some situations, the competent authority may raise the operational volume initial ARC to a level which is higher than that indicated by Figure 6. The ANSP should be consulted to assure that the assumptions related to the operational volume are accurate.

(e) A competent authority may designate parts of their airspace as atypical. ARC-b, ARC-c, ARC-d are generally defining airspace with increasing risk of collision between a UAS and manned aircraft.

Identification of the vertical limit of the operational volume

(a) The vertical limit of the flight geography is the maximum height where the UA is intended to operate in normal conditions.

(b) On top of the flight geography the UAS operator should identify the extent of the contingency volume as the maximum height the UA will travel when applying the contingency procedures.

Atypical air environment

(a) An atypical air environment (leading to ARC-a classification) is defined as airspace where the risk of collision between a UAS and manned aircraft is acceptably low without the addition of any tactical mitigation. This is usually the case, when it can be generally expected that no manned aircraft use the airspace volume intended for the operation.

(b) Examples may include operation in reserved or restricted airspaces, or operation at very low altitudes (including in close proximity to obstacles) in those areas where manned aircraft generally do not operate[23].

S4.5 Step #5 – Application of strategic mitigations to determine residual ARC (optional)

S.4.5.1 Introduction (GUIDANCE)

(a) As stated before, the ARC is a qualitative classification of the rate at which a UAS would encounter a manned aircraft in a given airspace environment. However, it is recognized that the operational volume may have a collision risk that differs from the Initial ARC assigned.

(b) If an applicant considers that the initial ARC assigned is too high for the condition in the local operational volume, then refer to Annex C to AMC1 Article 11 for the ARC reduction process.

[23] Refer to definition I.19 in Annex I to AMC1 to Article 11.

(c) If the applicant considers that the initial ARC assignment is correct for the condition in the local operational volume, then that initial ARC becomes the residual ARC.

S.4.5.2 Outcome (GUIDANCE)

(a) Identification of the strategic mitigations applied to reduce the initial ARC of the operational volume.

(b) Identification of the residual ARC.

(c) Documentation of information and references used to support the application of strategic mitigations.

S.4.5.3 Task description (PROCEDURE)

(a) Identify the applicable strategic mitigations listed in Section 5 of Annex C to AMC1 Article 11.

(b) Identify the residual ARC of the operational volume following the process listed in Section 6 of Annex C to AMC1 Article 11.

(c) Utilise Chapter A3 of Annex A to AMC1 Article 11, for further guidance on presenting the data supplementing the risk assessment to the authority.

(d) If flying in VLOS, consider the additional guidance below.

S.4.5.4 Instruction (GUIDANCE)

Application of the strategic mitigations

For VLOS operations or operations where the remote pilot is supported by one or multiple airspace observers (located in a way that the UA is always at a VLOS distance of the remote pilot or of one airspace observer that is able to scan the sky and communicate real time with the remote pilot informing of possible other manned or unmanned aircraft in the area of operation[24]), the initial air risk class can be reduced by one class. In these conditions, the crew is assumed to have the ability to assess the other aircraft activity in the airspace and therefore is able to lower the encounter rate, applying this mitigation both before and during the operation. The mitigation cannot be used to reduce the ARC to an ARC-a. In ARC-d environments, an additional agreement with ATC might be required.[25]

S4.6 Step #6 – Tactical mitigation performance requirement (TMPR) and robustness levels

S4.6.1 Introduction (GUIDANCE)

Tactical mitigations are applied to mitigate any residual risk of a mid-air collision needed to achieve the applicable airspace safety objective.

S4.6.2 Outcome (GUIDANCE)

(a) Identification of the applicable TMPR and corresponding level of robustness.

(b) Collection of information and references to be used to support the compliance with the TMPR.

---

[24] This type of operation is some times referred to as 'EVLOS'.

[25] This information will be reflected in a future version of Annex C.

S.4.6.3 Task description (PROCEDURE)

Identify if flying in VLOS or BVLOS.

VLOS Operations

(a) Develop and document a VLOS de-confliction scheme, in which it is explained which methods will be used for detection, and

(b) Define the associated criteria applied for the decision to avoid incoming traffic. In case the remote pilot relies on detection by aerial observers, the use of phraseology will have to be described as well.

BVLOS Operations

(a) Identify the applicable TMPR level deriving it from the residual ARC using Table 6.

(b) Identify the applicable TMPR according to Section 5 of Annex D to AMC1 Article 11.

(c) Utilise Chapter A.3 of Annex A to AMC1 Article 11, for further guidance on presenting the data supplementing the risk assessment to the authority.

Residual ARC	Tactical mitigation performance requirements (TMPR) and corresponding level of robustness
ARC-d	High
ARC-c	Medium
ARC-b	Low
ARC-a	No requirement

Table 6 - Tactical mitigation performance requirement (TMPR) and TMPR level of robustness assignment

S.4.6.4 Instruction (GUIDANCE)

Applications of tactical mitigations

Tactical mitigations will take the form of either 'see and avoid'' (i.e., operations under VLOS) or may require a system which provides an alternate means of achieving the applicable airspace safety objective (operation using a detect and avoid (DAA) system, or multiple DAA systems). Annex D to AMC 1 Article 11 provides the method for applying tactical mitigations.

VLOS operations

(a) VLOS is considered an acceptable tactical mitigation for collision risk for all ARC levels.

(b) Notwithstanding the above, the operator is advised to consider additional means to increase situational awareness with regard to air traffic operating in the vicinity of the operational volume.

(c) In the case of multiple segments of the flight, those segments done under VLOS do not have to meet the TMPR nor the TMPR robustness requirements, whereas those done BVLOS do need to meet the TMPR and the TMPR robustness requirements.

(d) In general, the VLOS provisions are applicable when one or more airspace observers are employed. In this case additional requirements over and above VLOS may be proposed, including definition of procedures and phraseology. Communication latency between remote pilot and airspace observers should be less than 15 seconds.

(e) For VLOS operations, it is assumed that an airspace observer is not able to detect traffic beyond 2 NM. (Note that the 2 NM range is not a fixed value and may largely depend on atmospheric conditions, aircraft size, geometry, closing rate, etc.). Therefore, the operator may have to adjust the operation and /or procedures accordingly.

Tactical mitigation performance requirement (TMPR) levels

(a) High TMPR (ARC-d): This is airspace where either the manned aircraft encounter rate is high, and/or the available strategic mitigations are Low. Therefore, the resulting residual collision risk is high, and the TMPR is also high. In this airspace, the UAS may be operating in integrated airspace and will have to comply with the operating rules and procedures applicable to that airspace, without reducing existing capacity, decreasing safety, negatively impacting current operations with manned aircraft, or increasing the risk to airspace users or persons and property on the ground. This is no different than the requirements for the integration of comparable new and novel technologies in manned aviation. The performance level(s) of those tactical mitigations and/or the required variety of tactical mitigations is generally higher than for the other ARCs. If operations in this airspace are conducted more routinely, the competent authority is expected to require the operator to comply with the recognised DAA system standards (e.g., those developed by RTCA SC-228 and/or EUROCAE WG-105).

(b) Medium TMPR (ARC-c): A medium TMPR will be required for operations in airspace with a moderate likelihood of encounter with manned aircraft, and/or where the strategic mitigations available are medium robustness. Operations with a medium TMPR will likely be supported by systems currently used in aviation to aid the remote pilot with detection of other manned aircraft, or on systems designed to support aviation that are built to a corresponding level of robustness. Traffic avoidance manoeuvres could be more advanced than for a low TMPR.

(c) Low TMPR (ARC-b): A low TMPR will be required for operations in airspace where the likelihood of encountering another manned aircraft is low but not negligible and/or where strategic mitigations address most of the risk and the resulting residual collision risk is low. Operations with a low TMPR are supported by technology that is designed to aid the remote pilot in detecting other traffic, but which may be built to lesser standards. For example, for operations below 500 feet AGL, the traffic avoidance manoeuvres are expected to mostly be based on a rapid descent to an altitude where manned aircraft are not expected to ever operate.

(d) No TMPR (ARC-a): This is airspace where the manned aircraft encounter rate is expected to be extremely low, and therefore there is no need for a TMPR. It is defined as airspace where the risk of collision between a UAS and manned aircraft is acceptable without the addition of any tactical mitigation. An example of this may be UAS flight operations in some parts of Alaska or northern Sweden where the manned aircraft density is so low that the airspace safety threshold could be met without any tactical mitigation.

(e) Annex D to AMC1 Article 11 provides information on how to satisfy the TMPR based on the available tactical mitigations and the TMPR Level of Robustness.

Guidance on airspace / operation requirements

(a) Modifications to the initial and subsequent approvals may be required by the competent authority or ANSP as safety and operational issues arise.

(b) The operator and competent authority need to be cognizant that the ARCs are a generalized qualitative classification of collision risk. Local circumstances could invalidate the aircraft density assumptions of the SORA, for example with special events. It is important that both the competent authority and operator fully understand the airspace and air-traffic flows and develop a system which can alert operators to changes to the airspace on a local level. This will allow the operator to safely address the increased risks associated with these events.

(c) There are many airspaces, operational and equipage requirements which have a direct impact on the collision risk of all aircraft in the airspace. Some of these requirements are general and apply to all airspaces, while some are local and are required only for a particular airspace. The SORA cannot possibly cover all the possible requirements required by the competent authority for all conditions in which the operator may wish to operate. The applicant and the competent authority need to work closely together to define and address these additional requirements.

(d) The SORA process should not be used to support operations of a UAS in a given airspace without the UAS being equipped with the required equipment for operations in that airspace (e.g. equipment required to ensure interoperability with other airspace users). In these cases, specific exemptions may be granted by the competent authority. Those exemptions are outside the scope of the SORA.

(e) Operations in controlled airspace, an airport/heliport environment or a Mode-C Veil/Transponder Mandatory Zone (TMZ) will likely require prior approval from the ANSP. The applicant should ensure that they coordinate with the relevant ANSP/authority prior to commencing operations in these environments.

S4.7 Step #7 – Specific Assurance and Integrity Levels (SAIL) determination

S.4.7.1 Introduction (GUIDANCE)

(a) The SAIL parameter consolidates the ground and air risk analyses and drives the required activities.

(b) The SAIL represents the level of confidence that the UAS operation will stay under control.

S.4.7.2 Outcome (GUIDANCE)

Identification of the SAIL.

S.4.7.3 Task description (PROCEDURES)

Identify the SAIL associated with the proposed operation deriving it from the final GRC and residual ARC using Table 7.

SAIL Determination				
	Residual ARC			
Final GRC	a	b	c	d
≤2	**I**	**II**	**IV**	**VI**

3	**II**	**II**	**IV**	**VI**
4	**III**	**III**	**IV**	**VI**
5	**IV**	**IV**	**IV**	**VI**
6	**V**	**V**	**V**	**VI**
7	**VI**	**VI**	**VI**	**VI**
>7	Operation classified in the certified category			

Table 7 - SAIL determination

S.4.7.4 Instruction (GUIDANCE)

(a) The level of confidence that the operation will remain in control is represented by the SAIL.

(b) The SAIL is not quantitative but instead corresponds to:

i. the level of OSO robustness to be complied with (see Table 14),

ii. description of activities that might support compliance with those objectives, and

iii. the evidence that indicates the objectives have been satisfied.

S.4.8 Step #8 – Determination of containment provisions

S.4.8.1 Introduction (GUIDANCE)

(a) The containment provisions ensure that the target level of safety can be met for both ground and air risk in the adjacent area.

(b) The containment provisions 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.

(c) There are three possible levels of robustness for containment: low, medium and high; each with a set of safety requirement described in Annex E to AMC1 Article 11.

S.4.8.2 Outcome (GUIDANCE)

(a) A set of operational limits for population in the adjacent area.

(b) A derived level of robustness for containment.

S.4.8.3 Task description (PROCEDURE)

a) If the UA has a take-off weight of less than 250g apply low containment with no required operational limits for the population in the adjacent area and go to Step #9. However when conducting a multiple simultaneous operation (MSO), the competent authority may require to have additional considerations related to safety and security.

Otherwise:

b) Determine the size and population characteristics of the adjacent area:

i. 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 maximum speed of the UA:

A. if the distance is less than 5 km, use 5 km,

B. if the distance is between 5 km and 35 km, use the distance calculated,

C. if the distance is more than 35 km, use 35 km.

ii. Calculate the average population density between the outer limit of the ground risk buffer and the outer limit of the adjacent area.

iii. Assess the presence of outdoor assemblies of people during the time when the flight takes place within 1 km of the outer limit of the operational volume.

c) Determine a set of operational limits appropriate for intended operation using the columns in Tables 8-13

i. Choose an operational limit for the acceptable average population density in the established adjacent area.

ii. Choose an operational limit for the acceptable size of assemblies of people within 1km surrounding the operational volume.

d) Use Tables 8-13 to identify the required containment robustness level for the chosen operational limits, the characteristic dimension of the UA and the SAIL of the operation.

1 m UA (< 25 m/s) Sheltering assumed applicable for the UA in the adjacent area			
Average population density allowed	No upper limit		< 50,000 ppl/km^2
Outdoor assemblies allowed within 1km of the OPS volume	> 400k	Assemblies of 40k to 400k	Assemblies < 40k
SAIL			
I & II	High	Medium	Low
III	Medium	Low	Low
IV & VI	Low	Low	Low
V & VI	Low	Low	Low

Table 8 - Containment provisions 1m UA

3 m UA (< 35 m/s) Shelter applicable for the UA in the adjacent area				
Average population density allowed	No upper limit		< 50,000 ppl/km^2	< 5,000 ppl/km^2
Outdoor assemblies allowed within 1km of the operational volume	> 400k	Assemblies of 40k to 400k	Assemblies < 40k people	
SAIL				
I & II	Out of scope	High	Medium	Low
III	Out of scope	Medium	Low	Low

IV	Medium	Low	Low	Low
V & VI	Low	Low	Low	Low

Table 9 - Containment provisions 3m UA with shelter assumption

3 m UA (< 35 m/s) Shelter not applicable for the UA in the adjacent area				
Average Population density allowed	No Upper Limit	< 50,000 ppl/km^2	< 5,000 ppl/km^2	< 500 ppl/km^2
Outdoor Assemblies allowed within 1km of the operational volume	> 400k	Assemblies of 40k to 400k	Assemblies < 40k people	
SAIL				
I & II	Out of scope	High	Medium	Low
III	Out of scope	Medium	Low	Low
IV	Medium	Low	Low	Low
V & VI	Low	Low	Low	Low

Table 10 - Containment provisions 3m UA without shelter assumption

8 m UA (< 75 m/s) Sheltering assumed not applicable for the UA in the adjacent area					
Average population density allowed	No upper limit	< 50,000 ppl/km^2	< 5,000 ppl/km^2	< 500 ppl/km^2	< 50 ppl/km^2
Outdoor assemblies allowed within 1km of the operational volume	> 400k	Assemblies of 40k to 400k	Assemblies < 40k		
SAIL					
I & II	Out of scope	Out of scope	High	Medium	Low
III	Out of scope	Out of scope	Medium	Low	Low
IV	Out of scope	Medium	Low	Low	Low
V	Medium	Low	Low	Low	Low
VI	Low	Low	Low	Low	Low

Table 11 - Containment provisions 8m UA

20 m UA (< 125 m/s) Sheltering assumed not applicable for the UA in the adjacent area					
Average population density allowed	No upper limit	< 50,000 ppl/km^2	< 5,000 ppl/km^2	< 500 ppl/km^2	< 50 ppl/km^2
Outdoor assemblies allowed within 1km of the operational volume	> 400k	Assemblies of 40k to 400k	Assemblies < 40k		
SAIL					

I & II	Out of scope	Out of scope	Out of scope	High	Medium
III	Out of scope	Out of scope	Out of scope	Medium	Low
IV	Out of scope	Out of scope	Medium	Low	Low
V	Out of scope	Medium	Low	Low	Low
VI	Medium	Low	Low	Low	Low

Table 12 - Containment provisions 20m UA

< 40 m UA (< 200 m/s) Sheltering assumed not applicable for the UA in the adjacent area					
Average population density allowed	No upper limit	< 50,000 ppl/km^2	< 5,000 ppl/km^2	< 500 ppl/km^2	< 50 ppl/km^2
Outdoor assemblies allowed within 1km of the operational volume	> 400k	Assemblies of 40k to 400k	Assemblies < 40k		
SAIL					
I & II	Out of scope	Out of scope	Out of scope	Out of scope	High
III	Out of scope	Out of scope	Out of scope	Out of scope	Medium
IV	Out of scope	Out of scope	Out of scope	Medium	Low
V	Out of scope	Out of scope	Medium	Low	Low
VI	Out of scope	Medium	Low	Low	Low

Table 13 - Containment provisions 40m UA

e) Ensure the operation complies with the containment provisions listed in Annex E – Section 4.

S.4.8.4 Instruction (GUIDANCE)

Utilise Chapter A3 of Annex A to AMC1 Article 11 for further guidance on presenting the data supplementing the risk assessment to the authority.

Adjacent Area

(a) The adjacent area represents the ground area adjacent to the ground risk buffer where it is reasonably expected a UA may crash after a loss of control situation resulting in a flyaway.

(b) The operator is not approved to plan flights in this area and it should only be overflown unintentionally in the event of a loss of control that results in a fly away.

(c) In the above situation, the direction and duration of the fly away is assumed to be random, thus the average population density of the adjacent area is used, instead of the maximum as is done in Step #2.

(d) Conservative simplifications for calculating the average population density may be used by the operator when compliance with the operational limit can be assured.

Calculating the size of the adjacent area

The diagram below in Figure 7 depicts how to determine the adjacent area size.

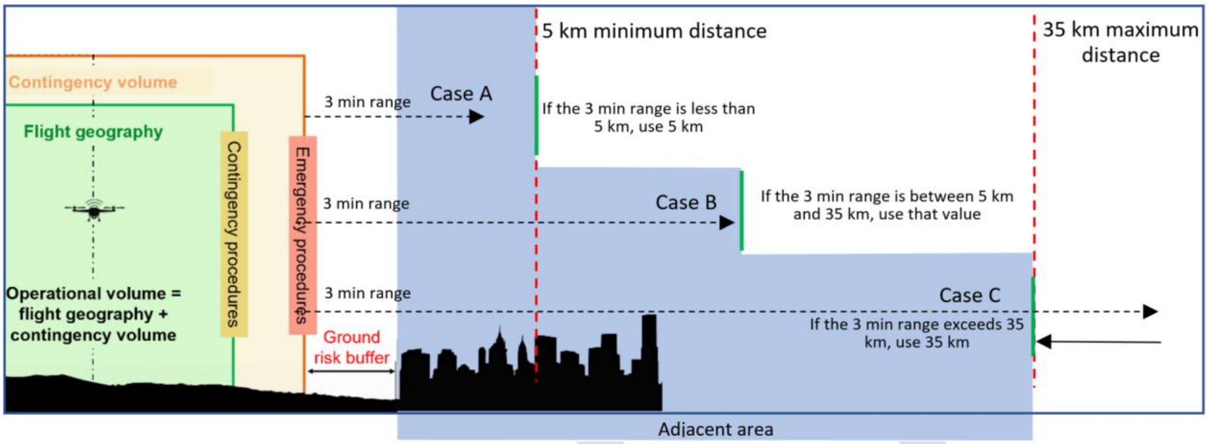


Figure 7 - Lateral limits - Adjacent area

If the ground risk buffer is larger than the adjacent area then the assessment of adjacent area is not required.

Adjacent area containment provisions

(a) When using Tables 8-13 to identify the required containment robustness level of the operation:

i. Select the correct table based on the maximum characteristic dimension of the UA used in Step 2.

A. For a 3m UA determine whether sheltering can be applied in the adjacent area

B. If sheltering applies for a UA greater than 3m, the operator can use Annex F[26] to apply the credit and determine the appropriate containment provisions;

ii. Identify the correct row based on the SAIL found in Step 7;

iii. identify the appropriate column to derive the containment level of robustness based on the adjacent area population density.

iv. If the results are 'out of scope', the operation cannot be conducted in the specific category. In this case, adjusting the location of the operation or an increase of the SAIL of the operation could be considered.

(b) Example: An operation uses a SAIL III 2.5 m drone with a maximum speed of 30 m/s, sheltering is applicable, the outer limit of the adjacent area is 5.4 km from the boundary of the operational volume. An assessment of the adjacent area shows no large assemblies of people within 1 km and the area is mostly over rural and suburban areas, expecting an average population density between 1k-4k people/km^2. This results in low containment provisions. If the UAS operator

[26] http://jarus-rpas.org/wp-content/uploads/2024/06/SORA-v2.5-Annex-F-Release.JAR_doc_29pdf.pdf

decides to use a UA with low containment, the operator should document operational limitations for the low containment SAIL III UA:

i. No assemblies of people > 40k people within 1 km of the operational volume

ii. The adjacent area (5,4km from the operational volume) average population density should not exceed 50,000 people/km^2.

Adjacent area operational limitations

(a) The UAS operator defined operational limitations have to be adhered to when planning the operational volume for a flight operation.

(b) The UAS operator should have a procedure to identify and take into account scheduled open air assemblies of people in excess of the operational limitations within 1 km of the operational volume. The values for the sizes of assemblies of people are to be understood as rough order of magnitude guidelines as measuring the actual values is not practical.

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

Containment feedback into ground risk buffer and operational volume definition

(a) If the UAS operator determines they require medium or high robustness containment for their operational objective, there might be a recursive effect, as these containment provisions have higher provisions 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 defined by the operator in Step #1.

(b) If this is the case, the applicant needs to go back to Step #2 and re-evaluate the GRC.

(c) Alternatively, the operator might choose to reduce the size of their operational volume described in Step #1 to allow for a larger ground risk buffer.

Containment provisions **for adjacent airspace**

By containing flight to the operational volume and assuring the immediate cessation of the flight in case of an unlikely breach of the operational volume, low robustness containment is generally considered sufficient to allow operations adjacent to all airspaces. In cases of high density adjacent airspace, the competent authority may require a higher level of assurance.

Notes on using an alternative method for ground risk containment

The methodology proposed in Step 8 may overestimate the adjacent area risk in certain cases. Applicants may therefore employ an alternative method to compute the ground risk containment provisions, as described in Annex F[27], Section 5.3. Due to the increased workload of this method for applicants and authorities, its application should be limited to cases where effective mitigations might be applied in the adjacent area. This method also allows the possibility of “No Containment” provisions for the adjacent ground risk. Nevertheless, the adjacent airspace must also be considered, and thus the competent authority needs to confirm that the adjacent airspace can be sufficiently protected without containment.

[27] http://jarus-rpas.org/wp-content/uploads/2024/06/SORA-v2.5-Annex-F-Release.JAR_doc_29pdf.pdf

S4.9 Step #9 – Identification of Operational Safety Objectives (OSO)

S.4.9.1 Introduction (GUIDANCE)

This step of the SORA process is to map the operation's SAIL score to required levels of robustness of the operational safety objectives (OSO).

S.4.9.2 Outcome (GUIDANCE)

(a) Identification of the required robustness levels of the individual OSOs,

(b) Collection of information and references to be used to show compliance with the OSO provisions.

S.4.9.3 Task description (PROCEDURE)

(a) Identify the level of robustness of each OSO, deriving it from the SAIL of the proposed operation using Table 14.

(b) Refer to Annex E to AMC1 Article 11 for the integrity and assurance provisions of each OSO based on its level of robustness:

i. Identify the provisions for procedures and document them accordingly,

ii. Identify the technical provisions for the UAS and document them accordingly,

iii. Identify the training provisions for the personnel essential for the safety of the operation and document them accordingly.

OSO ID		SAIL						Dependencies (Crit. references as per Annex E)		
		I	II	III	IV	V	VI	Operator	Training org	Designer
OSO#01	Ensure that the UAS operator is competent and/or proven	NR	L	M	H	H	H	x		
OSO#02	UAS designed and produced by a competent and/or proven entity	NR	NR	L	M	H	H			x[28]
OSO#03	Maintenance of UAS	L	L	M	M	H	H	Crit. 2 Crit. 3		Crit. 1

[28] Annex E includes provisions for both design and production organisations.

OSO#04	UAS components essential to safe operations are designed to an airworthiness design standard	NR	NR	NR	M	H	H			x
OSO#05	UAS is designed considering system safety and reliability	NR	NR(c)	M	M	H	H			x
OSO#06	C3 link characteristics are appropriate for the operation	NR	L	L	M	H	H	x		x
OSO#07	Conformity check of the UAS configuration	L	L	M	M	H	H	Crit. 1 Crit. 2		Crit 1
OSO#08	Operational procedures are defined, validated and adhered to	L	M	H	H	H	H	x		Crit 1
OSO#09	Remote crew trained and current	L	L	M	M	H	H	x	x	
OSO#13	External services supporting UAS operations are adequate to the operation	L	L	M	H	H	H	x		
OSO#16	Multi crew coordination	L	L	M	M	H	H	Crit. 1 Crit. 3	Crit. 2	
OSO#17	Remote crew is fit to operate	L	L	M	M	H	H	x		
OSO#18	Automatic protection of the flight envelope from human errors	NR	NR	L	M	H	H			x
OSO#19	Safe recovery from human error	NR	NR	L	M	M	H			x
OSO#20	A human factors evaluation has been performed and the HMI found appropriate for the mission	NR	L	L	M	M	H	x		x
OSO#23	Environmental conditions for safe operations defined, measurable and adhered to	L	L	M	M	H	H			x
OSO#24	UAS designed and qualified for adverse environmental conditions	NR	NR	M	H	H	H			x

Table 14 - Recommended operational safety objectives (OSO)

(c) See further guidance in Annex E to AMC1 Article 11 regarding UAS designs that employ novel or complex features which have very limited operational experience and intend to be operated in SAIL II.

S.4.9.4. Instruction (GUIDANCE)

(a) Table 14 is a consolidated list of common OSOs that historically have been used to ensure safe UAS operations. It represents the collected experience of many experts and is therefore a solid starting point to determine the required safety objectives for a specific operation.

(b) While the operator is the organisation responsible for showing compliance for all OSOs, some of the evidence may be developed by other organisations such as designer or training organisations as identified in Table 14.

(c) Table 14 indicates the corresponding OSOs. In this table:

i. NR stands for “not required” to show compliance to the competent authority, however, the applicant is still expected to consider the operational safety objective at a low integrity level,

ii. L stands for low robustness,

iii. M stands for medium robustness,

iv. H stands for high robustness.

S.4.10 Step #10 – Comprehensive safety portfolio

S.4.10.1 Introduction (GUIDANCE)

(a) The final step of the SORA involves the compilation of the Comprehensive Safety Portfolio (CSP).

(b) The CSP is a structured argument using the SORA process, that is supported by a body of evidence which provides a robust safety case. This demonstrates that the proposed operation has been assessed correctly and meets its SORA objectives.

S.4.10.2 Outcome (GUIDANCE)

(a) A completed CSP to be provided to the competent authority for the application for the operational authorisation.

(b) By documenting all elements of the SORA, the competent authority can assess a standardised document suite that provides assurance that the SORA process has been completed correctly and the operation can be conducted safely.

S.4.10.3. Task description (PROCEDURE)

(a) Finalise and present all the documentation that needs to be included in the CSP. This should include:

i. The finalized **detailed operational description** from Step #1 that details the proposed operation(s), providing the air and ground risk information necessary to validate the safety claims within the proposed operational context;

ii. All **safety claims** and their robustness made through Steps #2 (iGRC), #3 (M1(A), M1(B), M1(C), M2), #4 (initial ARC), #5 (Strategic Mitigations for Air Risk), updated (if required) from Phase 1 to reflect the finalised operation;

iii. All **derived provisions** based on the safety claims; the final GRC, the residual ARC, TMPR, the OSOs associated with the SAIL, and the containment provisions;

iv. **Compliance evidence**, which is the data, facts, and information that provide the necessary justification for each of the safety claims and derived provisions made through the SORA process at the robustness level required. The CSP covers operational, technical, personnel, and organisational compliance evidence;

v. The necessary linkages and references between documents, that ensures the CSP makes a **justified safety case** that demonstrates the operation has satisfied all required SORA safety claims and derived provisions,

vi. It is expected that a finalised **compliance matrix** (based on the initial compliance matrix if developed in Phase 1) will be used to map the safety claims and derived provisions to the compliance evidence.

(b) Refer to Annex A to AMC1 Article 11 for more guidance on structuring documentation as part of the CSP.

S.4.10.4. Instruction (GUIDANCE)

(a) The applicant should only put information into the CSP as required by the items mentioned above. If a requirement has a low robustness (ref. Section S2.4), it is mostly sufficient to self-declare the compliance by a statement in the CSP. SORA provisions for self-declaration in no way prevents the competent authority from requesting further documents to validate the declaration, if considered necessary for the given operation.

(b) The CSP is expected to be a collection of documents specific to the operation(s). It can be modularized and consist of multiple sub-documents and sub-sections to accommodate the need to perform the intended operation(s).

(c) Appropriate references and version/configuration control apply to all documents in the CSP, including subsections and sub-documents. Annex A to AMC1 Article 11, Chapter A4 provides a template that could be used for developing the CSP that is in line with the provisions of the Main Body to SORA. Any changes may require a separate process from the competent authority. The management of any changes should follow the relevant competent authority's requirements.

(d) A completed and valid CSP forms the basis for the issue of an operational authorisation.

(e) In the case the operator uses external service(s), reference(s) to Service Level Agreement(s) (SLA) providing a delineation of responsibilities between the Service Provider(s) and the operator should be included as part of the CSP. It should also detail the functionality, limitations and performance of the service.

Annex A to AMC1 Article 11 is replaced by the following:

Annex A to AMC1 to Article 11

GUIDELINES ON COLLECTING AND PRESENTING SYSTEM AND OPERATIONS FOR AN UAS OPERATION CONDUCTED IN THE SPECIFIC CATEGORY

The aim of this annex is to provide guidance to UAS operators for collecting and presenting evidence and data. This will assist applicants with compiling a complete application to obtain operational authorization for UAS operations in the specific category.

This document does not replace civil regulations but provides recommendations and guidance as to how sUAS operators can comply with those regulations, using the SORA process.

This document is composed of five chapters.

A.1: Key Principles for completing the application documents in the specific category

This chapter explains the different documents and how to use them to present an application.

A.2: SORA Risk Assessment writing template

This chapter is intended to support the applicant with compiling all the information necessary to perform a risk assessment.

A.3: Operations Manual Structure

This chapter provides an operations manual structure for applicants to follow in order to present their operations manual in an appropriate manner.

A.4: Compliance Matrix

This chapter provides a template for applicants on how to present the reference between the SORA driven provisions and the operations manual.

A.5: How to present a flight area

This chapter contains guidance to applicants on how to create and include a flight area into the operations manual.

A.1 Key Principles for completing the application documents

How does an application generally work?

The operations manual serves as the basis for an operational authorisation in the specific category. When the competent authority issued the operational authorisation it accepts and the related operations manual.

General workflow

Before starting to collect information and describing procedures, the applicant should outline a preliminary operational concept (Refer to paragraph S.3.1 to AMC 1 to Article 11). This preliminary operational concept ensures that the applicant can effectively explore all available options, and select the most suitable approach for their specific needs.

Key considerations for this initial plan include:

— the intended flight location(s);

— the maximum operational flight altitude and speed;

— the flight mode: either Visual Line of Sight (VLOS), or Beyond Visual Line of Sight (BVLOS) with or without AO;

— the type of UAS to be used;

— environmental limitations (time of day, weather).

In the next step, the applicant assesses the risk for the intended operation and develops a high-level view of the SORA provisions. For this, they should use the template provided in section A.2 and follow each step of the SORA process.

It is considered best practice for applicants to engage with the competent authority before moving to the data collection and procedure description (refer to paragraph S.3.3 of AMC1 to Article 11). In this dialogue, the applicant shares their preliminary operational information and initial risk assessment. The competent authority and the applicant evaluate the alignment of the risk assessment with the operational information and check the correct application of the SORA steps. The competent authority may provide feedback to applicants on their expectations on how to achieve an operational authorisation considering the resulting Specific Assurance Integrity Level (SAIL).

Once the risk assessment has been validated and the applicant has secured confirmation from the competent authority, the next step involves identifying the specific provisions that arise from this risk assessment. Following this identification, the applicant must then collect the relevant evidence and information, as well as describe the procedures that will be implemented. The applicant must ensure that all integrity and corresponding assurance provisions are met. These can be found in the Annexes B – E to AMC1 Article 11. It is recommended to utilize the operations manual structure from Chapter A.3 for this purpose.

The applicant should use the template provided in chapter A.4 (compliance matrix) once all procedures are described and the evidence collected. This is done by providing the corresponding reference to the integrity and/or assurance evidence for each requirement. This document serves as a check list for the applicant to review prior to submission of an application. The competent authority may use this document as a reference to assist in the review process.

The competent authority reviews the application in accordance with the provisions arising from the risk assessment and the respective SAIL. In this process, the implementation of all technical and operational requirements is checked based on the descriptions in the operations manual, or other associated documents as required. The competent authority has the option to request revisions of documents or to ask for additional supporting documentation.

For the applicant to address the additional demands effectively, the competent authority may also provide guidance on how the applicant can proceed to close any outstanding issues.

Figure 1 below graphically depicts the process described above and thus serves as an additional illustration of the general workflow.

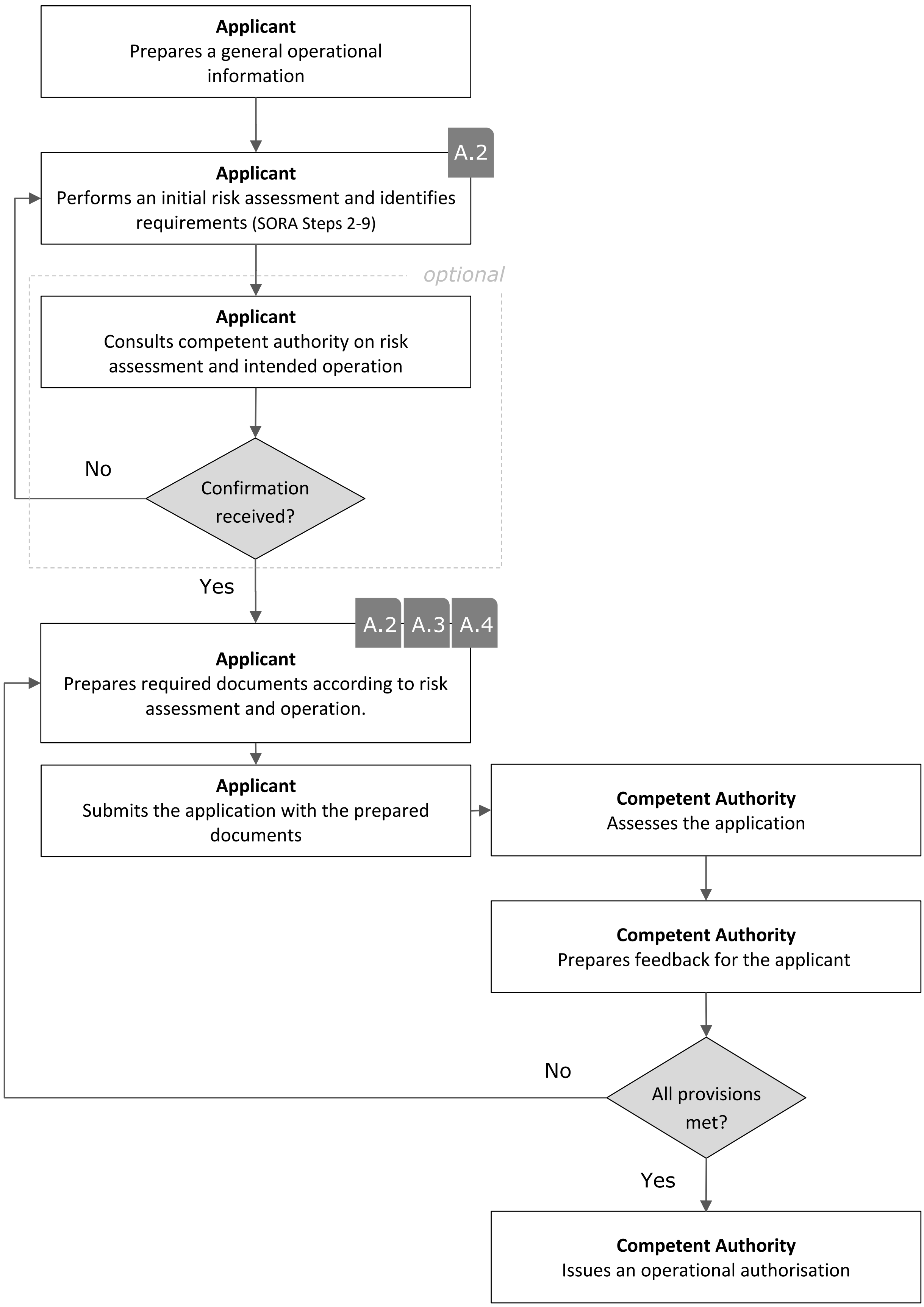


Figure A.1 Recommended level of detail and use of supporting documents and references

The operations manual and associated annexes should enable the applicant to describe to the competent authority the intended operation(s) to a level of detail that effectively enables:

— the identification of the Ground Risk Class (GRC), Air Risk Class (ARC), associated mitigations, and SAIL determination.

— compliance with the required Operational Safety Objectives (OSOs), mitigations and containment. The provisions can be assessed and verified with the information contained or referenced by it.

The applicant should only put information into the operations manual that is recommended above. Supporting documents as evidence for the points above can usually be kept internal to the operator's organisation and may not need to be submitted to the competent authority. The competent authority may request further documents, if considered necessary for the given operation.

Document setup for additional flight areas, UAS or operations

When a UAS operator seeks to expand their approved operations manual(s) to include a new flight area, UAS, or operation, the primary question is whether the underlying risk assessment covers these additions. If it does, the new information can be incorporated into existing parts (See chapter A.3 of this Annex — Part A to T) of the operations manual. Otherwise, it is considered best practice to establish new parts for this information.

When dealing with complex operational structures it's recommended to align the manual's structure with the competent authority to ensure it meets both national and industry standards.

Operation-specific details should typically be organized into separate parts for clarity during approval and ease of use. Conversely, general or related information can be consolidated into a shared segment. An example would be adding an additional UAS with the same characteristic dimensions, but a different set of procedures. This could be added to the existing part B, for illustration purposes see Figure 2.

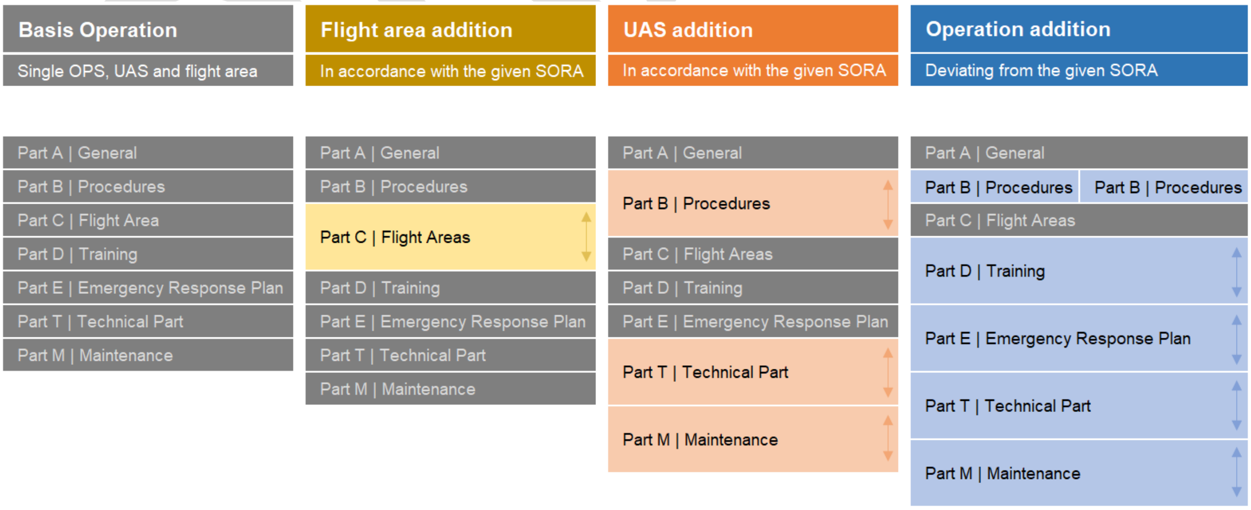


Figure A.2 Common scenarios and how they may impact the operations manual

A.2 SORA risk assessment template

How to use this chapter?

The UAS operator should submit an application for an operational authorisation according to the form provided in AMC1 UAS.SPEC.030(2). By providing this questionnaire-style template for documenting the risk assessment, applicants are encouraged to focus on the essential information required and to avoid unnecessary lengthy explanations about their operational procedures.

The remarks section is optional and designed for applicants to provide additional information when needed, helping to prevent misunderstandings. At this stage, no evidence is required, as the provisions are determined by the risk analysis process.

Once the application form is completed, both the applicant and the competent authority will have all the necessary information to complete phase 1 assessment (for reference see figure A.1). Please note that for phase 1 the fields 2.9 (OM references) and 2.10 (compliance evidence file reference) of the application form (AMC1 UAS.SPEC.030(2) may not be filled yet.

In situations involving the use of multiple UAs or flight locations with varying ground or air risk classes, it is advisable to consult with the competent authority. This practice helps ensure alignment with expectations and adherence to national standards. In certain cases, it might be possible to include multiple flight areas or UAs into one form.

Evidence should not be included in application form. Instead, it should be incorporated into the operations manual (OM) A.3 and referenced in the Comprehensive Safety Portfolio (A.4.).

A.3 Operations manual structure

How to use this chapter?

The intention of this operations manual structure is to provide a standardised framework for documenting essential information related to a specific operation. This serves only as an example structure for applicants to create a comprehensive document that outlines the procedures and relevant details necessary for the safe and efficient execution of an operation.

The structure divides the operations manual into logical subject parts, that offer a structure on where to include specific topics crucial for creating a standardised manual for safe UAS operation.

While the structure is not inherently mandatory, the topics it contains should be incorporated into the operations manual as needed for the specific operation(s) to provide the relevant information and evidence required for safe UAS operation. It is advisable to adhere to the provided structure, as it aligns with the expectations and practices of most authorities. An example of an operations manual may be found on the EASA website.[29]

In general, any information that does not have direct operational relevance to the operator or staff should be placed in the relevant Annex to ensure the document remains concise and reader-friendly.

The key intentions and purposes of this structure include:

1. **Standardisation:** It ensures that all critical aspects of the operation are documented consistently, following industry standards, regulations, and best practices.
2. **Compliance:** It helps operators meet regulatory requirements by specifying the information and procedures needed to obtain necessary approvals and certifications.
3. **Clarity:** It provides a clear and organized structure for conveying operational procedures, safety protocols, and other essential information, reducing the risk of misunderstandings and errors.
4. **Safety:** It emphasizes safety measures, emergency procedures, and risk mitigation strategies to enhance overall safety during the operation.
5. **Efficiency:** It streamlines the process of creating an operations manual by providing predefined sections and guidelines, saving time and effort for applicants.
6. **Consistency:** It ensures that all UAS operators involved in the same type of operation follow the same documented procedures, promoting uniformity and reducing the potential for confusion.
7. **Reference:** It serves as a valuable reference document for UAS operators, remote crew members, authorities, and other stakeholders involved in or overseeing the operation.
8. **Documentation:** It aids in the systematic recording of operational details, making it easier to track changes, updates, and compliance with evolving regulations.

[29] https://www.easa.europa.eu/en/downloads/139674/en

Recommended structure for the operations manual

Cover Page	
Document Control	
Other applicable documents	
Purpose and scope of this document	
List of Content	
List of definitions and abbreviations	
1.	**General part (Part A)**
1.1.	**Opening statement**
1.2.	**Security and privacy statement**
1.3.	**Environmental statement**
1.4.	**The operating organisation**
1.4.1.	**Structure / organisational chart**
1.4.2.	**Duties and responsibilities of the personnel**
1.5.	**Change management**
1.6.	**Retention periods**
1.7.	**Document control**
1.8.	**Requirements and qualifications of the personnel**
1.8.1.	**Control monitoring unit**
1.8.2.	**Maintenance personnel**
1.8.3.	**Ground staff**
1.8.4.	**Training, examination and supervision personnel**
1.9.	**Crew member is “fit for the operation”**
1.9.1.	**Preventive health care**
1.9.2.	**Duty hours and rest periods**

2.	**Procedures (Part B)**
2.1.	**Multi-crew coordination**
2.2.	**Flight planning**
2.2.1.	**Use of up-to-date materials**
2.2.2.	**Geographical zones**
2.3.	**External services and systems**
2.3.1.	**Services**
2.3.2.	**Systems**
2.4.	**Procedures for obtaining and evaluating weather conditions**
2.5.	**Procedures for responding to unexpected adverse weather conditions**
2.6.	**Procedures for TMPR (tactical mitigation performance requirement)**
2.7.	**Occurrence reporting**
2.7.1	**What must be reported?**
2.7.2.	**Who reports?**
2.7.3.	**What must be observed after reporting?**
2.8.	**Procedures specifically for UAS 1**
2.8.1.	**Normal procedures**
2.8.2.	**Contingency procedures**
2.8.3.	**Emergency procedures**
2.9.	**Procedures specifically for UAS 2**
2.9.1.	**Normal procedures**
2.9.2.	**Contingency procedures**
2.9.3.	**Emergency procedures**
3.	**Flight areas (Part C)**

3.1.	**General operational limitations**
3.1.1.	**Environmental conditions**
3.1.2.	**Technical operational Limitations**
3.2.	**Flight area 1**
3.2.1.	**Description**
3.2.2.	**Calculation of CV / GRB**
3.2.3	**Specific procedures of the flight area**
3.2.4.	**Emergency response plan (ERP) — Local information**
3.3.	**Flight area 2**
3.3.1.	**Description**
3.3.2.	**Calculation of CV / GRB**
3.3.3.	**Specific procedures of the Flight area**
3.3.4.	**Emergency response plan (ERP) — Local information**
3.4.	**Flight area 3**
3.4.1.	**Description**
3.4.2.	**Calculation of CV / GRB**
3.4.3.	**Specific procedures of the flight area**
3.4.4.	**Emergency response plan (ERP) — Local information**
4.	**Training (Part D)**
5.	**Emergency response plan (Part E)**
5.1.	**General**
5.2.	**Creation of the emergency response plan**
5.3.	**ERP template**
5.4.	**Preparation and briefing**

5.5.	**Reporting procedures and obligations after an emergency**
6.	**Technical part of UAS (Part T) (reference to the manufacturer's instructions may be sufficient)**
6.1.	**UAS 1 [model/type]**
6.1.1.	**Description**
6.1.2.	**Image / graphic**
6.1.3.	**C3 Link**
6.1.4.	**Parachute (M2)**
6.1.5.	**TMPR**
6.1.6.	**Containment**
6.1.7.	**Human–machine interface (HMI)**
6.1.8.	**Payload**
6.1.9.	**Automatic protection of the flight envelope**
6.1.10.	**Designed and qualified for adverse environmental conditions**
6.2.	**UAS 2 [model/type]**
6.2.1.	**Description**
6.2.2.	**Image / graphic**
6.2.3.	**C3 Link**
6.2.4.	**Parachute (M2)**
6.2.5.	**TMPR**
6.2.6.	**Containment**
6.2.7.	**Human–machine interface (HMI)**
6.2.8.	**Payload**
6.2.9.	**Automatic protection of the flight envelope**
6.2.10.	**Designed and qualified for adverse environmental conditions**

7.	**Maintenance (Part M)**
7.1.	**General**
7.2.	**Software updates**
7.3.	**Maintenance UAS 1 [model/type]**
7.4.	**Maintenance UAS 1 [model/type]**
8.	**Annex**
8.1.	**Evidence**
8.1.1.	**Organisational**
8.1.1.1.	**Organisation operating certificate**
8.1.1.2.	**Maintenance program / organisation certificate**
8.1.2.	**Operational**
8.1.2.1.	**Operational agreements (e.g. with ATC)**
8.1.2.2.	**M1**
8.1.2.3.	**Flight tests**
8.1.2.4.	**Performance of external services and systems**
8.1.3.	**Technical**
8.1.3.1.	**Design (DVR, TC)**
8.1.3.2.	**M2**
8.1.3.3.	**Manufacturer competence**
8.2.	**Printed forms**
8.2.1.	**List of maintenance personnel**
8.2.2.	**List of personnel authorised to conduct Pre-flight and Post-flight Inspections**
8.2.3.	**List of the training / experience level of personnel**
8.2.4.	**List of authorised remote pilots**

8.2.5.	**List of training on the emergency response plan (ERP)**
8.2.6.	**Operator flight logbook**
8.2.7.	**Technical logbook**
8.3.	**Check lists**
8.3.1.	**ERP template**
8.3.2.	**Pre-flight inspection — check list**
8.3.3.	**Post-flight inspection — check list**
8.4.	**Manuals**
8.4.1.	**Maintenance manual for UAS 1**

Reference table for provisions

The following table offers a comprehensive overview of the suitable locations within the operations manual where the provisions specified in the Annexes to AMC 1 to Article 11 (SORA) can be sensibly incorporated.

OSOs ↓	Integrity (I) / Assurance (A)	Criterion	OM
OSO #01	I	-	Part A Part D
	A	-	Annex 8.1.1.1
OSO #02	I	-	Part T
	A	-	Annex 8.1.3.3
OSO #03	I	-	Part M Chapter 7.1 Annex 8.1.1.2
	A	#1	Part A Chapter 1.7 Annex 8.1.1.2
		#2	Part A Chapter 1.6 Part A Chapter 1.7 Annex 8.1.1.2

OSO #04	**I**	**-**	**Part T**
	A	**-**	**Annex 8.1.3.1**
OSO #05	**I**	**-**	**Part T**
	A	**-**	**Annex 8.1.3.1**
OSO #06	**I**	**-**	**Part T Chapter 6.1.3**
	A	**-**	**Annex 8.1.3.1**
OSO #07	**I**	**-**	**Part B Chapter 2.8.1** **Part D** **Annex 8.2.6**
	A	**#1**	**Part A Chapter 1.7**
		#2	**Part A Chapter 1.7**
OSO #08	**I**	**#1**	**Part B** **Part D** **Annex 8.3**
		#2	**Part B** **Part D**
		#3	**Part E**
	A	**-**	**Part B** **Part D** **Annex 8.1.2.3** **Part E** **Annex 8.3.1**
OSO #09	**I**	**-**	**Part A Chapter 1.7**
	A	**-**	**Part D**
OSO #13	**I**	**-**	**Part B Chapter 2.3**
	A	**-**	**Part B Chapter 2.3** **Annex 8.1.2.4**

OSO #16	I	#1	Part B Chapter 2.1
		#2	Part D
	A	#1	Part B Chapter 2.1 Annex 8.1.2.3
		#2	Part D
		#3	Annex 8.1.2.4
OSO #17	I	-	Part A Chapter 1.9
	A	-	Part A Chapter 1.9
OSO #18	I	-	Part T
	A	-	Annex 8.1.3.1
OSO #19	I	-	Part B Chapter 2.8
	A	-	Annex 8.1.3.1
OSO #20	I	-	Part T Chapter 6.1.7
	A	-	Annex 8.1.3.1
OSO #23	I	-	Part B Chapter 2.4 Part C Chapter 3.1.1 Part D
	A	-	Part C Chapter 3.1 Part B Chapter 2.4 Annex 8.1.2.3 Part D
OSO #24	I	-	Part T
	A	-	Annex 8.1.3.1
M1	I	-	Part C Chapter 3.2.3.2
	A	-	Annex 8.1.2.2
M2	I	-	Part T

	A	**-**	**Annex 8.1.3.2**
ARC Mitigation	**I**	**-**	**Part C Chapter 3.2.3.3**
	A	**-**	**Annex 8.1.2.1**
TMPR	**I**	**-**	**Part B Chapter 2.8.3.4** **Part B Chapter 2.8.3.5** **Part T Chapter 6.1.5**
	A	**-**	**Annex 8.1.3.1**
Containment	**I**	**-**	**Part T Chapter 6.1.6**
	A	**-**	**Annex 8.1.3.1**
Payload	**I**	**-**	**Part T Chapter 6.1.8**
	A	**-**	**Annex 8.1.3.1**

A.4 Compliance Matrix

How to use this chapter?

This chapter provides a template for applicants on how to present the reference between the SORA driven provisions and the operations manual from A.3 of Annex A to AMC1 Article 11 to the competent authority.

For all provisions that must be fulfilled to conduct a safe UAS operation, the applicant should put the specific reference into the table where it can be found.

For those OSOs that in Table 14 of the AMC 1 to Article 11 (SORA main body) are identified as 'NR' the UAS operator is still expected to consider its applicability at least as low integrity level even if it is not required to show compliance to the competent authority. In this case the UAS operator may still indicate, as good practice, the reference to the evidence.

This is not a list of declarations or evidence — but the reference where it can be found.

Example:

...		
Provision	**Level of robustness**	**Reference to documentation**
OSO #08	☒ Low ☐ Medium ☐ High	Document name: *MyOperationsManual.pdf* Chapter or Page number: *Chapter B, page 42 – 47* *Chapter Annex, page 815*
...		

The level of robustness is in this case is SAIL dependant and should be checked accordingly (e.g. low for SAIL II).

Compliance Matrix		
Provision	**Level of robustness**	**Reference to documentation**

Ground risk mitigations		
M1 (A) Strategic mitigations **- Sheltering**	☐ None ☐ Low	Document name: __________ Chapter or Page number: __________
M1 (B) Strategic mitigations **- Operational restrictions**	☐ None ☐ Medium ☐ High	Document name: __________ Chapter or Page number: __________
M1 (C) Tactical mitigations **- Ground observation**	☐ None ☐ Low	Document name: __________ Chapter or Page number: __________
M2 – Effects of UA impact dynamics are reduced	☐ None ☐ Medium ☐ High	Document name: __________ Chapter or Page number: __________

Strategic air risk mitigations		
Air risk class mitigation	☐ ARC-d (AEC 1 or 2) → ARC-c ☐ ARC-d (AEC 1 or 2) → ARC-b ☐ ARC-d (AEC 3) → ARC-c	Document name: __________

	☐ ARC-d (AEC 3) → ARC-b ☐ ARC-c (AEC 4) → ARC-b ☐ ARC-c (AEC 5) → ARC-b ☐ ARC-c (AEC 6,7,8) → ARC-b ☐ ARC-c (AEC 9) → ARC-b	Chapter or Page number: ____________________________

Tactical mitigations performance requirements		
TMPR level	☐ VLOS (deconfliction scheme) ☐ BVLOS ☐ No requirement (ARC-a) ☐ Low requirement (ARC-b) ☐ Medium requirement (ARC-c) ☐ High requirement (ARC-d)	Document name: ____________________________ Chapter or Page number: ____________________________
TMPR function	Detect	Document name: ____________________________ Chapter or Page number: ____________________________
	Decide	Document name: ____________________________ Chapter or Page number: ____________________________
	Command	Document name: ____________________________ Chapter or Page number: ____________________________
	Execute	Document name: ____________________________ Chapter or Page number:

		______
	Feedback loop	Document name: ______ Chapter or Page number: ______
TMPR robustness	TMPR integrity and assurance objectives	Document name: ______ Chapter or Page number: ______

Containment provisions		
Containment	☐ Low ☐ Medium ☐ High ☐ Tethered	Document name: ______ Chapter or Page number: ______

Operational Safety Objectives		
OSO #01 **Ensure that the UAS operator is competent and/or proven**	☐ NR ☐ Low ☐ Medium ☐ High	Document name: ______ Chapter or Page number: ______
OSO #02 **UAS manufactured by competent and/or proven entity**	☐ NR ☐ Low ☐ Medium ☐ High	Document name: ______ Chapter or Page number: ______

OSO #03 **Maintenance of the UAS**	☐ Low ☐ Medium ☐ High	Document name: ________ Chapter or Page number: ________
OSO #04 **UAS components essential to safe operations are designed to an Airworthiness Design Standard (ADS)**	☐ NR ☐ Low ☐ Medium ☐ High	Document name: ________ Chapter or Page number: ________
OSO #05 **UAS is designed considering system safety and reliability**	☐ NR ☐ Low ☐ Medium ☐ High	Document name: ________ Chapter or Page number: ________
OSO #06 **C3 link characteristics (e.g. performance spectrum use) are appropriate for the operation**	☐ NR ☐ Low ☐ Medium ☐ High	Document name: ________ Chapter or Page number: ________
OSO #07 **Conformity check of the UAS configuration**	☐ Low ☐ Medium ☐ High	Document name: ________ Chapter or Page number: ________
OSO #08 **Operational procedures are defined, validated and adhered to**	☐ Low ☐ Medium ☐ High	Document name: ________ Chapter or Page number: ________
OSO #09 **Remote crew trained and current**	☐ Low ☐ Medium ☐ High	Document name: ________ Chapter or Page number: ________

OSO #13 **External services supporting UAS operations are adequate for the operation**	☐ Low ☐ Medium ☐ High	Document name: __________ Chapter or Page number: __________
OSO #16 **Multi-crew coordination**	☐ Low ☐ Medium ☐ High	Document name: __________ Chapter or Page number: __________
OSO #17 **Remote crew is fit to operate**	☐ Low ☐ Medium ☐ High	Document name: __________ Chapter or Page number: __________
OSO #18 **Automatic protection of the flight envelope from human errors**	☐ NR ☐ Low ☐ Medium ☐ High	Document name: __________ Chapter or Page number: __________
OSO #19 **Safe recovery from human error**	☐ NR ☐ Low ☐ Medium ☐ High	Document name: __________ Chapter or Page number: __________
OSO #20 **A human factors evaluation has been performed and the human machine interface (HMI) found appropriate for the mission**	☐ NR ☐ Low ☐ Medium ☐ High	Document name: __________ Chapter or Page number: __________
OSO #23 **Environmental conditions for safe operations are defined, measurable and adhered to**	☐ Low ☐ Medium ☐ High	Document name: __________ Chapter or Page number: __________

OSO #24 **UAS is designed and qualified for adverse environmental conditions**	☐ NR ☐ Medium ☐ High	Document name: ____________________ Chapter or Page number: ____________________

Confirmation	
Have all safety provisions **been described and met?**	☐Yes ☐No
Place, date	**Name and signature**

A.5 How to document and present a flight area

How to use this chapter?

This chapter provides guidelines on how to prepare and present a flight area, typically located under Part C of the operations manual. The goal is to present the proposed flight area in a way that is both straightforward and easy to understand. This is crucial not just for the competent authority reviewing this section, but especially for all individuals participating in the flight operation who consult the operations manual.

It is worth noting that this section is also relevant for operators who have the privilege to analyse, approve and document flight areas independently, such as those under a generic operational authorisation.

For better usability, section A.5 is divided into two main subsections:

A.5.1 provides a comprehensive guide on creating a KML file, which is a file format for displaying information in a geographic context. It also specifies the basic necessities for the illustration and delves into the methods of depicting the flight area, as well as explaining the underlying reasons for these representations in the operations manual.

A.5.2 provides a sample computation for determining the minimum dimensions of the contingency volume and the ground risk buffer. These examples are intended solely as illustrative calculations. For a more in-depth analysis, one can also employ sophisticated flight mechanics-based computations. These calculations can be incorporated into the operations manual annex.

While adhering to these guidelines, it is important to cite the source of the calculations used. If the applicant chooses to use alternative calculations, it is important to provide clear explanation and supporting documentation that outlines the methodology and its safety assurances.

A5.1 Presentation

The provided graphical representation of the flight area should contain as a minimum:

— An area: flight geography in transparent green colour

— An area: contingency volume in transparent yellow colour

— An area: ground risk buffer in transparent red colour

— A position: remote pilot's position (for VLOS operation)

— A position: take off / landing position (optional)

The applicant should provide the flight area to the competent authority when required. This should be in the format of a *.kml file or a similar format suitable for visualisation, accompanied by the operations manual or a referenced document that includes all pertinent flight area details. There are two methods for delineating the flight area: "inside out" or "reverse". The choice between them largely depends on the constraining factor. For many applications, the "inside out" method will provide the desired areas based on the specific flight geography.

However, there may be situations where it's preferable to utilise the maximum available ground risk buffer (e.g., controlled ground) and then determine the maximum possible flight geography from that. This is called “reverse”.

inside out: reverse:

Figure 8 — Inside out versus reverse computation of the flight area

Areas within the flight geography that need to be excluded for any reason (e.g. higher ground risk) should be addressed in the same way as to surround them with a contingency volume and a ground risk buffer.

A screenshot of the flight area, accompanied by a concise description, all input values, and the calculations for contingency volume (CV) and ground risk buffer (GRB) should be documented. For instance, in Part C of the operations manual according to A.3.

The content should be presented in a manner that is easily comprehensible to all parties involved in the operation, enabling swift access to all pertinent data during routine operations. It is also crucial for the competent authority to understand the calculation process. If the derivation of the calculation or the overall rationale is unusually extensive, it is advisable to relocate the sections not directly pertinent to daily operations, to the OM's annex.

Example:

Detailed information for each flight area is typically located under Part C, following the recommended format outlined in A.3. In a structured chapter layout, this might appear as:

3 Part C – Flight Areas

3.2 Flight area [project name]

Description

The flight area, along with its precise coordinates, is delineated in the accompanying KML file "[project name.kml]".

Figure 9 — Graphical representation of the flight area

The centre of the figure is located at **[N53.1234567 E11.1234567]**.

The remote pilot's position is located at **[N53.1434567 E11.1434567]**.

General comment: [The flight area is an area used for agricultural purposes, …]

Special procedures/mitigations: [CTR Clearance for airport XY is required, as per OM 2.2]

Calculation of CV / GRB

The contingency volume and the ground risk buffer were determined using Annex A, Chapter 5

UA characteristics:

— Type: **[rotary wing without parachute]**

— Altitude measurement: **[barometric]**

— Maximum speed in operation V_0: **[10,0 m/s]**

— Maximum permissible wind speed V_{Wind}: **[3,0 m/s]**

— Characteristic dimension **CD**: **[1,50 m]**

— Maximum pitch angle Θ_{max}: **[45°]**

The following parameters were used:

— Hight of the Flight Geography H_{FG}: **[100,0 m]**

— Calculation method: **[from inside]**

— Manoeuvre on entering into the contingency volume (horizontal): **[stopping]**

— Manoeuvre on entering the contingency volume (vertical): **[kinetic into potential]**

— Manoeuvre on entering the Ground Risk Buffer: **[power off]**

Assumptions:

— GNSS accuracy S_{GNSS}: **[0,5 m]**

— Position holding error S_{Pos}: [3,0 m]

— Map error S_K: [1,0 m]

— Reaction time t_R: [1,0 s]

— Altitude measurement error H_{AM}: [H_{Baro} = 1,0 m]

— Additional distance (horizontal) S_{Add}: [0,0 m]

— Additional distance (vertical) H_{Add}: [0,0 m]

Reasons for deviations from the standard values:

— S_{GPS} ([0,5 m] instead of [3,0 m]): [The UA is equipped with …]

— …

— H_{CM} ([3,0 m] instead of [5,1 m]): [The assumption based on …]

Results

Flight altitude

— Altitude of the flight geography H_{FG}: [100,0 m]

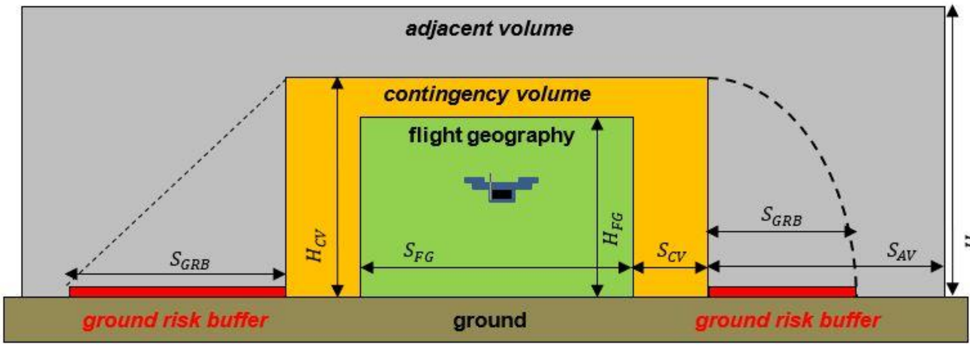
Contingency Volume:

— Horizontal S_{CV}: [34,5 m]

— Vertical H_{CV}: [113,1 m]

Ground Risk Buffer:

— Horizontal S_{GRB}: [113,8 m]



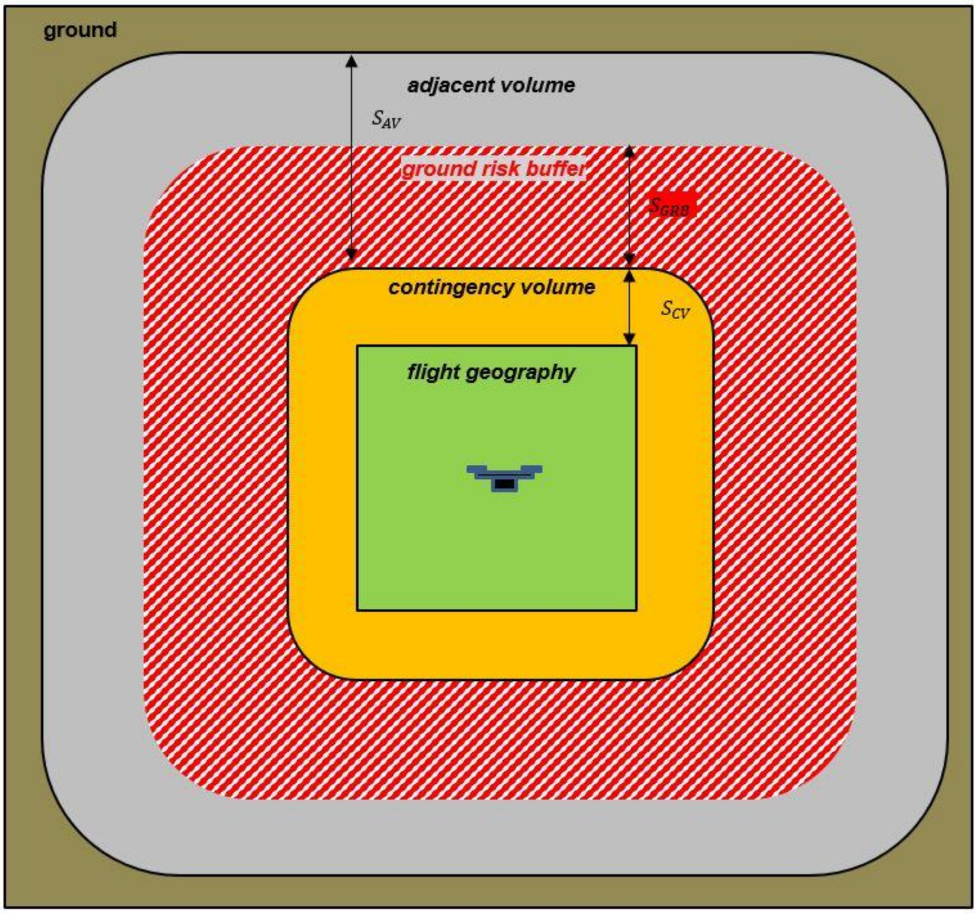


Figure 10 — Schematic representation of Flight Geography, Contingency Volume and Ground Risk Buffer

A5.2 Calculations used in the example case above

5.2.1 Information Required for calculations

V_0, m/s	Maximum operational speed that is flown. This corresponds to the information in field 0.8 in the A.2 form. *Note: A speed below 3 m/s for multirotor and $1.25 \cdot V_{\text{Stall,clean}}$ for fixed-wing aircraft is not considered realistic.*
CD, m	The "maximum UA characteristic dimension" or "CD" is the maximum possible length of a straight line that can be spanned from one point on the UA geometry to another point. Propellers and rotors are part of the geometry, whereby their most unfavourable position is considered. This corresponds to the information in field 0.6 of the A.2 form. *Note: Commonly used values for:* *Fixed-wing aircraft* • *Wing-span or* • *Fuselage length* *Multirotor* • *Diagonal distance from rotor tip to rotor tip, rotors in unfavourable position*
V_{Wind}, m/s	Maximum wind speed specified in the operations manual up to which the UA may be operated.
FG	Flight geography
CV	Contingency volume
GRB	Ground risk buffer

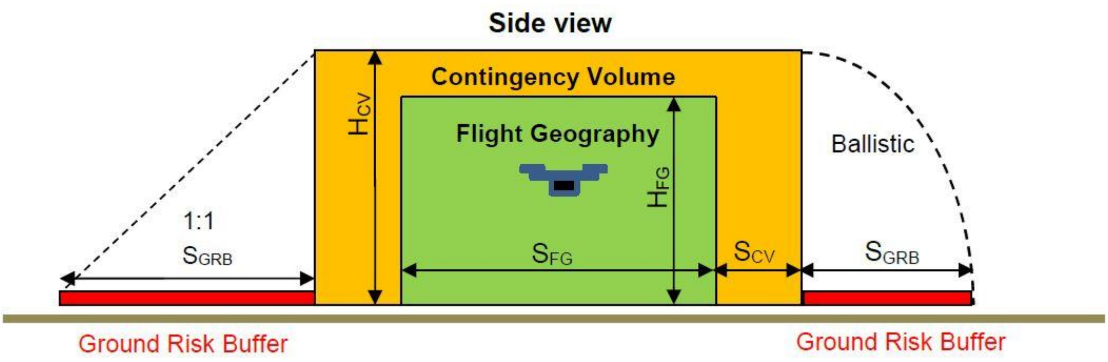


Figure 11 — Schematic representation of Flight Geography, Contingency Volume and Ground Risk Buffer

5.2.2 Computation Flight Geography

Variant 1 (inside out):

The size of the flight geography usually results from the operator's desired flight geography. The contingency volume and the ground risk buffer just add up to this area.

Variant 2 (reverse):

Determination of the maximum flight geography available, e.g. when operating over a controlled ground area.

In this example (controlled ground), the ground projection of flight geography, contingency volume and the ground risk buffer must be completely contained in the controlled ground area. A calculation in reverse is recommended:

The outer limit of the ground risk buffer corresponds to the topology of the controlled ground area.

In the first step, the horizontal extent (width) of the ground risk buffer is subtracted from the topology of the controlled ground area. This gives the boundary between the contingency volume and the ground risk buffer.

In the second step, the horizontal extent (width) of the contingency volume is then subtracted from this limit. This results in the maximum possible expansion of the flight geography as the remaining area.

Notes on the realistic definition of particularly small flight geographies:

Flight Geography horizontal	
Width flight geography: S_{FG}	$S_{FG} \geq 3$ CD
F light Geography vertical	
Height flight geography: H_{FG}	$H_{FG} \geq 3$ CD

Note: Smaller values than $H_{FG} = 3$ CD and $S_{FG} = 3$ CD are considered unrealistic, also for automated waypoint flights.

5.2.3 Computation Contingency Volume

Notes on the realistic dimensioning of the contingency volume. Assumptions can be substituted with real values if evidence is available:

Contingency volume horizontal	
GNSS accuracy: S_{GNSS}	$S_{GNSS} = 3\ \mathrm{m}$
Position holding error: S_{Pos}	$S_{Pos} = 3\ \mathrm{m}$
Map error: S_K	$S_K = 1\ \mathrm{m}$
Reaction distance: S_R	Manual initiation of measures Reaction time: $t_R = 3$ s, with V_0 results in with V_0 results in $S_R = V_0\, t_R$ *Note: t_R can also be smaller in fully automatic systems (e.g. geofence).*
Contingency manoeuvres: S_{CM}	Multirotor - stopping Based on $S_{CM} = \frac{1}{2}\, a\, t_R^{\ 2} + V_0\, t_R$ follows for a thrust to weight ratio of at least 2 $\text{thrust} \geq 2\, m\, g$ and a maximum pitch angle of less than 45 degrees $\Theta_{max} \leq 45^\circ$ The minimum distance for stopping to hovering mode is: $S_{CM} = \frac{1}{2} \frac{V_0^{\ 2}}{g \tan(\Theta)}$ Fixed-wing aircraft -180° turn: Assumption: roll angle $\Phi_{max} \leq 30^\circ$ The radius for the turn is: $S_{CM} = \frac{V_0^{\ 2}}{g \tan(\Phi)}$

Horizontal extension of the contingency volume: S_{CV}	$S_{CV} = S_{GPS} + S_{Pos} + S_K + S_R + S_{CM}$
Examples	
Example multirotors: $V_0 = 10\ \frac{m}{s}, \Theta = 45^{\circ}, [\tan(45°) = 1]$	$S_{CV} = 3\ m + 3\ m + 1\ m + 10\ m + \frac{1}{2} \cdot \frac{\left(10\ \frac{m}{s}\right)^2}{9{,}81\ \frac{m}{s^2} \cdot 1} = 22{,}1\ m$
Example fixed-wing aircraft: $V_0 = 30\ \frac{m}{s}, \Phi = 30^{\circ}$	$S_{CV} = 3\ m + 3\ m + 1\ m + 30\ m + \frac{\left(30\ \frac{m}{s}\right)^2}{9{,}81\ \frac{m}{s^2} \cdot \tan(30°)}$ $= 195{,}9\ m$
Contingency volume vertical	
Altitude measurement error: H_{AM}	$H_{AM} = H_{Baro} = 10\ m$ for barometric altitude measurement, or $H_{AM} = H_{GNSS} = 4\ m$ for GNSS-based altitude measurement *Note: when operating close to large buildings the altitude information provided by GNSS may not be reliable.*
Reaction distance: H_R	Manual initiation of measures Reaction time: $t_R = 3$ s, with 45° pitch angle results $H_R = V_0 \cdot 0{,}7 \cdot t_R$ *Note: t_R can also be smaller in fully automatic systems (e.g. geofence).*
Contingency manoeuvres: H_{CM}	For multirotor The forward kinetic energy is completely converted into potential energy. This results in $H_{CM} = \frac{1}{2} \frac{V_0{}^2}{g}$ For fixed-wing aircraft

	Exit the FG upwards with a 45° pitch angle, then fly on a constant circular path with V_0 and radius *r* until level flight is achieved. With $r = \frac{V_0^{\,2}}{g}$ results in the contingency manoeuvre height being approximately $H_{\mathrm{CM}} = \frac{V_0^{\,2}}{g} \cdot 0{,}3$
Contingency volume: H_{CV}	$H_{\mathrm{CV}} = H_{\mathrm{FG}} + H_{\mathrm{AM}} + H_{\mathrm{R}} + H_{\mathrm{CM}}$
Examples	
Height of flight geography	$H_{\mathrm{FG}} = 100\ \mathrm{m}$
Example multirotor: $V_0 = 10\ \frac{\mathrm{m}}{\mathrm{s}}$	$H_{\mathrm{CV}} = 100\ \mathrm{m} + 4\ \mathrm{m} + 7\ \mathrm{m} + \frac{1}{2} \cdot \frac{\left(10\ \frac{\mathrm{m}}{\mathrm{s}}\right)^2}{9{,}81\ \frac{\mathrm{m}}{\mathrm{s}^2}} = 116{,}1\ \mathrm{m}$
Example fixed-wing a/c: $V_0 = 30\ \frac{\mathrm{m}}{\mathrm{s}}$	$H_{\mathrm{CV}} = 100\ \mathrm{m} + 4\ \mathrm{m} + 21\ \mathrm{m} + \frac{\left(30\ \frac{\mathrm{m}}{\mathrm{s}}\right)^2}{9{,}81\ \frac{\mathrm{m}}{\mathrm{s}^2}} \cdot 0{,}3 = 152{,}52\ \mathrm{m}$

5.2.4 Computation ground risk buffer

Ground risk buffer horizontal	
Simplified approach: 1:1 rule: S_{GRB}	$S_{\mathrm{GRB}} = H_{\mathrm{CV}} + \frac{1}{2}\ \mathrm{CD}$
Ballistic approach: S_{GRB} ***Note: Only permitted for helicopters and VTOL capable UAS (including multirotor)!***	$S_{\mathrm{GRB}} = V_0 \sqrt{\frac{2\,H_{\mathrm{CV}}}{g}} + \frac{1}{2}\mathrm{CD} + 3V_0$
Termination with parachute: S_{GRB} *Note: Values below $V_{\mathrm{Wind}} = 3\ \frac{\mathrm{m}}{\mathrm{s}}$ are not considered realistic for this computation.*	t_{P} = Time to open the parachute From the rate of descent with the parachute open (V_{z}) and the maximum permissible wind speed for operation (V_{Wind}) results $S_{\mathrm{GRB}} = V_0\ t_{\mathrm{P}} + V_{\mathrm{Wind}}\ \frac{H_{\mathrm{CV}}}{V_{\mathrm{z}}}$

Termination with fixed-wing aircraft: S_{GRB}	• <u>Power is switched off:</u> A glide ratio of $E = \frac{1}{\varepsilon} = \frac{C_L}{C_D}$ results in $S_{\mathrm{GRB}} = E\ H_{\mathrm{CV}}$ • <u>Power is switched off and the flight control surfaces are permanently set in a way that no gliding is possible:</u> The simplified approach can be chosen (1:1 rule).
Examples	
Simplified approach: Multirotor: $V_0 = 10\ \frac{\mathrm{m}}{\mathrm{s}}$, $\mathrm{CD} = 1{,}5\ \mathrm{m}$, $H_{\mathrm{CV}} = 113{,}1\ \mathrm{m}$	$S_{\mathrm{GRB}} = 113{,}1\ \mathrm{m} + \frac{1}{2} \cdot 1{,}5\ \mathrm{m} = 113{,}85\ \mathrm{m}$
Ballistic Approach: Multirotor: $V_0 = 10\ \frac{\mathrm{m}}{\mathrm{s}}$, $\mathrm{CD} = 1{,}5\ \mathrm{m}$, $H_{\mathrm{CV}} = 113{,}1\ \mathrm{m}$	$S_{\mathrm{GRB}} = 10\ \frac{\mathrm{m}}{\mathrm{s}} \sqrt{\frac{2 \cdot 113{,}1\ \mathrm{m}}{9{,}81\ \frac{\mathrm{m}}{\mathrm{s}^2}}} + \frac{1}{2} \cdot 1{,}5\ \mathrm{m} = 48{,}77\ \mathrm{m}$
Fixed-wing aircraft only power is switched off: $V_0 = 30\ \frac{\mathrm{m}}{\mathrm{s}}$, $\mathrm{CD} = 3\ \mathrm{m}$, $H_{\mathrm{CV}} = 149{,}52\ \mathrm{m}$	$E = 20$ $S_{\mathrm{GRB}} = 149{,}52\ \mathrm{m} \cdot 20 = 2990{,}4\ \mathrm{m}$
Fixed-wing aircraft power is switched off and flight control surfaces set so that no gliding is possible: $V_0 = 30\ \frac{\mathrm{m}}{\mathrm{s}}$, $\mathrm{CD} = 3\ \mathrm{m}$, $H_{\mathrm{CV}} = 149{,}52\ \mathrm{m}$	$S_{\mathrm{GRB}} = 149{,}52\ \mathrm{m} + \frac{1}{2} \cdot 3\ \mathrm{m} = 151{,}02\ \mathrm{m}$
GRB vertical	- not applicable -

5.2.5 Examples of Computation for VLOS/BVLOS maximum distance(s)

When determining the operating range for visual line of sight (VLOS) operations, care must be taken to ensure that the remote pilot can actually operate the UAS within visual range.

To check whether the described UAS operation is in VLOS or beyond visual line of sight (BVLOS), the following calculations may be used.

VLOS / BVLOS with AO limit	The maximum possible VLOS distance between remote pilot or observer and UA results from the **smaller value of ALOS and DLOS**. Anything beyond that is considered **BVLOS**.
ALOS	Attitude Line of Sight The attitude line of sight defines the maximum distance up to which a remote pilot can detect the position and orientation of the UA. Up to this limit, the remote pilot is able to control the flight path of the UA and is able to determine the attitude and position of the UA. This distance was determined in practical tests.
DLOS	Detection Line of Sight The detection line of sight defines the distance up to which other aircraft can be visually detected, and sufficient time is available for an avoidance manoeuvre. The ground visibility is crucial for this.
GV	Ground Visibility The ground visibility depends on the operational area and the meteorological conditions, and must be determined at the respective time of operation. The procedure for precisely determining ground visibility should be described in chapter 2.2.1 of the OM. The use of landmarks or the use of a transmissometer are possible. The maximum ground visibility to be assumed is **5 km**, analogue to the visibility according to the VFR rules in airspace G.

ALOS limit	For rotorcraft and multirotors $ALOS_{max} = 327 \cdot CD + 20\ m$ For fixed-wing aircraft: $ALOS_{max} = 490 \cdot CD + 30\ m$
DLOS limit	$DLOS_{max} = 0{,}3 \cdot GV$ GV depends on the actual ground visibility at site and time of operation. However, it always applies: $GV_{max} = 5\ km$

If the largest possible distance between the remote pilot's location and the outer side of the contingency volume (boundary between contingency volume and ground risk buffer) is greater than the VLOS boundary, no VLOS operation can take place. UAS operations must then take place in BVLOS.

5.2.6 Examples for maximum VLOS distances

The following table is valid for a ground visibility of 5 km or more.

Characteristic dimension (CD)	Maximum VLOS distance	
	Rotary Wing	Fixed Wing
1 m	347 m	520 m
2 m	674 m	1010 m
3 m	1000 m	1500 m
3,5 m	1164,5 m	1500 m
4 m	1328 m	1500 m
4,53 m	1500 m	1500 m
> 4,53 m	1500 m	1500 m

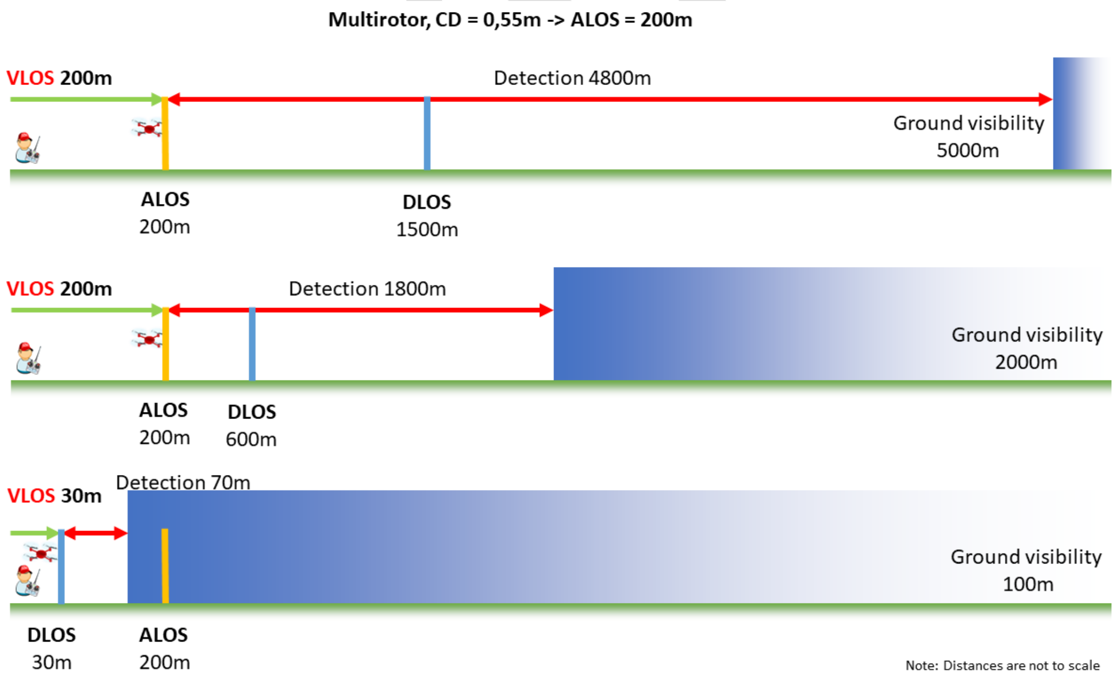


Figure 12: Multirotor VLOS Range

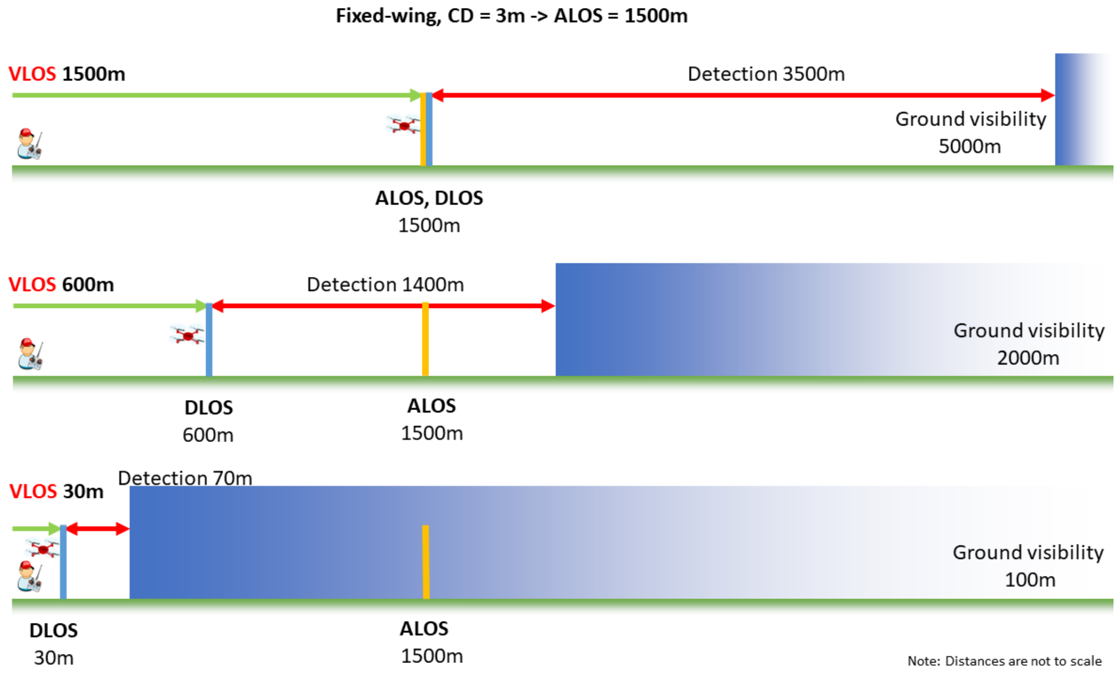


Figure 13: Fixed-wing VLOS Range

Annex B to AMC1 to Article 11 is replaced by the following:

Annex B to AMC1 to Article 11

INTEGRITY AND ASSURANCE LEVELS FOR THE MITGATIONS USED REDUCE THE INTRINSIC GROUND RISK CLASS

B.1 How to use Annex B

The following table provides the basic principles to consider when using SORA Annex B.

#	Principle description	Additional information
#1	Annex B provides assessment criteria for the integrity (i.e., safety gain) and assurance (i.e., method of proof) of the applicant's proposed mitigations. The proposed mitigations are intended to reduce the intrinsic Ground Risk Class (GRC) associated with a given operation.	The identification and implementation of mitigations is the responsibility of the applicant.
#2	Annex B does not cover the Level of Involvement (LoI) of the Competent Authority. LoI is based on the Competent Authority assessment of the applicant's ability to perform the given operation.	
#3	A proposed mitigation should have a positive effect on reducing the ground risk associated within defined operational limitations.	
#4	To achieve a given level of integrity/assurance, when more than one criterion exists for that level of integrity/assurance, all applicable criteria need to be met, unless specified otherwise.	If a criterion for a mitigation is not applicable it can be ignored (e.g., passive mitigations do not require training or activation).
#5	Annex B intentionally uses non-prescriptive terms (e.g., suitable, reasonably practicable) to provide flexibility to both the applicant and the Competent Authorities. This does not constrain the applicant in proposing mitigations, nor the Competent Authority in evaluating what is needed on a case-by-case basis.	
#6	This Annex in its entirety also applies to single-person organisations.	
#7	Annex B mitigations are applied to the operational volume and ground risk buffer. Annex B mitigations may be applied to the adjacent area.	Details of mitigation application to adjacent area can be found in Annex F[30].
#8	All bullet points within all tables in this Annex are meant to be fulfilled unless followed by OR.	

[30] http://jarus-rpas.org/wp-content/uploads/2024/06/SORA-v2.5-Annex-F-Release.JAR_doc_29pdf.pdf

#9	The GRC cannot be lowered to a value less than the equivalent for controlled ground area.	
#10	Any criterion labelled "Technical design" will most likely require the support of the UAS or Component designer for providing declarations and if applicable gathering the required evidence.	Authorities may divide the requirements for different responsible parties in local regulations.
#11	The applicant may claim more points of GRC reduction than indicated in Table 11 (Table 5 in the Main Body), when the appropriate orders of magnitude reduction of the risk to uninvolved people can be demonstrated. Any of these claims should be fulfilled to the high robustness level.	

Table B. 1 – Basic principles

B.2 M1(A) – Strategic mitigations -–Sheltering

M1(A) mitigation is linked to the fact that people spend on average a very small amount of time outdoors unprotected by a structure. Therefore, operators using sufficiently small UAS can expect to have a large percentage of the population sheltered from an impact. This assumption may also apply to larger UAS, in these cases, the sheltering effectiveness should be demonstrated.

Time based arguments such as "I fly at night and there are less people outdoors in my iGRC footprint" do not belong to M1(A) low robustness. At medium robustness time-based arguments are included. Sheltering at low robustness is to be understood as a generally applicable mitigation given by the characteristics of the environment being flown, with no operational restrictions added.

To prevent double counting time-based restrictions, M1(A) medium robustness mitigation cannot be combined with any M1(B) mitigations. However, M1(A) low robustness has no operational restrictions and can be combined with M1(B) mitigations.

		LEVEL of INTEGRITY	
		Low	**Medium**
M1(A) – Sheltering	Criterion #1 (Evaluation of people at risk)	If the applicant claims a reduction due to a sheltered operational environment, the applicant: a) flies over operational environments generally consisting of structures providing shelter, b) it is reasonable to expect that on average a vast majority of the uninvolved people will be located under a structure[1] This mitigation cannot be claimed when only overflying open-air assemblies of people or areas with no shelter.	Same as low. In addition, the applicant restricts operating times (e.g. during night time) and demonstrates that an even greater proportion of uninvolved people are sheltered.

	Comments	*[1] The consideration of this mitigation may vary based on local conditions. A metastudy of time-activity pattern studies shows that people generally spend at most 10% of their time outside. Diffey, B. (2010). An overview analysis of the time people spend outdoors. The British journal of dermatology. 164. 848-54. 10.1111/j.1365-2133.2010.10165.x.* *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%. However, assemblies of people should be avoided. Applicants and/or authorities may consider to adapt this ratio based on other evidence.* *When the UAS operator applies M1(A) with at least medium level of robustness the competent authority should issue an operational authorisation with precise identification of the location, since the same conditions may not apply in all locations at all times.*
	Criterion #2 (Evaluation of penetration hazard)	The applicant uses a drone that is not expected to penetrate structures and fatally injure people under the shelter[2].
	Comments	*[2] Guidance on how to evaluate sheltering effect can be found from:* • *ASSURE UAS Ground Collision Severity Evaluation A4 report section "4.12. Structural Standards for Sheltering (KU)", pages 103 to 111, or* • *MITRE presentation given during the UAS Technical Analysis and Applications Center (TAAC) conference in 2016 titled 'UAS EXCOM Science and Research Panel (SARP) 2016 TAAC Update' - PR 16-3979.* *In general, it can be expected that UAS with a take off mass of less than 25 kg are not able to penetrate into buildings except in rare cases where the UAS speed or building materials are unusual (tents, glass roofs, etc).*

Table B. 2- Level of integrity assessment criteria for M1(A) mitigation

		LEVEL of ASSURANCE	
		Low	**Medium**
M1(A) – Sheltering	Criterion #1 (Evaluation of people at risk)	The applicant declares that the operation is in an environment that has structures[1] providing shelter where people are generally expected to be, and the applicant does not fly over large open -air assemblies of people.	Same as Low. In addition, the applicant has time-based restrictions in place and evidence to support that a higher proportion of people are sheltered. Medium robustness M1(A) mitigation cannot be combined with M1(B) mitigations.
	Comments	*[1] 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 the majority of such cases.*	
	Criterion #2 (Evaluation of penetration hazard)	The applicant declares that the UA used has a take off mass of less than 25 kg. OR For UA with take off mass higher than 25 kg[1], the applicant has supporting evidence that the required level of integrity is achieved. This is typically done by means of testing, analysis, simulation, inspection, design review or through operational experience.	
	Comments	*[1]UA technical information needed for the evaluation may require support from the UAS designer.*	

Table B. 3 - Level of assurance criteria for M1(A) mitigation

B.3 M1(B) – Strategic mitigations – Operational restrictions

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.

Improvements in static data population density maps are not part of M1(B) mitigation and should be already used in the intrinsic ground risk assessment at Step #2. Use of best available data is encouraged to be used already for the iGRC determination.

An authority may on a case-by-case basis accept pure time exposure arguments for ground risk reduction but should consider how this affects the cumulative risk. M1(B) mitigations are combinations of limitations on time and location of the operation to reduce the number of people at risk at a set time and location.

<table>
<tr><td colspan="2" rowspan="2"></td><td colspan="2">LEVEL of INTEGRITY</td></tr>
<tr><td>Medium</td><td>High</td></tr>
<tr><td rowspan="4">M1(B) – Operational restrictions</td><td>Criterion #1 (Evaluation of people at risk)</td><td colspan="2">The applicant provides spacetime-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 in Step #2.
This can be done by means of:
a) An analysis or appraisal of characteristics[1] of the location and time[2] 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 can incorporate real time or historical data.</td></tr>
<tr><td>Comments</td><td colspan="2">[1] Characteristics of the location should be understood as land use that relate to the presence of people, e.g., industrial area, urban park or shopping centres.
[2] 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.</td></tr>
<tr><td>Criterion #2 (Impact on at risk population)</td><td>The at-risk population is lowered by at least 1 iGRC population band[3] (~90%) using one or more methods described in the Level of Integrity for Criterion #1 above.</td><td>The at-risk population is lowered by at least 2 iGRC population bands[3] (~99%) using one or more methods described in the Level of Integrity for Criterion #1 above.</td></tr>
<tr><td>Comments</td><td colspan="2">[3] iGRC population band is described in “3.6.4 – Step #3” of SORA Main body.</td></tr>
</table>

Table B. 4 - Level of integrity assessment criteria for M1(B) mitigation

<table>
<tr><td colspan="2" rowspan="2"></td><td colspan="2">LEVEL of ASSURANCE</td></tr>
<tr><td>Medium</td><td>High</td></tr>
<tr><td rowspan="4">M1(B) – Operational restrictions</td><td>Criterion #1 (Evaluation of people at risk)</td><td colspan="2">All mapping products, data sources and processes used to claim lowering the density of population at risk are accepted by the competent authority.</td></tr>
<tr><td>Comments</td><td colspan="2">N/A</td></tr>
<tr><td>Criterion #2 (Impact on at risk population)</td><td>The applicant has supporting evidence that the required level of integrity is achieved. This is typically done by means of analysis, simulation, surveys or through operational experience.</td><td>The claimed level of integrity is validated by the competent authority of the MS or by an entity that is designated by the competent authority against a standard considered adequate by the competent authority and/or in accordance with means of compliance acceptable to that authority.</td></tr>
<tr><td>Comments</td><td colspan="2">Quantitative and qualitative mitigations can in combination meet the target reductions of at-risk populations set in medium and high integrity levels.</td></tr>
</table>

Table B. 5 - Level of assurance criteria for M1(b) mitigation

B.4 M1(C) – Tactical Mitigations – Ground observation

M1(C) mitigation is a tactical mitigation where the remote crew or the system can 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.

		LEVEL of INTEGRITY Low
M1(C) – Ground observation	Criterion #1 (Procedures)	To achieve a reduction of people at risk: a) The remote crew members observe the vast majority of the overflown areas during the operation, and identify area(s) of less risk on the ground; b) The remote pilot will 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).
	Comments	*[1] iGRC population band is described in "4.2.3– Step #3" of SORA Main body.*
	Criterion #2 (Technical means)	If the mitigation is achieved through the use of technical means[1] (e.g., camera(s) mounted on the UA or visual ground observers with radios/phones), these should provide data of sufficient quality allowing reliable detection of uninvolved people on the ground.
	Comments	*[1]Criterion 2 may require support from the UAS or Component designer to gather the required evidences.*

Table B. 6 - Level of integrity assessment criteria for M1(C) mitigation

		LEVEL of ASSURANCE Low
M1(C) – Ground observation	Criterion #1 (Procedures)	The operational procedures for the mitigation are documented. The applicant declares that the required level of integrity has been achieved.
	Comments	*N/A*
	Criterion #2 (Technical means)	Authorities may allow the use of technical means[1] for ground observation with assurance criteria acceptable to them.
	Comments	*[1]Criterion 2 may require support from the UAS or Component designer to gather the required evidences.*

Table B. 7 - Level of assurance assessment criteria for M1(C) mitigation

B.5 M2 – Effects of the UA impact dynamics are reduced

M2 mitigations are intended to reduce the effect of ground impact once the control of the operation is lost. This is done either by reducing the probability of lethality of a UA impact (i.e., energy, impulse, transfer energy dynamics, etc.) and/or by reducing the size of the expected critical area (see table 8 below). Examples include, but are not limited to parachutes, autorotation, frangibility, stalling the aircraft to slow the descent and increase the impact angle. An applicant should demonstrate the required total amount of reduction (see integrity criteria) in either or both factors.

The base assumption in SORA for UAS impact lethality before M2 mitigation is applied is that most[311] impacts are lethal. Based on the characteristic dimensions of an UA, the related critical areas are below displayed in Table 8. 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 should be conducted already in Step #2 of SORA and is not part of M2 mitigation.

Critical area calculations are defined in Annex F[32] chapter 1.8[33]. The SORA Main Body assumes the following critical areas for each characteristic dimension:

Maximum characteristic dimension (m)	1	3	8	20	40
Critical area (m^2)	6.5	65	650	6500	65,000

Table B. 8 - Critical areas associated with the maximum characteristic dimension (unmitigated)

Applicants claiming for a mitigation by reduction of critical area shall use the values above as the baseline of comparison to show the appropriate mitigation.

If an applicant has used the modifications according to Annex F[32] in Step #2, or using the automatic tool available on the EASA website[34], to show a corrected critical area for their UAS and matched the corrected critical area to a column in Table 8, then this table value is used as the baseline against which the mitigation is assessed.

If an applicant has used the modifications according to Annex F[32] in Step #2 to show both a corrected critical area and matching population density, then this custom critical area value is used as the baseline against which the mitigation is assessed, and the custom population density value must be used as a limitation in the operation.

---

[31] *Most UA impacts are assumed to be lethal in the SORA ground risk model except:*
- *Impacts during slide of UA with characteristic dimension less or equal to 1 m*
- *Any impacts during slide of UA with total kinetic energy below 290 Joules*

See Annex F (http://jarus-rpas.org/wp-content/uploads/2024/06/SORA-v2.5-Annex-F-Release.JAR_doc_29pdf.pdf) for more details on calculation.

[32] http://jarus-rpas.org/wp-content/uploads/2024/06/SORA-v2.5-Annex-F-Release.JAR_doc_29pdf.pdf

[33] Additional guidelines on the assessment of the critical area may be found at https://www.easa.europa.eu/en/downloads/139781/en.

[34] https://www.easa.europa.eu/en/domains/drones-air-mobility/operating-drone/critical-area-assessment-tool-caat

<table>
<tr><th colspan="2" rowspan="2"></th><th colspan="2">LEVEL of INTEGRITY</th></tr>
<tr><th>Medium[g]</th><th>High</th></tr>
<tr><td rowspan="4">M2 – Effects of UA impact dynamics are reduced</td><td>Criterion #1 (Technical design)</td><td>(a) Effects of impact dynamics and immediate post impact hazards[a], 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%)[b,c].
(b) When applicable, in case of malfunctions, failures or any combinations thereof that may lead to a crash, the UAS contains all elements required for the activation of the mitigation[d].
(c) When applicable, any failure or malfunction of the proposed mitigation itself (e.g., inadvertent activation) does not adversely affect the safety of the operation.</td><td>Same as Medium.
In addition:
(a) When applicable, the activation of the mitigation is automated[d,e,f].
(b) The effects of impact dynamics and immediate post impact hazards[a], critical area or the combination of them are reduced such that the risk to the population is reduced by an approximate 2 orders of magnitude (99%)[b,c].</td></tr>
<tr><td>Comments</td><td colspan="2">[a] Examples of immediate post impact hazards include fires and release of high energy parts.
[b] Latest research on UAS impacts estimate injuries using the Abbreviated Injury Scale (AIS) developed for automotive impact tests and test dummies. An impact that has a 30% chance of causing injury of AIS level 3 injury or greater is estimated to have a 10% probability of death. Note that the SORA methodology only considers fatalities. It does not provide guidance on the injury levels / thresholds beyond which an injury should be considered as a fatality. Further Guidance on how to evaluate impact severity measurement may be found for example in Ranges of Injury Risk Associated with Impact from Unmanned Aircraft Systems DOI: 10.1007/s10439-017-1921-6, ASSURE UAS reports A14 and A4 on UAS Ground Collision Severity Evaluation.
[c] 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 chance that the mitigation does not function as intended) combined meet the requirement.
[d] For medium robustness the applicant is expected to address only probable malfunctions, failures and their combinations.
[e] An automated activation may be required when reaction time is critical or the operator cannot determine the need for activation.
[f] The applicant may nevertheless implement an additional manual activation function.
[g] MoC to Light-UAS.2512[35] is an acceptable means to comply with the medium level of robustness for M2. Moreover, it provides additional explanation of the M2 criteria.</td></tr>
<tr><td>Criterion #2 (Procedures)</td><td colspan="2">Any equipment used to reduce the effect of the UA impact dynamics are installed and maintained in accordance with UAS/Mitigation designer instructions.</td></tr>
<tr><td>Comments</td><td colspan="2">N/A</td></tr>
</table>

[35] https://www.easa.europa.eu/en/document-library/product-certification-consultations/means-compliance-mitigation-means-m2-ref-amc

	Criterion #3 (Training)	When use of the mitigation requires action from the remote crew, then appropriate training must be provided for the remote crew by the operator. 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.
	Comments	*N/A*

Table B.15 - Level of Integrity Assessment Criteria for M2 mitigation

		LEVEL of ASSURANCE	
		Medium	**High**
M2 – Effects of UA impact dynamics are reduced	Criterion #1 (Technical design)	The applicant has supporting evidence to claim the required level of integrity and reliability is achieved. This is typically done by means of testing, analysis, simulation[a], inspection, design review or through operational experience. A UAS with a C0 or C1 class mark or with MTOM lower or equal to 900g and a maximum speed of 19 m/s fulfils this assurance Criteria 1. The applicant may declare compliance with MoC to Light-UAS.2512[b] providing the supporting evidence defined in it.	The competent authority should request the applicant to use a UAS for which EASA has verified the claimed integrity through a DVR.
	Comments	*[a] When a simulation is used, the validity of the targeted environment used in the simulation needs to be justified.* *[b] https://www.easa.europa.eu/en/document-library/product-certification-consultations/means-compliance-mitigation-means-m2-ref-amc*	
	Criterion #2 (Procedures)	(a) Procedures are validated against standards considered adequate by the competent authority of the MS and/or in accordance with the means of compliance acceptable to that authority. (b) The adequacy of the procedures is proved through: i) Dedicated flight tests, or ii) Simulation, provided that the representativeness of the simulation means is proven for the intended purpose with positive results.	Same as Medium. In addition: (a) The DVR covers the procedures, flight tests and simulations (b) The competent authority of the MS or by an entity that is designated by the competent authority verifies that the procedures developed by the UAS operator are acceptable.

	Comments	*AMC2 UAS.SPEC.030(3)(e) (Operational procedures for medium and high levels of robustness) is considered an acceptable means of compliance.*	
	Criterion #3 (Training)	a) Training syllabus is available. b) The operator provides theoretical and practical training for the remote crew. c) Personnel responsible for installation and maintenance of the mitigation measures have completed relevant training.	Same as medium. In addition, the competent authority of the MS or an entity that is designated by the competent authority: a) validates the training syllabus. b) Verifies the remote crew competencies
	Comments	*N/A*	

Table B. 10 - Level of Assurance Assessment Criteria for M2 mitigation

B.6 Mitigations effects table for determining the final GRC

Ground risk mitigation	Level of Robustness		
	Low	Medium	High
M1(A) – Strategic mitigations - Sheltering	-1	-2	N/A
M1(B) – Strategic mitigation – Operational restrictions	N/A	-1	-2
M1(C) – Tactical mitigations – Ground observation	-1	N/A	N/A
M2 – Effects of UA impact dynamics are reduced	N/A	-1	-2

Table B. 91 - Mitigations effect for final GRC determination

Annex E to AMC1 to Article 11 is amended as follows:

Annex E to AMC1 to Article 11

INTEGRITY AND ASSURANCE LEVELS FOR THE OPERATIONAL SAFETY OBJECTIVES (OSOs)

E.1. How to use SORA Annex E

The following Table E.1 provides the basic principles to consider when using SORA Annex E.

	Principle description	Additional information
#1	Annex E provides assessment criteria for the integrity (i.e. safety gain) and assurance (i.e. method of proof) of OSOs proposed by an applicant.	The identification of OSOs for a given operation is the responsibility of the applicant. The relationships between the SAIL and the Low/Medium/High level of robustness of an OSO can be found in Step #9 of the SORA Main Body.
#2	Annex E does not cover the LoI of the competent authority. LoI is based on the competent authority's assessment of the applicant's ability to perform the given operation.	
#3	~~To achieve a given level of integrity/assurance, w~~When more than one criterion exists for a given ~~that~~ level of integrity/assurance in an OSO, all the ~~applicable~~ criteria need to be met at the required integrity/assurance level to satisfy the given OSO.	
#4	~~'Optional'~~ 'Not required (NR)' cases defined in SORA main body Table 14 ~~6~~ do not need to be defined in terms of integrity and assurance levels in Annex E.	~~All robustness levels are acceptable for OSOs for which an 'optional' level of robustness is defined in Table 6 'Recommended OSOs' of the SORA main body.~~ Applicants are encouraged anyway to consider also the OSO classified an NR
#5	When the criteria to assess the level of integrity or assurance of an OSO rely on 'standards' that are not yet available, the OSO needs to be developed in a manner acceptable to the competent authority.	
#6	Annex E intentionally uses non-prescriptive terms (e.g. suitable, reasonably practicable) to provide flexibility to both the applicant and the competent authorities. This does not constrain the applicant in proposing mitigations, nor the competent authority in evaluating what is needed on a case-by-case basis.	

#7	This annex in its entirety also applies to single-person organisations.	
#8	Some of the OSOs refer to the Functional Test Based (FTB) approach which is described in detail in section E.3.	

Table E.1 – Basic principles to consider when using SORA Annex E

E.2 OSOs related to technical issues with the UAS

OSO #01 — Ensure that the UAS operator is competent and/or proven

TECHNICAL ISSUE WITH THE UAS		**Level of integrity**		
		Low **(SAIL II)**	**Medium** **(SAIL III)**	**High** **(SAIL IV to VI)**
OSO #01 Ensure that the UAS operator is competent and/or proven	~~Criteria~~ Criterion	The applicant is knowledgeable of the UAS [1] being used and as a minimum has the following relevant operational procedures[2]: (a) checklists, (b) maintenance, (c) training, (d) responsibilities, and associated duties.	Same as Low. In addition, the applicant has an organization appropriate~~[1]~~[3] for the intended operation, with at least the following in place: ~~Also, the applicant has a method to identify, assess, and mitigate the risks associated with flight operations. These should be consistent with the nature and extent of the operations specified.~~ a) a method to continuously evaluate whether the operator is operating according to the terms of the operational authorization and check whether the mitigations proposed as part of the operational authorization are still appropriate; b) occurrence analysis procedures and reporting to the designer in case of design-related in-service events.	~~Same as medium~~ The applicant has a safety management system in place in line with ICAO Annex 19 principles.
	Comments	~~*N/A*~~ *[1] Including monitoring of any related airworthiness directives or recommendations issued by National Aviation Authorities and designer recommendations (Service Bulletin, Service Information Letter, etc.)*	~~[1]~~[3] *For the purpose of this assessment, 'appropriate' should be interpreted as commensurate with/proportionate to the size of the organisation and the complexity of the operation.*	*N/A*

		[2] Operational procedures (checklists, maintenance, training, etc.) can be justified in the context of other applicable OSO.		

TECHNICAL ISSUE WITH THE UAS		**Level of assurance**		
		Low (SAIL II)	**Medium (SAIL III)**	**High (SAIL IV to VI)**
OSO #01 Ensure that the UAS operator is competent and/or proven	~~Criteria~~ Criterion	The elements delineated in the level of integrity are available and addressed in the operations manual ~~ConOps~~.	Prior to the first operation, the competent authority of the MS or an entity that is designated by the competent authority performs an audit of the organisation.	The applicant holds an organisational operating certificate(e.g. LUC) or has a recognised flight test organisation. In addition, the competent authority of the MS or an entity that is designated by the competent authority verifies the UAS operator's competencies.
	Comments	*N/A*	*~~N/A~~* *Audits should be adapted to the size and scope of the organization and focus on items that can be connected to the applicable OSOs and their robustness depending on the SAIL of the operation. Audits can take the form of desk reviews, if deemed appropriate.*	

OSO #02 — UAS designed and produced by a competent and/or proven entity

TECHNICAL ISSUE WITH THE UAS		**Level of integrity**		
		Low (SAIL III)	**Medium (SAIL IV)**	**High (SAIL V & VI)**
OSO #02 UAS designed and produced by a competent and/or proven entity	~~Criteria~~ Criterion for design	As a minimum, design documentation covers: (a) the specification of the materials; and (b) the suitability and durability of the materials used ~~a) processes necessary to allow for repeatability in manufacturing and~~	Same as low. In addition, design documentation also covers~~:~~ ~~(a) the configuration control; and~~ ~~(b)~~ identification and traceability.	The design organisation complies with Subpart J of Annex I (Part 21) to Regulation (EU) No 748/2012.

		~~conformity within acceptable tolerances,~~ (c)configuration control.		
	~~Criteria~~ Criterion for production	As a minimum, production procedures cover (a) the, configuration control; (b) the processes necessary to allow for repeatability in manufacturing, and (c) conformity within acceptable tolerances.	Same as low. In addition, production procedures also cover: ~~(a) the configuration control;~~ ~~(b)~~(a) the verification of incoming products, parts, materials, and equipment; ~~(c)~~(b) identification and traceability; ~~(d)~~(c) in-process and final inspections & testing; ~~(e)~~(d) the control and calibration of tools; ~~(f)~~(e) handling and storage; and ~~(g)~~(f) the control of non-conforming items.	The production organisation complies with the organisational requirements that are defined in Subpart F or G of Annex I (Part 21) to Regulation (EU) No 748/2012.
	Comments	*N/A*	*N/A*	*N/A*

TECHNICAL ISSUE WITH THE UAS		**Level of assurance**		
		Low **(SAIL III)**	**Medium** **(SAIL IV)**	**High** **(SAIL V & VI)**
OSO #02 UAS designed and produced by a competent and/or proven entity	~~Criteria~~ Criterion for design	The specifications, suitability and durability of the materials are declared against a standard recognised by the competent authority and/or in accordance with means of compliance acceptable to the competent authority.	Same as low. In addition, evidence is available that the UAS has been designed in accordance with design procedures. The competent authority should request the applicant to use a UAS for which EASA has verified the claimed integrity through a DVR.	Same as medium. In addition: In addition, the competent authority should request the applicant to operate a UAS designed by an organisation approved by EASA according to Subpart J of Annex I (Part 21) to Regulation (EU) No 748/2012
	Criterion for production	The declared production procedures are developed to a standard that is considered adequate by the competent authority that issues the operational	Same as low. In addition, evidence is available that the UAS has been produced in conformance with its design.	Same as medium. In addition~~;~~, the competent authority of the MS or an entity that is designated by the competent authority validates

		authorisation and/or in accordance with a means of compliance acceptable to that authority.		compliance with the production organisational requirements that are defined in Subpart F or G of Annex I (Part 21) to Regulation (EU) No 748/2012.
	Comments	*N/A*	*N/A*	*N/A*

OSO #03 — ~~UAS maintained by competent and/or proven entity~~Maintenance of UAS

TECHNICAL ISSUE WITH THE UAS		Level of integrity		
		Low (SAIL I & II)	**Medium (SAIL III & IV)**	**High (SAIL V & VI)**
OSO #03 Maintenance of UAS ~~maintained by a competent and/or proven entity (e.g. industry standards)~~	Criterion #1 (Design)	The UAS designer maintenance instructions and requirements (including scheduled maintenance) to ensure a safe operation are defined.		
	~~Criteria~~ Criterion #2 procedure	(a) The UAS Operator[1] maintenance instructions[2] and requirements[3] are defined, and, when applicable, cover the UAS designer's instructions and requirements[4/5], and are adhered to. (b) The maintenance staff is competent and has received an authorisation to carry out UAS maintenance. ~~(c) The maintenance staff use the UAS maintenance instructions while performing maintenance~~.	Same as low. In addition: (a) Preventive/s~~S~~cheduled maintenance/ inspection of each UAS is organised and in accordance with ~~a~~ the UAS Operator maintenance programme on the basis of the UAS designer scheduled maintenance requirements[4] and adapted to the specificities of UAS operations. (b) Upon completion, the maintenance log system is used to record all the maintenance conducted on the UAS, including releases. A maintenance release can only be accomplished by a staff member who has received a maintenance release authorisation for that particular UAS model/family.	Same as medium. In addition, the maintenance staff work in accordance with a maintenance procedure manual that provides information and procedures relevant to the maintenance facility, records, maintenance instructions, release, tools, material, components, defect deferral, etc. The UAS operator complies with Regulation (EU) 2024/1107.
	Comments	~~*N/A*~~ *[1]The maintenance may be performed by an organization other than the Operator (e.g. use of a third party).*		

		[2] *The UAS Operator <u>maintenance instructions</u> are the information establishing how to carry out the needed maintenance/repairs. These instructions are used by the maintenance staff while performing maintenance.* [3] *The UAS Operator <u>maintenance requirements</u> are the needs for maintenance on the UAS, e.g. inspection after hard landing, regular check of lighting system. The UAS Operator ensures these requirements are covered in the UAS maintenance instructions.* [4] *The UAS Operator may just reuse the UAS designer instructions and requirements for maintenance.* [5] *The UAS designer instructions and requirements for maintenance are sometimes referred to as ICA (Instructions for Continuing Airworthiness).*

TECHNICAL ISSUE WITH THE UAS		Level of assurance		
		Low **(SAIL I & II)**	**Medium** **(SAIL III & IV)**	**High** **(SAIL V & VI)**
OSO #03 Maintenance of UAS ~~maintained by a competent and/or proven entity (e.g. industry standards)~~	Criterion #1 (design)	The UAS designer maintenance instructions and requirements (including scheduled maintenance) to ensure a safe operation are defined.	The UAS scheduled maintenance requirements are developed in accordance with standards considered adequate by the competent authority of the MS and/or in accordance with a means of compliance acceptable to that authority. In addition, if the UAS has a DVR or a type certificate according to Regulation (EU) 748/2012,, the maintenance programme includes the scheduled maintenance requirements developed as part of the design.	
	Criterion #~~1~~2 (Procedure)	(a) The UAS operator maintenance instructions are documented[1]. (b) The maintenance conducted on the UAS is recorded in a maintenance log system[2/3]~~[1/2]~~. (c) A list of the maintenance staff authorised to carry out maintenance is established and kept up to date.	Same as low. In addition: (a) The UAS operator maintenance programme covers the UAS designer's scheduled maintenance requirements and it is developed in accordance with standards considered adequate by the competent authority of the MS and/or in accordance with a means of compliance acceptable to that authority. ~~In addition, if the UAS has a DVR or©(R)TC, the maintenance programme includes the scheduled maintenance requirements developed as part of the design~~. (b) A list of the maintenance staff with maintenance release authorisation is established and kept up to date.	Same as medium. In addition, the maintenance programme and the maintenance procedures manual are validated by the competent authority of the MS or by an entity that is designated by the competent authority. The UAS operator complies with Regulation (EU) 2024/1107.
	Comment	*[1] The UAS Operator may just reuse the UAS designer instructions and requirements for maintenance.* *[2]~~[1]~~ The objective is to record all the maintenance performed on the aircraft, and why it is performed (rectification of defects or malfunctions, modifications, scheduled maintenance, etc.).* *[3]~~[2]~~ The maintenance log may be requested for inspection/audit by the approving authority or an authorised representative.*	*N/A*	*N/A*

	Criterion #~~2~~3 (Training)	A record of all the relevant qualifications, experience and/or training completed by the maintenance staff is established and kept up to date.	Same as low. In addition: (a) The <u>initial</u> training syllabus and training standard, including theoretical/practical elements, duration, etc., is defined and is commensurate with the authorisation held by the maintenance staff. (b) For staff that hold a maintenance release authorization, the <u>initial</u> training is specific to that particular UAS model/family. (c) All maintenance staff have undergone <u>initial</u> training.	Same as medium. In addition: (a) A programme for the <u>recurrent</u> training of staff holding a maintenance release authorisation is established; and (b) This programme is validated by the MS or by an entity that is designated by the competent authority. The UAS operator complies with Regulation (EU) 2024/1107.
	Comments	*N/A*	*N/A*	*N/A*

OSO #04 — UAS components essential to safe operations are designed to an airworthiness design standard ~~developed to authority recognized design standards~~

(a) For SAIL up to III, applicants are still encouraged to appropriately design their UAS (i.e. apply OSO #4). In this case the UAS components essential to safe operations are those whose failure would significantly impair the capability of the operator to meet the requested target level of safety in terms of loss of control of the operation. The term component is meant as including any element of the UAS .

(b) Starting at SAIL IV, it is considered that the safety objective associated to the SAIL of one operation (e.g. probability of loss of control of the operation below 10-4/FH for a SAIL IV operation) should be achieved with a UAS designed to be compliant with SC light UAS verified by EASA.

The list of airworthiness design standard (ADS) to be complied with through OSO#04 is not intended to duplicate requirements already covered by other design-related OSOs. While OSO #04 aims at ensuring that the UAS as a whole is designed according to an ADS f(for example, the design and construction, structure, and flight performance is part of the ADS, but not other OSOs), other design-related OSOs focus on particular systems/functionalities of the UAS and or technical disciplines (e.g., safety):

— OSOs #05 (System Safety Related)

— OSO #06 (C3)

— OSO #07 (conformity check)

— OSO #13 (external systems)

— OSO #18 (automatic protection of envelope)

— OSO #20 (HMI)

— OSO #23/#24 (adverse environment).

TECHNICAL ISSUE WITH THE UAS		**Level of integrity**		
		~~Low~~ **Medium (SAIL IV)**	**High (SAIL V)**	**High (SAIL VI)**
OSO #04 UAS components essential to safe operations are designed to an airworthiness design ~~developed to authority recognised design~~ standard~~s~~	~~Criteria~~ Criterion	The UAS components essential to safe operations are ~~is~~ designed to an airworthiness design standard~~s~~[1] considered adequate by the competent authority and/or in accordance with a means of compliance acceptable to that authority to contribute to the overall safety objective of 10-4/FH for the loss of control of the operation. ~~The standards and/or the means of compliance should be applicable to a low level of integrity and the intended operation.~~	The UAS components essential to safe operations are ~~is~~ designed to an airworthiness design standard~~s~~[1] considered adequate by the competent authority and/or in accordance with a means of compliance acceptable to that authority to contribute to the overall safety objective of 10-5/FH for the loss of control of the operation. ~~The standards and/or the means of compliance should be applicable to a medium level of integrity and the intended operation.~~	The UAS components essential to safe operations are ~~is~~ designed to an airworthiness design standard~~s~~[1] considered adequate by the competent authority and/or in accordance with a means of compliance acceptable to that authority to contribute to the overall safety objective of 10-6/FH for the loss of control of the operation. ~~The standards and/or the means of compliance should be applicable to a high level of integrity and the intended operation.~~
	Comments	*In case of experimental flights that investigate new technical solutions, the competent authority may accept that recognised standards are not met.* *[1] EASA Special Condition Light-UAS is the recommended airworthiness design standard* *The applicant can propose their own airworthiness design standard(s) to the competent authority.* *When aspects of an airworthiness design standards is covered by an OSO (for instance OSO#05), the OSO requirement takes precedence.*		

TECHNICAL ISSUE WITH THE UAS		Level of assurance		
		~~Low~~ Medium (SAIL IV)	~~Medium~~ High (SAIL V & VI)	
OSO #04 UAS components essential to safe operations are designed to an airworthiness design ~~developed to authority recognised design~~ standard~~s~~	~~Criteria~~ Criterion	The competent authority should request the applicant to use a UAS for which EASA has verified the claimed integrity through a DVR.	~~The competent authority should request the applicant to use a UAS for which EASA has issued a type certificate or restricted type certificate in accordance with Annex I (Part 21) to Regulation (EU) No 748/2012.~~ The competent authority should request the applicant to use a UAS for which EASA has issued a type certificate or restricted type certificate in accordance with Annex I (Part 21) to Regulation (EU) No 748/2012.	
	Comments	*N/A*	*N/A*	*N/A*
	Comment	In case the applicant decides to apply OSO #4 for UAS operated in SAIL I to III, then may use MoC light UAS.FTB (https://www.easa.europa.eu/en/document-library/product-certification-consultations/final-means-compliance-special-condition-light).	N/A	

OSO #05 — UAS is designed considering system safety and reliability

~~This OSO complements:~~

~~(a) the safety requirements for containment defined in the main body; and~~

~~(b) OSO #10 and OSO #12, which only address the risk of a fatality while operating over populated areas or assemblies of people.~~

(a) OSO #05 ensures that the contribution of the UAS or of any external system supporting the operation to the loss of control of the operation inside the operational volume is commensurate to the acceptable level of risk associated with each SAIL. OSO#05 safety objectives are to be considered in conjunction with the containment safety requirements (Step#8 and section 4 of this Annex) and, when applicable, the ground risk mitigation requirements (Annex B, 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 is met and no single failure is expected to lead to a catastrophic effect.

(b) Note on SAIL II operations: Some UAS designs may employ novel or complex features which have very limited operational experience. If such features are identified by the competent authority or applicant, the applicant should assure that the equipment, systems, and installations are designed to minimize hazards in the event of a probable failure of the UAS or of any external system supporting the operation. This should be done through a declaration with a simple written justification from the applicant including functional diagrams and a description of how the system functions.

TECHNICAL ISSUE WITH THE UAS		Level of integrity		
		~~Low~~ Medium		High
		(SAIL III)	(SAIL IV)	(SAIL V & VI)
OSO #05 UAS is designed considering system safety and reliability	~~Criteria~~ Criterion	The equipment, systems, and installations are designed to minimise[1] hazards[2]~~[1]~~ in the event of a probable[3]~~[2]~~ ~~malfunction or~~ failure of the UAS or of any external system supporting the operation.	Same as low. In addition, the strategy for detection, alerting and management of any ~~malfunction~~, failure or combination thereof, which would lead to a hazard, is available.	~~Same as medium. In addition:~~ (a) Major failure conditions are not more frequent than remote~~[3]~~[4]; (b) Hazardous failure conditions are not more frequent than extremely remote~~[3]~~[4]; (c) Catastrophic failure conditions are not more frequent than extremely improbable~~[3]~~[4]; (d) No single failure can lead to a Catastrophic Failure Condition; and (d) SW and AEH whose development error(s) may cause or contribute to hazardous or catastrophic failure conditions are developed to an industry standard or a methodology considered adequate by EASA and/or in accordance with means of compliance acceptable to EASA~~[4]~~[5].
	Comments	*[1] The minimization of hazard criterion correlates to the contribution of the UAS and of any external system supporting the operation to the loss of control of the operation rate, thus the SAIL of the operation. As an example, at SAIL III, the contribution of the UAS and of any external system supporting the operation to the loss of control of the operation rate could be 10-4/FH assuming a traditional 10% contribution of the technical aspects to the safety of an operation.* *NOTE TO THE READER HERE WE WILL ADD REFERENCE TO A ANY MOC WE MY*	*Applicants may show compliance by MoC Light UAS.2510*	~~[3]~~[4] *NOTE TO THE READER HERE WE WILL ADD REFERENCE TO A ANY MOC WE MY PUBLISH BEFORE PUBLICAITON OF THE DECISION* ~~[5]~~[4] *NOTE TO THE READER HERE WE WILL ADD REFERENCE TO A ANY MOC WE MY PUBLISH BEFORE PUBLICAITON OF THE DECISION*

		PUBLISH BEFORE PUBLICAITON OF THE DECISION [2]~~[1]~~ *For the purpose of this assessment, the term 'hazard' should be interpreted as a failure condition that relates to major~~,~~ and hazardous~~, or catastrophic consequences~~ (the term "Catastrophic" is intentionally not included since the TLOS is considered met for SAIL I to IV operations with the provision of Note 1 above and, if applicable M2 requirements in Annex B).* [3]~~[2]~~ *For the purpose of this assessment, the term 'probable' should be interpreted in a qualitative way as 'anticipated to occur one or more times during the entire system/operational life of a UAS'.* *Applicants may show compliance by CM-SA-003 - SORA OSO#5 UAS designed considering system safety and reliability (SAIL III)*		

TECHNICAL ISSUE WITH THE UAS		**Level of assurance**		
		~~Low~~ Medium		**High**
		(SAIL III)	**(SAIL IV)**	**(SAIL V & VI)**
OSO #05 UAS is designed considering system safety and reliability	~~Criteria~~ Criterion	A functional hazard assessment[1/2] and a design and installation appraisal[3] that show that hazards are minimised, are available.	Same as low. In addition: (a) Safety ~~analyses~~ assessment are conducted in line with standards considered adequate by the competent authority and/or in accordance with a means of compliance acceptable to that authority. (b) A strategy for the detection of single failures of concern includes pre-flight checks. The competent authority should request the applicant to use a UAS for which EASA has validated the claimed integrity through a DVR.	The competent authority should request the applicant to use a UAS for which EASA has issued a type certificate or restricted type certificate in accordance with Annex I (Part 21) to Regulation (EU) No 748/2012.

TECHNICAL ISSUE WITH THE UAS		Level of assurance		
		~~Low~~ Medium		High
		(SAIL III)	(SAIL IV)	(SAIL V & VI)
	Comments	[1]The severity of failure conditions (no safety effect, minor, major, hazardous and catastrophic) should be determined according to the definitions provided in JARUS AMC RPAS.1309 Issue 2. [2] Eurocae ED-280 "Guidelines for UAS safety analysis for the specific category (low and medium levels of robustness)" may be considered by the applicant to support compliance with this criterion (FHA). For SAIL III and IV, Eurocae ED-280 "Guidelines for UAS safety analysis for the specific category (low and medium levels of robustness)" may be considered acceptable by the competent authority to support compliance with this criterion (FHA). [3] A simple written justification from the operator including functional diagrams and a description of how the system works explaining why the integrity claim is met is an acceptable means of compliance. Applicants may show compliance by CM-SA-003 - SORA OSO#5 UAS designed considering system safety and reliability (SAIL III)	~~N/A~~ For SAIL IV, Eurocae ED-280 "Guidelines for UAS safety analysis for the specific category (low and medium levels of robustness)" may be considered acceptable by the competent authority to support compliance with this criterion.	N/A

OSO #06 — C3 link characteristics (e.g. performance, spectrum use) are appropriate for the operation

(a) For the purpose of the SORA and this specific OSO, the term ‘C3 link’ encompasses:

(1) the 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 the following:

(1) The performance requirements for the C3 links necessary for the intended operation.

(2) All the C3 links, together with their actual performance and RF spectrum usage.

Note: The specification of the performance and RF spectrum for a C2 Link is typically documented by the UAS designer in the UAS flight manual.

Note: The main parameters associated with the performance of a C2 link (RLP) and the performance parameters for other communication links (e.g. RCP for communication with ATC) include, but are not limited to, the following:

(i) the transaction expiration time;

(ii) the availability;

(iii) the continuity; and

(iv) the integrity.

Refer to the ICAO references for definitions.

(3) The RF spectrum usage requirements for the intended operation (including the need for authorisation if required).

Note: Usually, countries publish the allocation of RF spectrum bands applicable in their territories. This allocation stems mostly from the International Communication Union (ITU) Radio Regulations. However, the applicant should check the local requirements and request authorisation when needed since there may be national differences and specific allocations (e.g. national sub-divisions of ITU allocations). Some aeronautical bands (e.g. AM(R)S, AMS(R)S 5030-5091MHz) were allocated for potential use in UAS operations under the ICAO scope for UAS operations classified as cat. C (‘certified’), but their use may be authorised for operations under the ‘specific’ category. It is expected that the use of other licensed bands (e.g. those allocated to mobile networks) may also be authorised under the ‘specific’ category. Some un-licensed bands (e.g. industrial, scientific and medical (ISM) or short-range devices (SRDs)) may also be acceptable under the 'specific' category; for instance, for operations with lower integrity requirements.

(4) Environmental conditions that might affect the performance of C3 links.

TECHNICAL ISSUE WITH THE UAS		**Level of integrity**		
		Low (SAIL II & III)	**Medium (SAIL IV)**	**High (SAIL V & VI)**
OSO #06 C3 link characteristics (e.g. performance, spectrum use) are appropriate for the operation	~~Criteria~~ Criterion	(a) The applicant determines that the performance, RF spectrum usage[1] and environmental conditions for C3 links are adequate to safely conduct the intended operation. (b) The remote pilot has the means to continuously monitor the C3 performance and ensures that the performance continues to meet the operational requirements[2].	Same as low[3].	Same as low. In addition, the use of licensed[4] frequency bands for C2 Links is required.
	Comments	*[1] For a low level of integrity, unlicensed frequency bands might be acceptable under certain conditions, e.g.:* *(a) the applicant demonstrates compliance with other RF spectrum usage requirements (e.g. Directive 2014/53/EU), by showing that the UAS equipment is compliant with these requirements; and* *(b) the use of mechanisms to protect against interference (e.g. FHSS, frequency de-confliction by procedure).* *[2] The remote pilot has continual and timely access to the relevant C3 information that could affect the safety of flight. For operations requesting only a low level of integrity for this OSO, this could be achieved by monitoring the C2 link signal strength and receiving an alert from the UAS HMI if the signal strength becomes too low.*	*[3] Depending on the operation, the use of licensed frequency bands might be necessary. In some cases, the use of non-aeronautical bands (e.g. licensed bands for cellular network) may be acceptable.*	*[4] This 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).* *In any case, the use of licensed frequency bands needs authorisation.*

TECHNICAL ISSUE WITH THE UAS		Level of assurance		
		Low (SAIL II & III)	**Medium (SAIL IV)**	**High (SAIL V & VI)**
OSO #06 C3 link characteristics (e.g. performance, spectrum use) are appropriate for the operation	~~Criteria~~ Criterion	The applicant declares that the required level of integrity has been achieved.	The competent authority should request the applicant to use a UAS for which EASA has verified the claimed integrity through a DVR.	The competent authority should request the applicant to use a UAS for which EASA has issued a type certificate or restricted type certificate in accordance with Annex I (Part 21) to Regulation (EU) No 748/2012.
	Comments	N/A.	*N/A*	*N/A*

OSO #07 — ~~Inspection of the UAS (product inspection) to ensure consistency with the ConOps~~ Conformity check of the UAS configuration

(a) The intent of this OSO is to ensure that the UAS used for the operation conforms to the UAS data used to support the approval/authorisation of the operation.

(b) This OSO does not describe a pre or post flight inspection as part of normal operations, these are covered under OSO #8.

TECHNICAL ISSUE WITH THE UAS		Level of integrity		
		Low (SAIL I & II)	**Medium (SAIL III & IV)**	**High (SAIL V & VI)**
OSO #07 ~~Inspection of the UAS (product inspection) to ensure consistency with the ConOps~~ Conformity check of the UAS configuration	~~Criteria~~ Criterion	~~The remote crew ensures that the UAS is in a condition for safe operation and conforms to the approved ConOps.~~ ~~[1]~~ The operator has UAS conformity check procedures ensuring periodically that: 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, e.g., maximum payload weight) considered under the approved concept of operation.		
	Comments	~~[1]~~ *The distinction between a low, a medium and a high level of robustness for this criterion is achieved through the level of assurance (see the table below).*		

TECHNICAL ISSUE WITH THE UAS		**Level of assurance**		
		Low	**Medium**	**High**
OSO #07 ~~nspection of the UAS (product inspection) to ensure consistency with the ConOps~~ Conformity check of the UAS configuration	Criterion #1 (Procedures)	~~Product inspection is~~ The UAS conformity check procedures are documented and accounts for the manufacturer's recommendations, if available.	Same as low. In addition, the UAS conformity checks are ~~the product inspection is~~ documented using checklists.	Same as medium. In addition, ,the product inspection procedures are validated by the competent authority of the MS or by an entity that is designated by the competent authority.
	Comments	*N/A*	*N/A*	*N/A*
	Criterion #2 (Training)	The remote crew is trained to perform the UAS conformity check ~~the product inspection~~, and that training is self-declared (with evidence available).	(a) A training syllabus including a UAS conformity check ~~product inspection~~ procedure is available. (b) The UAS operator provides evidences of the ~~competency-based,~~ theoretical and practical training.	The competent authority of the MS or an entity that is designated by the competent authority: (a) validates the training syllabus; and (b) verifies the remote crew competencies.
	Comments	*N/A*	*N/A*	*N/A*

~~E.3 OSOs related to operational procedures~~

OSO #08 – Operational procedures are defined, validated and adhered to

(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 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.

OPERATIONAL PROCEDURES		Level of integrity		
		Low (SAIL I)	Medium (SAIL II)	High (SAIL III to VI)
OSO #08, OSO #11, OSO #14 and OSO #21 Operational procedures are defined, validated and adhered to	Criterion #1 (Procedure definition)	(a) Operational procedures[1] appropriate for the proposed operation are defined and, as a minimum, cover the following elements: (1) Flight planning; (2) Pre- and post-flight inspections; (3) Procedures to evaluate the environmental conditions before and during the mission (i.e. real-time evaluation) including assessment of meteorological conditions (METAR, TAFOR, etc.) with a simple recording system,; (4) Procedures to cope with unexpected adverse operating conditions (e.g. when ice is encountered during an operation not approved for icing conditions); (5) Normal procedures; (6) Contingency procedures (to cope with abnormal situations); (7) Emergency procedures (to cope with emergency situations); (8) Pre-flight procedures including briefing of any involved persons about the potential risks and actions to take in case of misbehaviour of the UA,		

OPERATIONAL PROCEDURES		Level of integrity		
		Low (SAIL I)	Medium (SAIL II)	High (SAIL III to VI)
		(9) Occurrence-reporting procedures; and (b) The limitations of the external systems supporting the UAS operation[2] are defined in an OM. (c) The UAS flight manual / manufacturer instructions are available and the relevant information (e.g. limitations) is utilized to define the operational procedures		
	Comments	*[1] Operational procedures cover the deterioration of the UAS itself and any external system supporting the UAS operation. Please refer to part B of the OM example published by on the EASA website at https://www.easa.europa.eu/en/downloads/139674/en* *To properly address the deterioration of external systems required for the operation, it is recommended to:* *(a) identify these 'external systems';* *(b) identify the modes of deterioration of the 'external systems' (e.g. complete loss of GNSS, GDOP/PDOP, latency issues, etc.) which would lead to a loss of control of the operation;* *(c) describe the means to detect these modes of deterioration of the external systems ; and* *(d) describe the procedure(s) used when deterioration is detected (e.g. activation of the emergency recovery capability, switch to manual control, etc.).* *[2] In the scope of this assessment, external systems supporting the UAS operation are defined as systems that are not already part of the UAS but are used to:* *(a) launch/take off the UA;* *(b) make pre-flight checks; or* *(c) keep the UA within its operational volume (e.g. GNSS, satellite systems, air traffic management, U-space).* *External systems activated/used after a loss of control of the operation are excluded from this definition.*		
	~~Criterion #2 (Procedure complexity)~~	~~Operational procedures are complex and may potentially jeopardise the crew's ability to respond by increasing the remote crew's workload and/or their interaction with other entities (e.g. ATM, etc.).~~	~~Contingency/emergency procedures require manual control by the remote pilot[2] when the UAS is usually automatically controlled.~~	~~Operational procedures are simple.~~
	~~*Comments*~~	~~*N/A*~~	~~*[2] It should be considered that not all UAS have a mode where the pilot could directly control the surfaces; moreover, it may require significant skill not to make things worse.*~~	~~*N/A*~~

<table>
<tr><th colspan="2" rowspan="2">OPERATIONAL PROCEDURES</th><th colspan="3">Level of integrity</th></tr>
<tr><th>Low
(SAIL I)</th><th>Medium
(SAIL II)</th><th>High
(SAIL III to VI)</th></tr>
<tr><td rowspan="4"></td><td>Criterion #2~~3~~
(Consideration of Potential Human Error)</td><td>At a minimum, operational procedures[1] provide:
(a) a clear distribution and assignment of tasks, and
(b) an internal checklist to ensure staff are adequately performing their assigned tasks.</td><td>Operational procedures take human error into consideration.</td><td>Same as medium. In addition, the remote crew[3] receives crew resource management (CRM)[4] training.</td></tr>
<tr><td>Comments</td><td>~~N/A~~
[1]Please refer to part B of the OM example published by on the EASA website at https://www.easa.europa.eu/en/downloads/139674/en</td><td>N/A</td><td>[3] In the context of SORA, the term ‘remote crew’ refers to any person involved in the mission.
[4] CRM training focuses on the effective use of all the remote crew to ensure safe and efficient operation, reducing error, avoiding stress and increasing efficiency.</td></tr>
<tr><td>Criterion #3
(Emergency Response Plan)</td><td colspan="3">The Emergency Response Plan (ERP):
a) is suitable for the situation[6];
b) effectively mitigates all anticipated hazardous secondary effects after the initial crash;
c) clearly delineates Remote Crew member(s) duties;
d) is practical to use and trained, so that the Remote Crew can execute the procedures effectively under stress.
The ERP contains at minimum:
a) the list of anticipated emergency situations with secondary effects;
b) the procedures for each of the identified anticipated emergency situation (including criteria to identify each of these situations);
c) the list of relevant contacts to reach (e.g., Air Traffic Control, police, fire brigade, first responders).</td></tr>
<tr><td>Comments</td><td colspan="3">[6] The ERP should be proportional to the potential secondary effects of a ground impact, i.e., those effects that may occur after the initial ground impact (e.g., fire, release of poisonous gas).</td></tr>
</table>

OPERATIONAL PROCEDURES		**Level of assurance**		
		Low (SAIL I)	**Medium (SAIL II)**	**High (SAIL III to VI)**
OSO #08, OSO #11, OSO #14 and OSO #21 Operational procedures are defined, validated and adhered to	Criteria#1, #2 and #3	(a) The UAS operator developed operational procedures and ERP ~~do not require validation against either a standard or a means of compliance that is considered adequate by the competent authority of the MS.~~ (b) The UAS operator declares the adequacy of the operational procedures and ERP. ~~is declared, except fFor~~ At least the emergency procedures~~, which~~ are tested.	(a) Normal, contingency, ~~and~~ emergency procedures and ERP are ~~documented and~~ part of the operations manual (OM). (b) Operational procedures and ERP are ~~validated against~~ developed according respectively to AMC2 UAS.SPEC.030(3)(e) and AMC3 UAS.SPEC.030(3)(e)~~) standards considered adequate by the competent authority of the MS and/or in accordance with the means of compliance acceptable to that authority[1]~~. (c) The adequacy of the contingency and emergency procedures is proven through: (1) dedicated flight tests; or (2) simulation, provided that the representativeness of the simulation means is proven valid for the intended purpose with positive results; or (3) any other means acceptable to the competent authority.	Same as medium. In addition: (a) Flight tests performed to validate the operational procedures and checklists cover the complete flight envelope or are proven to be conservative. (b) The operational procedures, checklists, flight tests and simulations are validated by the competent authority of the MS or by an entity that is designated by the competent authority. (c) The representativeness of the tabletop exercise of the ERP is validated by the competent authority of the MS or by an entity that is designated by the competent authority..
	Comments	~~*N/A*~~ *Operational procedures do not require validation against either a standard or a means of compliance that is considered adequate by the competent authority*.	~~*1 AMC2 UAS.SPEC.030(3)(e) (Operational procedures for medium and high levels of robustness) is considered an acceptable means of compliance.*~~	
	Alternative Criteria #1, #2 and #3 taking credit for functional test-based methods	FUNCTIONAL TEST-BASED METHODS (for SAILs up to IV included) If the applicant has evidence of FTB flight hours proportionate to the risk/SAIL of the operation meeting one of the set of conditions described either in section E.3(c) or section E.3(d) and 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[3].
	Comments	*[3] 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., 3,000FH), the assurance level for OSO #08 is fulfilled at High Level.*

E.4 OSOs related to remote crew training

OSO #09 – Remote crew trained and current

(a) The applicant needs to propose a ~~competency-based,~~ theoretical and practical training that:

(1) is appropriate for the operation to be approved allowing the remote crew 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; and

(2) includes proficiency requirements and recurrent training.

(b) The entire remote crew (i.e. any person involved in the operation) should undergo ~~competency-based,~~ theoretical and practical training specific to their duties (e.g. pre-flight inspection, ground equipment handling, evaluation of the meteorological conditions, etc.).

<table>
<tr><th colspan="2" rowspan="2">REMOTE CREW COMPETENCIES</th><th colspan="3">Level of integrity</th></tr>
<tr><th>Low
(SAIL I & II)</th><th>Medium
(SAIL III & IV)</th><th>High
(SAIL V & VI)</th></tr>
<tr><td>OSO #09~~, OSO #15 and OSO #22~~
Remote crew trained and current</td><td>~~Criteria~~
Criterion</td><td colspan="3">The ~~competency-based,~~ theoretical and practical training ~~is adequate for the operation[1] and ensures knowledge of~~:
(a) ensures knowledge of:
(~~a~~1) the UAS Regulation;
(~~b~~2) airspace operating principles;
(~~c~~3) airmanship and aviation safety;
(~~d~~4) human performance limitations;
(~~e~~5) meteorology and assessment of meteorological conditions;
(~~f~~6) navigation/charts;
(~~g~~7) knowledge of the UAS; and
(~~h~~8) operating procedures and ERP.
(9) use of external services, including service limitations and system recovery if any[1]</td></tr>
</table>

		(b) is adequate for the operation, i.e., allows the remote crew 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.[2/3] (c) specifies or proficiency requirements and training recurrence.
	Comments	*[1] If external services are used, the UAS operator is responsible for using the services in the intended manner (e.g., as defined in a service level agreement) and ensuring that the remote crew is trained to use the service as intended.* *[2] The details of the areas to be covered for the different subjects listed above is provided by AMC1 UAS.SPEC.050(1)(d) (Theoretical knowledge subjects for the training of the remote pilot and all personnel in charge of duties essential to the uas operation in the 'specific' category), AMC2 UAS.SPEC.050(1)(d) (Practical-skill training of the remote pilot and all personnel in charge of duties essential to the uas operation in the 'specific' category) and AMC2 UAS.SPEC.050(1)(d) (UAS operation-specific endorsement modules)).* ~~[1]~~[3] *The distinction between a low, a medium and a high level of robustness for this criterion is achieved through the level of assurance (see table below).*

REMOTE CREW COMPETENCIES		**Level of assurance**		
		Low (SAIL I & II)	**Medium (SAIL III & IV)**	**High (SAIL V & VI)**
OSO #09~~, OSO #15 and OSO #22~~ Remote crew trained and current	~~Criteria~~ Criterion	Training is self-declared (with evidence available).	(a) Training syllabus is available and kept up to date. (b) ~~The UAS operator provides competency-based,~~ Evidences of theoretical and practical training are available.	The competent authority of the MS or an entity that is designated by the competent authority: (a) validates the training syllabus; and (b) verifies the remote crew competencies.
	Comments	*N/A*	*N/A*	*N/A*

~~E.5 OSOs related to safe design~~

~~(a) The objectives of OSO#10 and OSO#12 are to complement the technical containment safety requirements by addressing the risk of a fatality while operating over populated areas or assemblies of people.~~

~~(b) In the scope of this assessment, external systems supporting UAS operations are defined as systems that are not already part of the UAS but are used to:~~

~~(1) launch/take off the UA;~~

~~(2) make pre-flight checks; or~~

~~(3) keep the UA within its operational volume (e.g. GNSS, satellite systems, air traffic management, U-space).~~

~~External systems activated/used after a loss of control of the operation are excluded from this definition.~~

		LEVEL of INTEGRITY		
		Low	**Medium**	**High**
OSO #10 & OSO #12	Criteria	When operating over populated areas or assemblies of people, it can be reasonably expected that a fatality will not occur from any probable[1] failure[2] of the UAS or any external system supporting the operation.	When operating over populated areas or assemblies of people, it can be reasonably expected that a fatality will not occur from any single failure[3] of the UAS or any external system supporting the operation. SW and AEH whose development error(s) could directly lead to a failure affecting the operation in such a way that it can be reasonably expected that a fatality will occur, are developed to a standard considered adequate by the competent authority and/or in accordance with means of compliance acceptable to that authority.	Same as medium
	Comments	*[1] For the purpose of this assessment, the term 'probable' should be interpreted in a qualitative way as, 'anticipated to occur one or more times during the entire system/operational life of a UAS'.* *[2] Some structural or mechanical failures may be excluded from the criterion if it can be shown that these mechanical parts were designed according to aviation industry best practices.*	*[3] Some structural or mechanical failures may be excluded from the no-single failure criterion if it can be shown that these mechanical parts were designed to a standard considered adequate by the competent authority and/or in accordance with a means of compliance acceptable to that authority*	

		LEVEL of ASSURANCE		
		Low	**Medium**	**High**
OSO #10 & OSO #12	Criteria	A design and installation appraisal is available. In particular, this appraisal shows that: (a) the design and installation features (independence, separation and redundancy) satisfy the low integrity criterion; and	Same as low. In addition, the level of integrity claimed is substantiated by analysis and/or test data with supporting evidence. If the operation is classified as SAIL IV, the competent authority should request the	The competent authority should request the applicant to use a UAS for which EASA has issued a type certificate or restricted type certificate in accordance with Annex

		LEVEL of ASSURANCE		
		Low	Medium	High
		(b) particular risks relevant to the ConOps (e.g. hail, ice, snow, electromagnetic interference, etc.) do not violate the independence claims, if any.	applicant to use a UAS for which EASA has verified the claimed integrity through a DVR.	I (Part 21) to Regulation (EU) No 748/2012.
	Comments	N/A	N/A	N/A

~~E.6 OSOs related to the deterioration of external systems supporting UAS operations~~

OSO #13 – External services supporting UAS operations are adequate to the operation

For the purpose of SORA and this specific OSO, the term 'external services supporting UAS operations' encompasses any service providers necessary for the safety of the flight[1], such as:

- communication service providers (CSPs);
- Navigation Service Provider (e.g., Global navigation satellite system),
- ~~and~~ U-space service providers~~1~~.
- 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) or similar document.

DETERIORATION OF EXTERNAL SYSTEMS SUPPORTING UAS OPERATIONS BEYOND THE CONTROL OF THE UAS		Level of integrity		
		Low (SAIL I & II)	Medium (SAIL III)	High (SAIL IV to VI)
OSO #13 External services supporting UAS operations are	~~Criteria~~ Criterion	The applicant ensures that the level of performance for any externally provided service necessary for the safety of the flight[1] is adequate for the intended operation. If the externally provided service requires communication between the UAS operator and the service provider, the applicant ensures there is effective communication to support the service provision. Roles and responsibilities between the applicant and the external service provider are defined.		

[1] External service should be understood as any service that is provided to the UAS operator, which is necessary to ensure the safety of a UAS operation and is provided by a service provider other than the UAS operator. Examples of external services are:
- provision of geographical zones data and geographical limitations (including orography);
- collection and transfer of occurrence data;
- training and assessment of remote pilots;
- communication services that support the C2 link and any other safety-related communication;
- services that support navigation, e.g. GNSS services (compliance with requirement UAS.STS-01.030(6) could be ensured by referring to the conditions of use of such services in the corresponding Service Definition Document (SDD) or an equivalent one if available.);
- provision of services related to flight planning and management, including related safety assessments; and
- U-space services, which are defined in the corresponding regulation(s) and may include one or more of the above-mentioned services.

DETERIORATION OF EXTERNAL SYSTEMS SUPPORTING UAS OPERATIONS BEYOND THE CONTROL OF THE UAS		**Level of integrity**		
		Low (SAIL I & II)	**Medium (SAIL III)**	**High (SAIL IV to VI)**
adequate for the operation	*Comments*	*[1] A service whose loss would directly lead to a loss of control of the operation as identified per OSO#05.*		
	Comments	*N/A*	*N/A*	*Requirements for contracting services with the service provider may be derived from ICAO Standards and Recommended Practices (SARPs) that are currently under development.*

DETERIORATION OF EXTERNAL SYSTEMS SUPPORTING UAS OPERATIONS BEYOND THE CONTROL OF THE UAS		**Level of assurance**		
		Low (SAIL I & II)	**Medium (SAIL III)**	**High (SAIL IV to VI)**
OSO #13 External services supporting UAS operations are adequate for the operation	~~Criteria~~ Criterion	The applicant declares[1] that the requested level of performance for any externally provided service necessary for the safety of the flight is achieved ~~(without evidence being necessarily available).~~	The applicant has supporting evidence that the required level of performance for any externally provided service required for the safety of the flight can be achieved for the full duration of the mission. This may take the form of an SLA or any official commitment that prevails between a Service Provider and the applicant on relevant aspects of the service (including quality, availability and responsibilities). The applicant has means to monitor externally provided services that affect flight-critical systems and take appropriate actions if real-time performance could lead to the loss of control of the operation.	Same as medium. In addition: (a) the evidence of the performance of an externally provided service is achieved through demonstrations; and (b) the competent authority of the MS or an entity that is designated by the competent authority validates the claimed level of integrity.
	Comments	~~*N/A*~~ *[1] Supporting evidence for this declaration may still be requested by the competent authority.* *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*	*N/A*	*N/A*

		performance requirements in Annex D.		

~~E.7 OSOs related to human error~~

OSO #16 — Multi-crew coordination

~~This OSO applies only to those personnel directly involved in the flight operation.~~

~~HUMAN ERROR~~ MULTI CREW COORDINATION		Level of integrity		
		Low (SAIL I & II)	**Medium (SAIL III & IV)**	**High (SAIL V & VI)**
OSO #16 Multi crew coordination	Criterion #1 (Procedures)	Procedure(s) to ensure coordination between the crew members and robust and effective communication channels is (are) available and at a minimum cover: (a) assignment of tasks to the crew, and (b) establishment of step-by-step communications.[1]		
	Comments	*[1] The distinction between a low, a medium and a high level of robustness for this criterion is achieved through the level of assurance (see the table below).*		
	Criterion #2 (Training)	Remote crew training covers multi-crew coordination	Same as low. In addition, the remote crew[2] receives CRM[3] training.	Same as medium.
	Comments	*N/A*	*[2] ~~In the context of the SORA~~ In line with the definition I.110 provided in Annex I to AMC1 Article 11, the term 'remote crew' refers to any person that performs duties essential to the safety of flight (e.g. AO, UA observers) ~~involved in the mission~~.* *[3] CRM training focuses on the effective use of all the remote crew to assure a safe and efficient operation, reducing error, avoiding stress and increasing efficiency.*	*N/A*
	Criterion #3 (Communication devices)	N/A	~~Communication devices comply with standards considered adequate by the competent authority and/or in accordance with a means of compliance acceptable to that authority.~~	Same as Medium. In addition ~~C~~communication devices are redundant[4] and comply with standards considered adequate by the competent authority and/or in accordance with a means of compliance acceptable to that authority.

			The applicant determines that the performance of communication devices is adequate to safely conduct the intended operation. The remote crew has the means to check the performance of the communication devices at intervals deemed appropriate to ensure the performance continues to meet the operational requirements.	
	Comments	*N/A*	*N/A*	*[4] This implies the provision of an extra device to cope with the failure of the first device.*

HUMAN ERROR		**LEVEL of ASSURANCE**		
		Low (SAIL I & II)	**Medium (SAIL III & IV)**	**High (SAIL V & VI)**
OSO #16 Multi crew coordination	Criterion #1 (Procedures)	(a) Procedures ~~are~~ do not require validation ~~validated~~ against either a standard or a means of compliance considered adequate by the competent authority of the MS. (b) The adequacy of the procedures and checklists is declared.	(a) Procedures are validated against standards considered adequate by the competent authority of the MS and/or in accordance with the means of compliance acceptable to that authority[1]. (b) The adequacy of the procedures is proven through: (1) dedicated flight tests; or (2) simulation, provided that the representativeness of the simulation means is proven valid for the intended purpose with positive results; or (3) any other means acceptable to the competent authority.	Same as medium. In addition: (a) flight tests performed to validate the procedures cover the complete flight envelope or are proven to be conservative; and (b) the procedures, flight tests and simulations are validated by the competent authority of the MS or an entity designated by the competent.
	Comments	*N/A*	*[1] AMC2 UAS.SPEC.030(3)(e) (Operational procedures for medium and high levels of robustness) is considered an acceptable means of compliance.*	*N/A*
	Alternative Criterion #1 taking credit for	FUNCTIONAL TEST-BASED METHODS (for SAILs up to IV included):		N/A[3]

HUMAN ERROR		**LEVEL of ASSURANCE**		
		Low (SAIL I & II)	**Medium (SAIL III & IV)**	**High (SAIL V & VI)**
	functional test-based methods	If the applicant has evidence of FTB flight hours proportionate to the risk/SAIL of the operation meeting one of the set of conditions described either in section 3(c) or section 3(d) and executed: • within the full operational scope/envelope intended by the UAS Operator, and • 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[2].		
	Comments	*[2] 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., 3,000FH), the assurance level for OSO#16 Criterion #1 is fulfilled at Medium Level.*		*[3] Functional test-based method are not considered feasible for operations with a SAIL V or VI.*
	Criterion #2 (Training)	Training is self-declared (with evidence available).	(a) Training syllabus is available. (b) ~~The UAS operator provides competency-based,~~ Evidences of theoretical and practical training are available.	The competent authority of the MS or an entity that is designated by the competent authority: (a) validates the training syllabus; and (b) verifies the remote crew competencies.
	Comments	*N/A*	*N/A*	*N/A*
	Criterion #3 (Communication devices)	*N/A*	The applicant has supporting evidence that the required level of integrity is achieved. This is typically done by testing, analysis, simulation~~1~~[1], inspection, design review or through operational experience.	If the communication device is included in the UAS configuration, ~~T~~ the competent authority should request the applicant to operate a UAS designed by an organisation approved by EASA according to Subpart J of Annex I (Part 21) to Regulation (EU) No 748/2012. Otherwise the competent authority of the MS or an entity that is designated by the competent authority validates the claimed level of integrity.

HUMAN ERROR		LEVEL of ASSURANCE		
		Low (SAIL I & II)	**Medium (SAIL III & IV)**	**High (SAIL V & VI)**
	Comments	*N/A*	*[1] When simulation is performed, the validity of the targeted environment that is used in the simulation needs to be justified.*	*N/A*

OSO #17 — Remote crew is fit to operate

(a) For the purpose of this assessment, the expression 'fit to operate' should be interpreted as physically and mentally fit to perform their duties and safely discharge their responsibilities.

(b) Fatigue and stress are contributory factors to human error. Therefore, to ensure that vigilance is maintained at a satisfactory level of safety, consideration may be given to the following:

(1) remote crew workload and duty times;

(2) regular breaks;

(3) rest periods;

(4) personal Protective Equipment (PPE);

(5) workplace environment, including ergonomics of the workstation; and

(4) handover/takeover procedures.

HUMAN ERROR		**Level of integrity**		
		Low (SAIL I & II)	**Medium (SAIL III & IV)**	**High (SAIL V & VI)**
OSO #17 Remote crew is fit to operate	~~Criteria~~ Criterion	The applicant has a policy defining the criteria[1] and the means for the how the remote crew can declare themselves fit to operate before starting their duty and report themselves unfit, if required, during their shift. ~~conducting any operation.~~	Same as low. In addition: (a) Duty, flight duty and resting times for the remote crew are defined by the applicant and adequate for the operation. (b) The UAS operator defines requirements appropriate for the remote crew to operate the UAS.	Same as Medium. In addition: (a) The remote crew is medically fit, (b) A fatigue risk management system (FRMS) is in place to manage any escalation in duty/flight duty times.
	Comments	*~~N/A~~* *[1] Criteria should take into account local legislation and may cover drugs (including prescriptions) and alcohol consumption.*	*N/A*	*N/A*

HUMAN ERROR		**LEVEL of ASSURANCE**		
		Low (SAIL I & II)	**Medium (SAIL III & IV)**	**High (SAIL V & VI)**
OSO #17 Remote crew is fit to operate	~~Criteria~~ Criterion	The policy defining the criteria and the means for ~~to define how~~ the remote crew to declare~~s~~ themselves fit to operate before starting their duty and report themselves unfit, if required during their shift ~~(before an operation)~~ is documented. ~~The remote crew fit-to-operate declaration (before an operation) is based on a policy defined by the applicant.~~	Same as low. In addition: (a) Remote crew duty, flight duty and the resting time policy are 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, and 3. resting times within the duty cycle. (c) There is evidence that the remote crew is fit to operate the UAS.	Same as medium. In addition: (a) Medical standards considered adequate by the competent authority and/or the means of compliance acceptable to that authority are established and the competent authority of the MS or an entity that is designated by the competent authority verifies that the remote crew is medically fit. (b) The competent authority of the MS or an entity that is designated by the competent authority y validates the duty/flight duty times. (c) If an FRMS is used, it is validated and monitored by the competent authority of

				the MS or an entity that is designated by the competent authority.
	Comments	*N/A*	*N/A*	*N/A*

OSO #18 — Automatic protection of the flight envelope from human errors

(a) Each UA is designed with a flight envelope that describes its safe performance limits with regard to relevant flight parameters such as minimum and maximum operating speeds, and its operating structural strength.

(b) Automatic protection of the flight envelope is intended to prevent the remote pilot from operating the UA outside its flight envelope. If the applicant demonstrates that the remote-pilot is not in the loop, this OSO is not applicable.

(c) A UAS implementing such an automatic protection function will ensure that the UA is operated within an acceptable flight envelope margin even in the case of incorrect remote-pilot control inputs (human errors).

(d) UAS without automatic protection functions are susceptible to incorrect remote-pilot control inputs (human errors), which can result in the loss of the UA if the designed performance limits of the aircraft are exceeded.

(e) Failures or development errors of the flight envelope protection are addressed in OSOs #5~~, #10 and #12~~.

HUMAN ERROR		LEVEL of INTEGRITY		
		Low (SAIL III)	**Medium (SAIL IV)**	**High (SAIL V & VI)**
OSO #18 Automatic protection of the flight envelope from human errors	~~Criteria~~ Criterion	The UAS flight control system incorporates automatic protection of the flight envelope to prevent the remote pilot from making any single input under normal operating conditions that would cause the UA to exceed its flight envelope or prevent it from recovering in a timely fashion.	The UAS flight control system incorporates automatic protection of the flight envelope to ensure the UA remains within the flight envelope or ensures a timely recovery to the designed operational flight envelope following remote pilot error(s).[1/2]	
	Comments	*Applicants may show compliance by* CM-AS-012-SORA OSO#18 Envelope protection (SAIL III)	*[1] The distinction between a medium and a high level of robustness for this criterion is achieved through the level of assurance (see table below).* *[2] Compared to the Low level of robustness, Medium and a High levels need to address any operating conditions (normal, abnormal and emergency) and the potential for multiple errors.*	

HUMAN ERROR		LEVEL of ASSURANCE		
		Low (SAIL III)	Medium (SAIL IV)	High (SAIL V & VI)
OSO #18 Automatic protection of the flight envelope from human errors	~~Criteria~~ Criterion	The automatic protection of the flight envelope has been developed in-house or out of the box (e.g. using commercial off-the-shelf elements), without following specific standards.	The competent authority should request the applicant to use a UAS for which EASA has verified the claimed integrity through a DVR.	The competent authority should request the applicant to use a UAS for which EASA has issued a type certificate or restricted type certificate in accordance with Annex I (Part 21) to Regulation (EU) No 748/2012.
	Comments	*Applicants may show compliance by* CM-AS-012- SORA OSO#18 Envelope protection (SAIL III)	*N/A*	*N/A*

OSO #19 — Safe recovery from human errors

(a) This OSO addresses the risk of human errors which may affect the safety of the operation if not prevented or detected and recovered in a timely fashion.

i) Errors can be made by anyone involved in the operation.

ii) An example could be a human error leading to the incorrect loading of the payload, with the risk of it falling off the UA during the operation.

iii) Another example could be a human error not to extend the antenna mast, thus reducing the C2 link coverage.

Note: the flight envelope protection is excluded from this OSO since it is specifically covered by OSO #18.

(b) This OSO covers~~:~~ UAS design, i.e. systems detecting and/or recovering from human errors (e.g. safety pins, use of acknowledgment features, fuel or energy consumption monitoring functions …).

~~i) procedures and lists,~~

~~ii) training, and~~

~~iii) UAS design, i.e. systems detecting and/or recovering from human errors (e.g. safety pins, use of acknowledgment features, fuel or energy consumption monitoring functions …)~~

(c) Operational procedures and training are covered in OSO#08 and OSO#09 respectively.

HUMAN ERROR		LEVEL of INTEGRITY		
		Low (SAIL III)	**Medium (SAIL IV & V)**	**High (SAIL VI)**
OSO #19 Safe recovery from Human Error	~~Criterion #1 (Procedures and checklists)~~	~~Procedures and checklists that mitigate the risk of potential human errors from any person involved with the mission are defined and used.~~ ~~Procedures provide at a minimum:~~ ~~— a clear distribution and assignment of tasks, and~~ ~~— an internal checklist to ensure staff are adequately performing their assigned tasks.~~		
	~~*Comments*~~	~~*N/A*~~	~~*N/A*~~	~~*N/A*~~
	~~Criterion #2 (Training)~~	~~— The remote crew[1] is trained to use procedures and checklists.~~ ~~— The remote crew[1] receives CRM[2] training.[3]~~		
	~~*Comments*~~	~~*[1] In the context of SORA, the term 'remote crew' refers to any person involved in the mission.*~~ ~~*[2] CRM training focuses on the effective use of all the remote crew to ensure a safe and efficient operation, reducing error, avoiding stress and increasing efficiency.*~~ ~~*[3] The distinction between a low, a medium and a high level of robustness for this criterion is achieved through the level of assurance (see table below).*~~		
	Criterion ~~#3 (UAS design)~~	Systems detecting and/or recovering from human errors are developed according to industry best practices.	Systems detecting and/or recovering from human errors are developed to standards considered adequate by the competent authority and/or in accordance with a means of compliance acceptable to that authority.	Same as medium.
	Comments	*N/A*	*N/A* ~~*[1] National Aviation Authorities (NAAs) may define the standards and/or the means of compliance they consider adequate. The SORA Annex E will be updated at a later point in time with a list of adequate standards based on the feedback provided by the NAAs.*~~	*N/A*

HUMAN ERROR		LEVEL of ASSURANCE		
		Low (SAIL III)	**Medium (SAIL IV & V)**	**High (SAIL VI)**
OSO #19 Safe recovery from human error	~~Criterion #1 (Procedures and checklists)~~	~~(a) Procedures and checklists are not validated against either a standard or a means of compliance considered adequate by the competent authority of the MS.~~	~~(a) Procedures and checklists are validated against standards considered adequate by the competent authority of the MS and/or in accordance with the means of compliance acceptable to that authority[1].~~	~~Same as medium. In addition:~~ ~~(a) Flight tests performed to validate the procedures and checklists cover the complete flight envelope or are proven to be conservative.~~

HUMAN ERROR		LEVEL of ASSURANCE		
		Low (SAIL III)	**Medium (SAIL IV & V)**	**High (SAIL VI)**
		~~(b) The adequacy of the procedures and checklists is declared.~~	~~(b) The adequacy of the procedures and checklists is proven through:~~ ~~(1) dedicated flight tests, or~~ ~~(2) simulation, provided that the representativeness of the simulation means is proven valid for the intended purpose with positive results; or~~ ~~(3) any other means acceptable to the competent authority of the MS.~~	~~(b) The procedures, checklists, flight tests and simulations are validated by the competent authority of the MS or an entity that is designated by the competent authority.~~
	~~*Comments*~~	~~*N/A*~~	~~*[1] AMC2 UAS.SPEC.030(3)(e) (Operational procedures for medium and high levels of robustness) is considered an acceptable means of compliance.*~~	~~*N/A*~~
	~~Criterion #2 (Training)~~	~~Consider the criteria defined for the level of assurance of the generic remote crew training OSO (i.e. OSO #09, OSO #15 and OSO #22) corresponding to the SAIL of the operation.~~		
	~~*Comments*~~	~~*N/A*~~	~~*N/A*~~	~~*N/A*~~
	Criterion ~~#3 (UAS design)~~	The applicant declares that the required level of integrity has been achieved~~[1]~~.	The applicant has supporting evidence that the required level of integrity is achieved. That evidence is provided through testing, analysis, simulation[2], inspection, design review or operational experience. If the operation is classified as SAIL IV, the competent authority should request the applicant to use a UAS for which EASA has verified the claimed integrity through a DVR. If the operation is classified as SAIL V the competent authority should request the applicant to use a UAS for which EASA has issued a type certificate or restricted type certificate in accordance with Annex I (Part 21) to Regulation (EU) No 748/2012.	The competent authority should request the applicant to use a UAS for which EASA has issued a type certificate or restricted type certificate in accordance with Annex I (Part 21) to Regulation (EU) No 748/2012.

HUMAN ERROR		**LEVEL of ASSURANCE**		
		Low (SAIL III)	**Medium (SAIL IV & V)**	**High (SAIL VI)**
	Comments	~~*1 Supporting evidence may or may not be available.*~~ *N/A*	*[2] When simulation is performed, the validity of the targeted environment that is used in the simulation needs to be justified.*	*N/A*

OSO #20 — A human factors evaluation has been performed and the HMI has been found appropriate for the mission

HUMAN ERROR		**LEVEL of INTEGRITY**		
		Low (SAIL II & III)	**Medium (SAIL IV & V)**	**High (SAIL VI)**
OSO #20 A ~~H~~human ~~F~~factors evaluation has been performed and the HMI found appropriate for the mission	~~Criteria~~ Criterion	The UAS information and control interfaces are clearly and succinctly presented and do not confuse, cause unreasonable fatigue, or contribute to remote crew errors that could adversely affect the safety of the operation.		Same as Medium. In addition, the human factors evaluation is expected to cover: (a) an appraisal to check that the remote crew workload remains acceptable in both normal and emergency situations; (b) an appraisal of the efficiency of the emergency procedures (efficacy of the actions, expected potential latencies); analyses to check if prioritization of alarms and emergency procedures should be put in place to organize emergency procedures in such a way that they remain adapted to the criticality of the situation.
	Comments	*If an electronic means is used to support potential airspace observer(s) ~~VOs~~ in their role to maintain awareness of the position of the unmanned aircraft, its HMI:* *— is sufficient to allow the airspace observer(s) ~~VO~~ to determine the position of the UA during operation; and*		

		— *does not degrade the airspace observer(s) VO ability to:* — *scan the airspace visually where the unmanned aircraft is operating for any potential collision hazard; and* — *maintain effective communication with the remote pilot at all times.*

HUMAN ERROR		**LEVEL of ASSURANCE**		
		Low (SAIL II & III)	**Medium (SAIL IV & V)**	**High (SAIL VI)**
OSO #20 A Human Factors evaluation has been performed and the HMI has been found appropriate for the mission	~~Criteria~~ Criterion	The applicant conducts a human factors evaluation of the UAS to determine whether the HMI is appropriate for the mission. The HMI evaluation is based on inspection or analyses. The adequacy of the result of the HMI evaluation is declared.	Same as Low but the HMI evaluation is based on demonstrations or simulations.[1] ~~The competent authority should request EASA to witness the HMI evaluation of the UAS.~~ For operations classified in SAIL VI the competent authority should request the applicant to use a UAS for which EASA has issued a type certificate or restricted type certificate in accordance with Annex I (Part 21) to Regulation (EU) No 748/2012	Same as Medium. In addition, ~~EASA witnesses the HMI evaluation of the UAS and the competent authority of the MS or an entity that is designated by the competent authority witnesses the HMI evaluation of the possible electronic means used by the AO.~~ The competent authority should request the applicant to use a UAS for which EASA has issued a type certificate or restricted type certificate in accordance with Annex I (Part 21) to Regulation (EU) No 748/2012.
	Comments	*N/A*	*[1] When simulation is performed, the validity of the targeted environment that is used in the simulation needs to be justified.*	*N/A*
	Alternative Criterion taking credit for functional test-based methods	If the applicant has evidence of FTB flight hours proportionate to the risk/SAIL of the operation meeting one of the set of conditions described either in section 3(c) or section 3(d) and executed: (a) within the full operational scope/envelope intended by the UAS Operator, and	N/A	

		(b) following the operational procedures and the remote crew training referred to in the operational authorization, (c) 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[2].	
	Comments	*[2] 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., 3,000FH), the assurance level for OSO#20 is fulfilled at Low Level.*	N/A

~~E.8 OSOs related to adverse operating conditions~~

OSO #23 — Environmental conditions for safe operations are defined, measurable and adhered to

ADVERSE OPERATING CONDITIONS		LEVEL of INTEGRITY		
		Low (SAIL I & II)	Medium (SAIL III & IV)	High (SAIL V & VI)
OSO #23 Environmental conditions for safe operations are defined, measurable and adhered to	Criterion ~~#1 (Definition)~~	The environmental conditions for safe operations are defined and reflected in the flight manual or equivalent document.[1]		
	Comments	*[1] The distinction between a low, a medium and a high level of robustness for this criterion is achieved through the level of assurance (see table below).* *The definition of the environmental conditions for safe operation should take into account the limitations provided in the flight manual / manufacturer instructions (refer to OSO#8)*		
	~~Criterion #2 (Procedures)~~	~~Procedures to evaluate environmental conditions before and during the mission (i.e. real-time evaluation) are available and include assessment of meteorological conditions (METAR, TAFOR, etc.) with a simple recording system.[2]~~		
	~~*Comments*~~	~~*[2] The distinction between a low, a medium and a high level of robustness for this criterion is achieved through the level of assurance (see table below).*~~		
	~~Criterion #3 (Training)~~	~~Training covers assessment of meteorological conditions.[3]~~		
	~~*Comments*~~	~~*[3] The distinction between a low, a medium and a high level of robustness for this criterion is achieved through the level of assurance (see table below).*~~		

ADVERSE OPERATING CONDITIONS		LEVEL of ASSURANCE		
		Low (SAIL I & II)	Medium (SAIL III & IV)	High (SAIL V & VI)
OSO #23 Environmental conditions for safe operations defined, measurable and adhered to	Criterion #1 (Definition)	The applicant declares that the required level of integrity has been achieved.	The applicant has supporting evidence that the required level of integrity is achieved. This is typically done by testing, analysis, simulation, inspection, design review or through operational experience. If the operation is classified as SAIL IV, the competent authority should request the applicant to use a UAS for which EASA has issued a DVR.	The competent authority should request the applicant to use a UAS for which EASA has issued a type certificate or restricted type certificate in accordance with Annex I (Part 21) to Regulation (EU) No 748/2012
	Comments	*N/A* .		

	~~Criterion #2 (Procedures)~~	~~(a) Procedures do not require validation against either a standard or a means of compliance considered adequate by the competent authority of the MS.~~ ~~(b) The adequacy of the procedures and checklists is declared.~~	~~(a) Procedures are validated against standards considered adequate by the competent authority of the MS and/or in accordance with the means of compliance acceptable to that authority[1].~~ ~~(b) The adequacy of the procedures is proven through:~~ ~~(1) dedicated flight tests, or~~ ~~(2) simulation, provided that the representativeness of the simulation means is proven valid for the intended purpose with positive results; or~~ ~~(3) any other means acceptable to the competent authority of the MS.~~	~~Same as medium. In addition:~~ ~~(a) Flight tests performed to validate the procedures cover the complete flight envelope or are proven to be conservative.~~ ~~(b) The procedures, flight tests and simulations are validated by the competent authority of the MS or an entity that is designated by the competent authority.~~
	~~*Comments*~~	~~*N/A*~~	~~*[1] AMC2 UAS.SPEC.030(3)(e) (Operational procedures for medium and high levels of robustness) is considered an acceptable means of compliance.*~~	~~*N/A*~~
	~~Criterion #3 (Training)~~	~~Training is self-declared (with evidence available).~~	~~— Training syllabus is available.~~ ~~— The UAS operator provides competency-based, theoretical and practical training.~~	~~The competent authority of the MS or an entity that is designated by the competent authority:~~ ~~— validates the training syllabus; and~~ ~~— verifies the remote crew competencies.~~
	~~*Comments*~~	~~*N/A*~~	~~*N/A*~~	~~*N/A*~~

OSO #24 — UAS is designed and qualified for adverse environmental conditions (e.g. UA controllability and performance, adequate sensors, DO-160 qualification)

(a) To assess the integrity of this OSO, the applicant determines:

(1) whether credit can be taken for the equipment environmental qualification tests / declarations, e.g. by answering the following questions:

(i) Is there a Declaration of Design and Performance (DDP) available to the applicant stating the environmental qualification levels to which the equipment was tested?

(ii) Did the environmental qualification tests follow a standard considered adequate by the competent authority (e.g. DO-160)?

(iii) Are the environmental qualification tests appropriate and sufficient to cover all the environmental conditions related to the operation?

(iv) If the tests were not performed following a recognised standard, were the tests performed by an organisation/entity that is qualified or that has experience in performing DO-160 like tests?

(2) Can the suitability of the equipment for the intended/expected UAS environmental conditions be determined from either in-service experience or relevant test results?

(3) Any environmental limitations which, if exceeded, would compromise ~~affect~~ the suitability of the equipment or the operability or controllability of the UA (e.g. maximum cross wind) ~~for the intended/expected UAS environmental conditions~~.

(b) The lowest integrity level should be considered for those cases where a UAS equipment has only a partial environmental qualification and/or a partial demonstration by similarity and/or parts with no qualification at all.

ADVERSE OPERATING CONDITIONS		**LEVEL of INTEGRITY**		
		N/A	**Medium (SAIL III)**	**High (SAIL IV to VI)**
OSO #24 UAS is designed and qualified for adverse environmental conditions	~~Criteria~~ Criterion	N/A	The UAS is designed to limit the effect of environmental conditions defined and reflected in the flight manual or equivalent document.	The UAS is designed using environmental standards considered adequate by the competent authority and/or in accordance with a means of compliance acceptable to EASA ~~that authority~~.
	Comments	*N/A*	~~*N/A*~~ *As an example, if a UAS is proposed to be operated in raining conditions, it is not necessarily proposed to comply with DO-160G waterproof conditions; rain conditions can be limited as long as representative of the environmental conditions* *Applicants may show compliance by CM-AS-013 - SORA OSO#24 UAS designed and qualified for adverse environmental conditions (SAIL III)*	*N/A*

ADVERSE OPERATING CONDITIONS		LEVEL of ASSURANCE		
		N/A	**Medium (SAIL III)**	**High (SAIL IV to VI)**
OSO #24 UAS is designed and qualified for adverse environmental conditions	~~Criteria~~ Criterion	N/A	The applicant has supporting evidence that the required level of integrity has been achieved. This is typically done by testing, analysis, simulation[2], inspection, design review or through operational experience.	If the operation is classified as SAIL IV, the competent authority should request the applicant to use a UAS for which EASA has issued a DVR. If the operation is classified SAIL V or VI, the competent authority should request the applicant to use a UAS for which EASA has issued a type certificate or restricted type certificate in accordance with Annex I (Part 21) to Regulation (EU) No 748/2012.
	Comments	*N/A*	*[2] When simulation is performed, the validity of the targeted environment that is used in the simulation needs to be justified* *Applicants may show compliance by CM-AS-013 - SORA OSO#24 UAS designed and qualified for adverse environmental conditions (SAIL III)*	*N/A*
	Criterion	*N/A*	FUNCTIONAL TEST-BASED METHODS: If the applicant has evidence of FTB flight hours proportionate to the SAIL of the operation meeting one of the set of conditions described either section E.3(c) or section E.3(d) and executed: (a) within the full operational scope/envelope intended by the UAS Operator, and (b) following the maintenance, operational procedures and the remote crew training	*N/A*

ADVERSE OPERATING CONDITIONS		LEVEL of ASSURANCE		
		N/A	Medium (SAIL III)	High (SAIL IV to VI)
			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[2].	
	Comments	*N/A*	[2] *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. 3,000FH), the assurance level for OSO#24 is fulfilled at medium Level.*	*N/A*

E.3 Functional Test-Based (FTB) Approach

a. The objective of this section is to give some insight into the Functional Test-Based (FTB) approach referenced throughout Annex E to AMC1 Article 11. This is articulated around three different but complementary perspectives:

i. FTB as a Means of Compliance (MoC) to support **UAS designers** in demonstrating UAS operational reliability for the purposes of obtaining an FTB design appraisal;

ii. FTB design appraisal gained by UAS designers taken credit for by **UAS operators** when showing compliance with some of Annex E to AMC1 Article 11 OSOs;

iii. FTB as a means for **UAS operators** to take credit for safe and successful operations over time to expand their operational authorisation (based on the concept of "reliability growth model").

These three approaches are detailed in the following sections b), c) and d).

b. For FTB as a Means of Compliance (MoC) to support **UAS designers** in demonstrating UAS operational reliability refer to the MoC SC Light-UAS FTB[37] published by EASA:

c. FTB design appraisal gained by UAS designers taken credit for by **UAS operators** when showing compliance with some of Annex E to AMC1 Article 11 OSOs:

i. An FTB design appraisal gained by a UAS designer presents several benefits both for the UAS operator going through the operational authorization (OA) process and the competent authority issuing such OA, in particular when the UAS operator does not have a full relationship with the designer or does not have all the design details.

ii. In order for a UAS Operator to take credit for a FTB design appraisal gained by a UAS designer, the following conditions need to be met at a minimum:

— The functional tests supporting the FTB design appraisal gained by a UAS designer have been executed within the full operational scope/envelope intended by the UAS operator; this means that the test cycles are fully representative of the operators' intended operations with test points to verify safe operation at the operational limits and corners of the vehicle envelope.

— The functional tests supporting the FTB design appraisal gained by a UAS designer have been executed following the operational procedures and the remote crew training referred to in the operational authorization (and meeting the integrity assurance of the associated OSOs).

— The UAS operator maintenance instructions are established based on the UAS designer's instructions and requirements which were used for maintenance, repair, or replacement of UAS sub-systems during the functional tests supporting the FTB design appraisal gained by the UAS designer.

— Any UAS configuration differences compared to the initial configuration used by the UAS designer to gain the FTB design appraisal are confirmed by the UAS

[37] https://www.easa.europa.eu/en/document-library/product-certification-consultations/final-means-compliance-special-condition-light

designer not to impair the validity of the design appraisal.

— The minimum number of test cycles are proportionate to the risk of the operation, with at least:

  ○ 30 hours for SAIL I;

  ○ 300 hours for SAIL II;

  ○ 3,000 hours for SAIL III; and

  in order to achieve a 95% confidence (assuming a binomial/Poisson distribution for the operational level hazard rate and no failures during the test)[38].

  Note that FTB methods are not considered feasible for UAS operations with a SAIL above or equal to IV.

— The functional tests supporting the FTB design appraisal gained by a UAS designer have been executed by the UAS designer according to principles/standards considered adequate by the competent authority in charge of granting the operational authorization, including at a minimum the following principles:

  ○ The functional tests supporting the FTB design appraisal gained by a UAS designer have been executed using an acceptable sample size of unmanned aircraft.

  ○ Safe life limits for UAS subsystems 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 testing) have been derived by the UAS designer and captured in the FTB design appraisal limitations.

iii. Additionally, induced failure tests may help demonstrate compliance with the following OSOs and Step #8:

— OSO#05 and Step #8: safety and reliability / safe design (e.g., induced failure tests with no loss of control or containment as path-fail criteria);

— OSO#06: 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);

— OSO#18: Automatic protection of the flight envelope from human errors;

However, this kind of test is not addressed in this version of Annex E to AMC1 Article 11 since competent authorities are still in the process of defining the modalities of test-based approaches. In the meantime, credit for induced failure testing may be proposed on a case-by-case basis by a UAS operator depending on the scope of the FTB design appraisal gained by the UAS designer.

[38] See the Rule of Three: https://en.wikipedia.org/wiki/Rule_of_three_(statistics)

d. FTB as a means **for UAS operators** to take credit for safe and successful operations over time to expand their operational authorisation (based on the concept of "reliability growth model"):

i. An FTB approach should also allow UAS operators to take credit for safe and successful operations over time to expand their operational authorisation based on the concept of "reliability growth", while still respecting the conditions of section 3(c).

ii. UAS operators should be able to 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 by the operators. This approach would only be valid under representative operating conditions, not requesting additional strategic or tactical mitigations.

Notes:

— The competent authority may accept accumulation of FTB hours between operators if the UAS configuration, operational procedures, training, etc. are demonstrated to be equivalent.

— This option does not cover expanded operating conditions which would require additional testing and/or analysis to be performed by the UAS designer. As an example, a UAS operator may start with a SAIL II operational authorisation to fly over population density up to 500 ppl/km^2 and, if they demonstrate 3,000 hours with no loss of control, they could be allowed to fly a SAIL III operation under the exact same operating conditions, except for an increase of the maximum population density allowed (5,000 ppl/km^2).

iii. To be relevant, the UAS Operator would need to show that:

— the next population band does not introduce new or unique hazards, or if so, these new or unique hazards are shown to be properly mitigated through test or analysis;

— the reliability demonstrated through operational testing demonstrates the required operational reliability at the higher SAIL level desired;

— any UAS configuration differences compared to the initial configuration do not impair the validity of the argument.

E.4 Containment requirements

a. In SORA Main Body, Step #8: Determination of containment requirements addresses the risk posed by an operational loss of control that could infringe on areas adjacent to the operational volume and buffers. The ground risk (in the adjacent area) and air risk in the adjacent airspace dictate the level of safety requirements to be met by containment design features and operational procedures.

b. The following section provides the generic containment requirements for the following 3 levels of containment: Low, Medium and High.

CONTAINMENT	**LEVEL of INTEGRITY**		
	Low	**Medium**	**High**[2]
Criterion #1 (Operational Volume Containment)	(Qualitative) No **probable**[1] single failure of the UAS or any external system supporting the operation shall lead to operation outside of the operation volume. OR (Quantitative) The probability of the failure condition "UA leaving the operational volume" shall be less than 10-3/Flight Hour (FH).		(Qualitative) No single failure of the UAS or any external system supporting the operation shall lead to operation outside of the operational volume. OR (Quantitative) The probability of the failure condition "UA leaving the operational volume" shall be less than10-4/FH.
Comments	*[1] Failures anticipated to occur one or more times during the entire operational life of an item.*		*[2] This may be achieved by a tether that prevents the drone from exiting the operational volume (see chapter below).* *[3] Failures unlikely to occur with each UA during its operational life but that may occur several times when considering the total operational life of a number of UA of this type.*

<table>
<tr><td></td><td></td><td>[4] This means a reduction by a factor of 10 of the likelihood of exiting the operational volume compared to the low & medium integrity containment.</td></tr>
<tr><td>Criterion #2

(End of Flight upon exit of the operational volume)</td><td colspan="2">When the UA leaves the operational volume, a safe end of the flight should be initiated through a combination of procedures/processes and/or available technical means.</td></tr>
<tr><td>Comments</td><td colspan="2">N/A</td></tr>
<tr><td>Criterion #3

(Definition of the final ground risk buffer)</td><td>The Ground Risk Buffer must at least adhere to the 1:1 principle[5].

The 1:1 rule may not be suitable for some UA configurations (e.g., fixed-wing or parachute-equipped UA). In those cases, the competent authority may require to define the ground risk buffer based on a ballistic methodology approach, a glide trajectory, representative flight tests, and/or a combination thereof.

A smaller ground risk buffer value may be proven by the applicant for a rotary wing UA using a ballistic methodology approach acceptable to the competent authority.</td><td>Ground risk buffer must consider the following points below:

(a) <u>Probable</u>[6] single failures (including the projection of high energy parts such as rotors and propellers) which would lead to an operation outside of the operational volume,

(b) Meteorological conditions (e.g., maximum sustained wind),

(c) UAS latencies (e.g., latencies that affect the timely manoeuvrability of the UA),

(d) UA behaviour when activating a technical containment measure, UA performance.</td></tr>
</table>

	In case the UAS uses a parachute the effect of wind when it is deployed, should be considered.	
Comments	[5] *The 1:1 principle refers to applying a ground risk buffer that is as wide as the maximum height of* the *operational volume*	[6] *For the purpose of this assessment, the term "probable" should be interpreted in a qualitative way as, "Anticipated to occur one or more times during the entire operational life of a UAS"..*
Criterion #4 (Ground risk buffer containment)	N/A	**No single failure**[7] of the UAS or any external system supporting the operation shall lead to operation **outside of the ground risk buffer**. Software (SW) and Airborne Electronic Hardware (AEH) whose development error(s) could **directly lead to operations outside of the ground risk buffer** shall be developed to an industry standard or methodology recognized as adequate by the competent authority.
Comments	*N/A*	[7]*Example* methods *of achieving this may include:* — *an independent Flight Termination Systems (FTS), that will initiate the end of the flight, when exiting the operational volume; or* — *a secondary independent emergency flight control system, that ends the flight in a controlled manner within the ground risk buffer; or* — *a tether that prevents the drone from exiting the ground risk buffer.*

Containment	**LEVEL of ASSURANCE**		
	Low	**Medium**	**High**
For all criteria	The applicant declares[1] that the required level of integrity has been achieved. The declaration of the applicant should in particular rely on: (a) For criterion #1, a design and installation appraisal[2] including at minimum: o design and installation features (e.g., independence, separation or redundancy claims); o any relevant particular risk (e.g., hail, ice, snow, electro-magnetic interference…) associated with the operation and how they are being addressed. (d) For criterion #2, the adequacy of Emergency Procedures to terminate flight are tested.	The applicant has supporting evidence that the required level of integrity is achieved. This is typically done by testing, analysis, simulation[2], inspection, design review or through operational experience. Among the supporting evidences: (a) For criterion #1 and criterion #4: Same as criterion #1 low. (b) For criterion #2: Adequacy of the Emergency Procedures to terminate flight are proven through: o dedicated flight tests, or o simulation provided the simulation is proven valid for the intended purpose with positive results.	Same as Medium. The competent authority should request the applicant to use a UAS for which EASA has verified the claimed integrity through a DVR. In addition, the competent of the MS or the entity that is designated by the competent authority validates the claimed level of integrity.
Comments	*[1] Supporting evidence for this declaration may still be requested by the competent authority.* *[2] A simple written justification from the operator including functional diagrams and*	*[2] When simulation is used, the suitability of the targeted environment used in the simulation needs to be justified.* *The competent authority may accept a declaration from the applicant for the compliance of the UAS design with the MoC to Light-UAS.2511 (https://www.easa.europa.eu/en/document-*	*N/A*

	a description of how the system works explaining why the integrity claim (i.e. no (probable/remote) single failure criterion) is met is an acceptable means of compliance.	*library/product-certification-consultations/final-means-compliance-light-uas2511-moc-light) when the UAS meets the conditions defined in such MOC. For UAS configurations exceeding the applicability of such MoC, the competent authority may decide to still accept declarations based on such MoC with evidence available, or to accept appropriate MoC proposed by the applicant. Otherwise, the competent authority may request the applicant to use a UAS for which EASA has verified the claimed integrity.*	

c. The following section is an alternative which can only be used in the specific use of a tether:

Containment specific criteria in case of tethered operations	**LEVEL of INTEGRITY** **Low, Medium and High[1]**
Criterion #1 (Technical design)	1) The length of the line is adequate to contain the UA in the operational volume. 2) Strength of the line is compatible with the ultimate loads[2] expected during the operation. 3) Strength of attachment points is compatible with the ultimate loads[2] expected during the operation. 4) The tether cannot be cut by rotating propellers.
Comments	*N/A*
Criterion #2 (Procedures)	The applicant has procedures to install and periodically inspect the condition of the tether.
Comments	*[1] The distinction between a medium and a high level of robustness for this criterion is achieved through the level of assurance (Table 5 below).* *[2] Ultimate loads are identified as the maximum loads to be expected in service, including all possible nominal and failure scenarios multiplied by a 1.5 factor of safety.*

Containment specific criteria in case of tethered operations	LEVEL of ASSURANCE		
	Low	**Medium**	**High**
Criterion #1 (Technical design)	The applicant declares[1] that the required level of integrity has been achieved.	The applicant has supporting evidence (including the tether material specifications) to claim the required level of integrity is achieved. (a) This is typically achieved through testing or operational experience. (b) Tests can be based on simulations, however the validity of the target environment used in the simulation needs to be justified.	The claimed level of integrity is validated by the competent authority of the MS or by an entity that is designated by the competent authority.
Comments	*[1] Supporting evidence for this declaration may still be requested by the competent authority.*	*N/A*	*N/A*
Criterion #2 (Procedures)	(a) Procedures do not require validation against either a standard or a means of compliance considered adequate by the competent authority. (b) The adequacy of the procedures is declared.	(a) Procedures are validated against standards considered adequate by the competent authority and/or in accordance with a means of compliance acceptable to that authority. (b) The adequacy of the procedures is proved through: ○ Dedicated flight tests, or	Same as Medium. In addition: (a) Flight tests performed to validate the procedures cover the complete flight envelope or are proven to be conservative. (b) The procedures, flight tests and simulations are validated by the competent authority of the MS or by an entity that is designated by the competent authority.

		○ Simulation provided the simulation is proven valid for the intended purpose with positive results.	
Comments	*N/A*	*[1] National Aviation Authorities (NAAs) may define the standards and/or the means of compliance they consider adequate. The SORA Annex B will be updated at a later point in time with a list of adequate standards based on the feedback provided by the NAAs.*	*N/A*

Annex I to AMC1 to Article 11 is introduced:

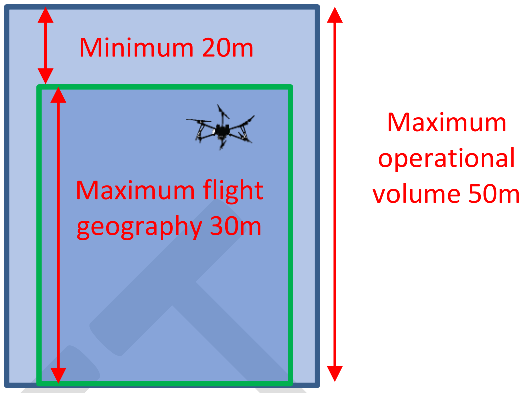
Annex I to AMC1 to Article 11

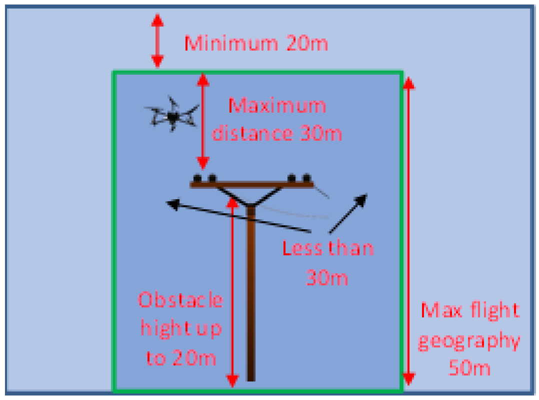
GLOSSARY OF TERMS

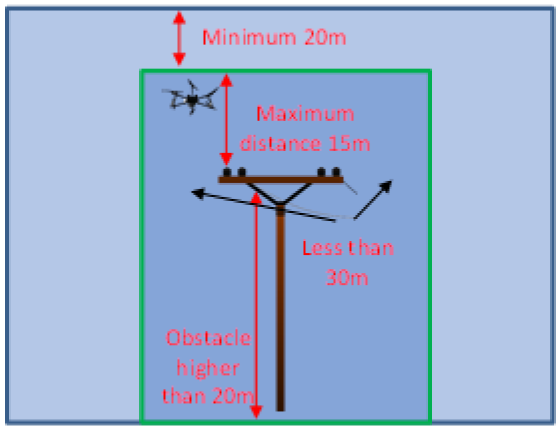
Term	Acronym	Definition
I.1. Abnormal situation		Situation in which it is no longer possible to continue the flight using normal procedures.
I.2. Acceptable risk		The level of risk that individuals or groups are willing to accept given the benefits gained. Each organization will have its own acceptable risk level, which is derived from its legal and regulatory compliance responsibilities, its threat profile, and its business/organizational drivers and impacts.
I.3. Adequate		What is necessary or sufficient for a specific requirement.
I.4. Adjacent airspace		The airspace adjacent to the operational volume. See point 2.2.6 of AMC 1 Article 11.
I.5. Adjacent ground area		The ground area adjacent to the ground risk buffer. See also point 2.2.5 of AMC 1 Article 11.
I.6. Aerodrome		A defined area, on land or on water, on a fixed, fixed offshore or floating structure, including any buildings, installations and equipment thereon, intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft;
I.7. Aerodrome environment		Aerodrome environment is normally protected by the MS through the creation of a geographical zone defined according to Article 15 of Regulation 2019/947. The aerodrome environment is generally defined as: a) class A, B, C, D, or E controlled airspaces which touch the surface with an aerodrome and/or controlled airspaces which do not touch the surface, but in connection to an aerodrome (normally depicted on aeronautical charts and sectionals); or b) any Mode C Veil (US) or TMZ (Europe) in Class A, B, C, D, or E, controlled airspace; or c) 5 nautical miles from an airport having an operational control tower; or d) 3 nautical miles from an airport with a published instrument flight procedure, but not an operational tower; or e) 2 nautical miles from an airport without a published instrument flight procedure or an operational tower; or f) 2 nautical miles from a heliport with a published instrument flight procedure.
I.8. Aeronautical information publication	AIP	A publication issued by or with the authority of a State and containing aeronautical information of a lasting character essential to air navigation.
I.9. Air risk class	ARC	The ARC is an initial assignment of generic collision risk of airspace before mitigations are applied. ARC is assigned to AEC based on a qualitative assessment of collision risk of generic types of airspace.

Term	Acronym	Definition
I.10. Aircraft operating manual		A manual, acceptable to the State of the Operator, containing normal, abnormal and emergency procedures, checklists, limitations, performance information, details of the aircraft systems and other material relevant to the operation of the aircraft. Note: The aircraft operating manual is part of the operations manual.
I.11. Aircraft		Any machine that can derive support in the atmosphere from the reactions of the air other than the reaction of the air against the earth's surface.
I.12. Airframe		The fuselage, booms, nacelles, cowlings, fairings, air foil surfaces (including rotors but excluding propellers and rotating air foils of engines), and landing gear of an UA and their accessories and controls.
I.13. Airspace encounter categories	AEC	The AEC is a qualitative classification of the probability that a UAS would encounter a manned aircraft in typical civil airspace found in the U.S. and Europe. The airspace encounter risk was grouped by operational altitude, airport environment, controlled airspace, uncontrolled Mode C veil/TMZ airspace, and in uncontrolled airspace over rural and/or urban populations. The AEC is based on the assessment of the proximity (the more aircraft in the airspace, the higher the rate of proximity, the greater the risk of collision), geometry (an airspace structure which reduces the probability that an aircraft find themselves on collision courses), and dynamics (in general, the faster the speed of the aircraft in the airspace, the greater the number of collision risks over a set time). Airspace where there is a higher density of manned aircraft, few airspace structural controls, and high aircraft closing speeds, will experience higher airspace encounter rates than in airspace where there is low density, high airspace structure and slow speeds.
I.14. Airspace observer	AO	Refer to Article 2(25).
I.15. Airworthiness		The condition of an item (aircraft, aircraft system, or part) in which that item operates in a safe manner to accomplish its intended function.
I.16. Applicant		Individual or organisation who desires to operate a UAS in a limited or restricted manner and submits the necessary technical, operational and human information related to the intended use of the UAS to the competent authority. See also point 2.5 (b) of AMC 1 to Article 11.
I.17. Assembly of people		Refer to Article 2(3)
I.18. Assurance		The level of verification required by the competent authority prior to granting an approval. All the integrity requirements must still be fulfilled by the UAS Operator, but the Verification of the implementation can happen prior to approval or after in auditing.

<table>
<tr><th>Term</th><th>Acronym</th><th>Definition</th></tr>
<tr><td>I.19. Atypical air environment</td><td></td><td>Defined as:
a) restricted Airspace or segregated Areas;
b) airspace where normally manned aircraft should not go (e.g., at a height low enough or close to an obstacle see examples below);







c) airspace not covered in Airspace Encounter Categories (AEC) 1 through 11.</td></tr>
<tr><td>I.20. Authority</td><td></td><td>The organization responsible within the state concerned with the certification of compliance with applicable requirements.</td></tr>
<tr><td>I.21. Authorization</td><td></td><td>The permit granted to an applicant by a competent authority.</td></tr>
<tr><td>I.22. Automatic system</td><td></td><td>Any system in which the UAS crew is supported by mechanized or computerized components executing predefined processes.</td></tr>
</table>

Term	Acronym	Definition
I.23. Autonomous UA		Refer to Article 2(17)s.
I.24. Barrier		A material object or set of objects that separates, demarcates, or services as a barricade; or something immaterial that impedes or separates. Both physical and non-physical barriers are utilised and applied in hazard control; i.e., anything used to control, prevent or impede unwanted adverse energy flow and / or anything used to control, prevent or impede unwanted event flow.
I.25. Beyond visual line-of-sight	BVLOS	Refer to Article 2(8)
I.26. Beyond visual line-of-sight with airspace observers	BVLOS with AO	A UAS operation whereby the remote pilot maintains an uninterrupted situational awareness of the airspace in which the UAS operation is being conducted via visual airspace surveillance through one or more airspace observers, possibly aided by technology means. The RPIC has a direct control of the UAS at all time.
I.27. Catastrophic		Failure condition that could result in one or more fatalities.
I.28. Certification		The legal recognition based on an appropriate assessment, that a product, part, service, organization, or person complies with the applicable requirements, through the issuance of a certificate, license, approval, or other documents as required by national laws and procedures, attesting such compliance.
I.29. Civil aircraft		Aircraft other than public/state or military aircraft.
I.30. Collision avoidance		Averting physical contact between an aircraft and any other object or terrain.
I.31. Command and control link	C2 Link	Refer to Article 2(27).
I.32. Commercial-off-the-shelf	COTS	Components designed to be implemented into existing systems without extensive customization and for which design data are not always available to the customer.
I.33. Competent authority		The authority responsible to assess the safety measures proposed by the applicant for a safety operation, following a specific operation risk assessment (SORA) and issuing the operational authorisation. See also point 2.5 (e) of AMC 1 to Article 11.
I.34. Compliance		Successful performance of all mandatory activities; agreement between the expected or specified result and the actual result.
I.35. Component		Any self-contained part, combination of parts, subassemblies or units, which perform a distinct function necessary to the operation of the system.
I.36. Configuration		The requirements, design and implementation that define a particular version of a system or system component.
I.37. Configuration control/management		The process of evaluating, approving or disapproving, and coordinating changes to configuration items after formal establishment of their configuration identification.

Term	**Acronym**	**Definition**
I.38. Conformity		Aircraft or part checked against design documents for correctness.
I.39. Contingency area		Refer to Article 2(31).
I.40. Contingency procedures		Planned course of action designed by the organization to respond effectively to a future event or abnormal situation that may or may not happen. It includes procedures executed by the remote pilot or by the UA, in case of autonomous flights, to return to normal operations or allow the safe cessation of the flight.
I.41. Contingency volume		Refer to Article 2(30). See also point 2.2.3 of AMC 1 to Article 11.
I.42. Control and monitoring unit	CMU	Refer to Article 2(26)
I.43. Controlled Airspace		Airspace class A, B, C, D, and E. An airspace of defined dimensions within which air traffic control service is provided in accordance with the airspace classification. Controlled airspace does not imply separation services are provided at all times. Classes A, B, C, D and E as described in ICAO Annex 11, 2.6.
I.44. Controlled ground area		Refer to Article 2(21).
I.45. Cooperative aircraft		Aircraft that have an electronic means of identification (i.e., a transponder) aboard and operating.
I.46. Critical (function)		A function whose loss would prevent the continued safe flight and landing of the UA thereby causing a significant increase in the safety risk for the third parties and/or environment involved.
I.47. Critical area		The ground area where persons would be expected to be impacted by the UA in the event of a loss of control or an unplanned landing.
I.48. Critical infrastructure		Means systems and assets vital to national defence, national security, economic security, public health or safety including both regional and national infrastructure.
I.49. Critical systems		Systems needed to perform one or more critical functions.
I.50. Criticality		The degree of impact that a malfunction has on the operation of a system.
I.51. Danger area		A danger area is an airspace of defined dimensions within which activities dangerous to the flight of aircraft may exist at specified times.
I.52. Datalink		A term referring to all interconnections to, from and within the UAS. It includes control, flight status, communication, and payload links.
I.53. Demonstration		A method of proof of performance by observation.
I.54. Detect and avoid	DAA	The capability to see, sense or detect conflicting traffic or other hazards and take the appropriate action to comply with the acceptable rules of flight.

Term		Acronym	Definition
I.55.	Emergency recovery capability		UAS safety feature that provides for the cessation of the UAs operation in a manner that minimises risk to persons on the ground, other airspace users and critical infrastructure (e.g., return to home).
I.56.	Emergency procedures		Planned course of action designed by the UAS operator to respond effectively to an emergency condition. They deal with controlling the aircraft to either return to a state where the operation is 'in control' or to minimise hazards until the flight has ended. It includes procedures that are executed by the remote pilot or by the UA. See also paragraph 2.3.2 (d) of AMC 1 to Article 11 (SORA Main Body).
I.57.	Emergency response plan	ERP	Plan of actions to be conducted in a certain order or manner, in response to an emergency event. For additional information, please refer to 2.3.2 (e) of AMC 1 Article 11.
I.58.	Environment		a) The aggregate of operational and ambient conditions to include the external procedures, conditions, and objects that affect the development, operation, and maintenance of a system. Operational conditions include traffic density, communication density, workload, etc. Ambient conditions include weather, EMI, vibration, acoustics, etc. and b) Everything external to a system which can affect or be affected by the system.
I.59.	Equipment		A complete assembly—operating either independently or within a system/sub-system—that performs a specific function.
I.60.	Failure		A loss of function or a malfunction of a system or a part thereof.
I.61.	Failure mode		The way in which the failure of an item occurs.
I.62.	Flight geography		Refer to Article 2(28). See also point 1.4(e) of SORA main body.
I.63.	Flight manual		A manual containing limitations within which the aircraft is to be considered airworthy, and instructions and information necessary to the flight crew members for the safe operation of the aircraft.
I.64.	Flight termination system	FTS	Procedure or function which aims to immediately end the flight.
I.65.	Flyaway		A condition due to loss of control of the operation, where the UAS is leaving the operational volume and it is not possible to regain control of the UA with none of the normal, contingency or emergency procedures being effective.
I.66.	Functional test-based	FTB	An approach to demonstrate compliance with some OSOs, as defined in Section 3 of Annex E to AMC1 to Article 11.
I.67.	Geo-awareness		Refer to Article 2(15)
I.68.	Geo-caging		An automatic function that helps the remote pilot to maintain the UAS within the defined overall volume (a 'cage').
I.69.	Geo-fencing		An automatic function for preventing the UA from entering a prescribed volume.

Term	Acronym	Definition
I.70. Ground risk buffer		Refer to Article 2(33). See also point 2.2.4 of AMC1 to Article 11.
I.71. Handover		The act of passing command and control from one control and monitoring unit to another.
I.72. Hazard		A potentially unsafe condition resulting from failures, external events, errors, or a combination thereof.
I.73. Height		The vertical distance of a level, a point, or an object considered as a point, measured from a specified datum.
I.74. Human error		Human action with unintended consequences.
I.75. Human Factors	HF	Factors affecting human performance and referring to principles that apply to aeronautical design, certification, training, operations and maintenance, and that seek safe interfaces between the human and other system components by proper consideration of human performance.
I.76. Human Factors principles		Principles which apply to aeronautical design, certification, training, operations and maintenance and that seek safe interface between the human and other system components by proper consideration to human performance.
I.77. Initial air risk class		Initial classification of the airspace before risk mitigations are applied.
I.78. Intrinsic ground risk class	iGRC	Initial classification of the ground risk before ground mitigations are applied.
I.79. Intrinsic ground risk class footprint	iGRC footprint	The projection of the iGRC on the surface of the earth.
I.80. Incident		An occurrence other than an accident that affects or could affect the safety of operations.
I.81. Industry Standard		A published document established by consensus and approved by a recognized body that sets out specifications and procedures to ensure that a material, product, method or service meets its purpose and consistently performs to its intended use. Standards are industry developed standards that define minimum safety and performance requirements of an acceptable product or a means of compliance to specific requirements.
I.82. Inspection		An examination of an item against a specific standard.
I.83. Integrated airspace	IA	Integrated airspace is considered 500 ft. AGL up to VHL airspace (≈FL600) and any airspace where manned aircraft will operate below 500 ft. AGL for take-off and landing. It is airspace where UAS are expected to conform and comply with the existing manned aircraft operating rules, procedures, and equipage.
I.84. Integrity		Attribute of a system or an item indicating that it can be relied upon to work as expected.

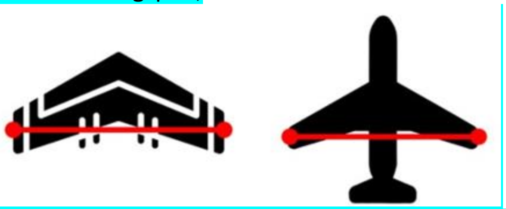
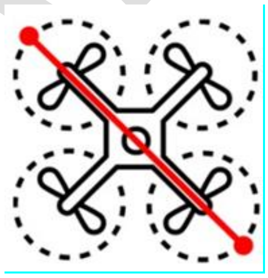
Term	Acronym	Definition
I.85. Involved person		Person directly involved with the operation of the UAS or fully aware that the UAS operation is being conducted near them. Involved persons are fully aware of the risks involved with the UAS operation and have accepted these risks. The UAS operator informs Involved persons of the risks and provides training on the relevant emergency procedures and/or contingency plans.
I.86. Loss of control of the operation		Situations where: — outcome of the situation highly relies on providence; or — cannot be handled by a contingency procedure.
I.87. Lost link (loss of datalink)		The loss of command and control link contact with the UA such that the remote pilot can no longer intervene in the UA's flight control.
I.88. Maintenance		Inspection, overhaul, repair, preservation, and/or the replacement of parts.
I.89. Malfunction		The occurrence of a condition whereby the operation is outside specified limits.
I.90. Maximum take-off mass	MTOM	Refer to Article 2(22).
I.91. Mid-air collision	MAC	An accident where two aircraft come into contact with each other while both are in flight.
I.92. Minimum aviation system performance standards	MASPS	A MASPS specifies characteristics that should be useful to designers, installers, service providers and users of systems intended for operational use within a defined volume. Where the systems are global in nature, the system may have international applications that are taken in to consideration. The MASPS describes the system (subsystems / functions) and provides information needed to understand the rationale for system characteristics, operational goals, requirements and typical applications. Definitions and assumptions essential to proper understanding of the MASPS are provided as well as minimum system test procedures to verify system performance compliance (e.g., end-to-end performance verification).
I.93. Mitigation		A means to reduce the risk of a hazard.
I.94. Minimum operational performance specification	MOPS	A MOPS provides standards for specific equipment(s) useful to designers, installers and users of the equipment. The word "equipment" used in a MOPS includes all components and units necessary for the system to properly perform its intended function(s). The MOPS provides the information needed to understand the rationale for equipment characteristics and requirements stated. The MOPS describes typical equipment applications and operational goals and establishes the basis for required performance under the standard. Definitions and assumptions essential to proper understanding are provided as well as installed equipment tests and operational performance characteristics for equipment installations.

Term	Acronym	Definition
I.95. Multiple Simultaneous UAS Operations	MSO	UA operations where multiple UAs are under a common (centralized) flight management and the individual UA's either: — operate relative to each other under the common flight management, (e.g., formation flights with a swarm of UAS performing displays for entertainment) or — operate independent of each other under the common flight management.
I.96. National aviation authority	NAA	Also referred as civil aviation authority, it is a government statutory authority in each country that oversees the approval and regulation of civil aviation.
I.97. Night		Refer to Article 2(34). Note: Civil twilight ends in the evening when the centre of the sun's disc is 6 degrees below the horizon and begins in the morning when the centre of the sun's disc is 6 degrees below the horizon.
I.98. Normal procedure		A set of instructions covering those features of operations which lend themselves to a definite or standardised procedure without loss of effectiveness.
I.99. Operation out of control		An operation unintentionally being conducted, outside of the limits approved in the authorisation.
I.100. Operational life		It is defined by the UAS design organisation as the maximum flight hours and/or cycles an UAS operator should use the UAS while continuously conforming with the maintenance design requirements.
I.101. Operations manual	OM	A manual containing procedures, instructions and guidance for use by operational personnel in the execution of their duties. Annex A to AMC 1 to Article 11 illustrate an example for its content.
I.102. Operational volume		Refer to Article 2(32). See also point 2.2.1 of AMC 1 to Article 11.
I.103. Parachute		A device used or intended to be used to retard the fall of a body or object through the air.
I.104. Population density		The number of people living per unit of an area (e.g., per square mile or square km).
I.105. Procedure		Standard, detailed steps that prescribe how to perform specific tasks.
I.106. Process		Set of inter-related resources and activities, which transform inputs into outputs.
I.107. Qualification		Process through which a State/ competent authority/applicant ensures that a specific implementation satisfies applicable requirements with a level of confidence.
I.108. Quantification		The act of assigning a numerical value to or measuring the probability that a specific event will occur.
I.109. Reliability		The probability that an item will perform a required function under specified conditions, without failure, for a specified period of time.

Term	Acronym	Definition
I.110. Remote crew member		A member of the crew that performs duties essential to the safety of flight whose duties and responsibilities has been assigned to these by the UAS operator. It may include the remote pilot in command, observers, maintenance staff, launch and recovery system operators etc.) is part of the remote crew.
I.111. Remote pilot (in command)	RPIC	A person, nominated by the UAS operator, responsible for the safe conduct of the flight of a UA by operating its flight controls, either manually or, when the unmanned aircraft flies automatically, by monitoring its course and remaining able to intervene and change the course at any time.
I.112. Risk		The combination of the frequency (probability) of an occurrence and its associated level of severity.
I.113. Risk analysis		The development of qualitative and / or quantitative estimate of risk based on evaluation and mathematical techniques.
I.114. Risk assessment		The process by which the results of risk analysis are used to make decisions.
I.115. Risk estimation		The combination of the consequences and likelihood of the harm.
I.116. Risk ratio		The ratio between a conditional probability with a mitigating system, divided by a conditional probability without a mitigating system. An example of conditional probability is the chance that, given an encounter, a potential MAC occurs. A relative risk measure, which compares the probability of an event in an unmitigated scenario to the probability of the same event in a mitigated scenario.
I.117. Robustness		Refer to Article 2(5)
I.118. Rural air volume		In the context of the air risk, the volume not defined as urban environment and not within the aerodrome traffic zone (ATZ) of an airport.
I.119. Safety		The state in which the risk of harm to persons or property is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and risk management.
I.120. Safety objective		A measurable goal or desirable outcome related to safety.
I.121. Safety risk		The composite of predicted severity and likelihood of the potential effect of a hazard.
I.122. See and avoid	S&A	The requirement of the pilot of an aircraft to “see” and “avoid” a collision, and to remain well clear of other aircraft in accordance with, 14 CFR 91.113, SERA 3201, and ICAO Annex 2 section 3.2.
I.123. Segregated airspace		Airspace of specified dimensions allocated for exclusive use to a specific user(s).
I.124. Sense and avoid	SAA	See detect and avoid.

Term	Acronym	Definition
I.125. Separation		Maintaining a specific minimum distance between an aircraft and another aircraft or terrain to avoid collisions, normally by requiring aircraft to fly at set levels or level bands, on set routes or in certain directions, or by controlling an aircraft's speed.
I.126. Severity		The consequence or impact of a hazard's effect or outcome in terms of degree of loss or harm.
I.127. Sheltering		Expected protection of people from the UA in case of crash into a building or structure.
I.128. Specific operation risk assessment	SORA	A methodology to guide both the applicant and the competent authority in determining whether a UAS operation can be conducted in a safe manner.
I.129. Specific category		Category of UAS where a proportionate approach to the assessment of the risk will be taken by requiring the UAS operator to present a specific operation risk assessment (SORA) of the UAS operation before operational authorisation will be granted by the competent authority.
I.130. Standard operating procedure	SOP	A set of instructions covering those features of operations which lend themselves to a definite or standardised procedure without loss of effectiveness.
I.131. Standard scenario		A description of a type of UAS operation, for which a specific operations risk assessment (SORA) has been conducted and on the basis of which mitigations means have been proposed that are deemed acceptable by the competent authority. The use of a standard scenario greatly simplifies and expedites the application process for the applicant and for the regulator.
I.132. Strategic conflict mitigation		A set of procedures aimed at reducing the UAS encounter probability prior to UAS take-off. Strategic mitigation is about controlling or mitigating risk by reducing local aircraft density or time of exposure of an individual UAS. These mitigations tend to take the form of operational restrictions of time or space. Strategic Mitigation does not fulfil the 14 CFR 91.113, SERA 3201, or ICAO Annex 2 section 3.2 to "see and avoid." (Examples of Strategic Mitigation: an operational restriction to fly between the hours of 10PM and 3 AM; operational restriction to stay below 500 feet AGL; operational restriction to stay within 1 mile of a geographic location; etc.). Strategic Mitigation traces to the strategic layer of ICAO's Conflict Management concept.
I.133. System		A combination of inter-related items arranged to perform a specific function(s).
I.134. System safety		System safety is a specialty within system engineering that supports program risk management. It is the application of engineering and management principles, criteria and techniques to optimize safety. The goal of System Safety is to optimize safety by the identification of safety related risks, eliminating or controlling them by design and/or procedures, based on acceptable system safety precedence.

Term	Acronym	Definition
I.135. Tactical conflict mitigation		The act of mitigating collision risk over a very short time horizon (minutes to seconds). Tactical mitigations take the form of SDAF loops (see, decide, action, and feedback loop). Tactical mitigation systems operate using a sensor to "see" the threat, "deciding" how to mitigate the risk, "acting" on the decision, and then having a system feedback in order to monitor the risk, and implement new corrections if needed. Tactical mitigation may fulfil the 14 CFR 91.113, SERA 3201 and ICAO Annex 2 section 3.2 "See and Avoid" requirement. (Examples of tactical mitigation: TCAS, ATC, ACAS, MIDCAS, DAA, ABSAA, GBSAA, see and avoid, etc.). Tactical mitigation traces to the separation provision and collision avoidance layers of ICAO's conflict management concept.
I.136. Testing		The process of operating a system under specified conditions, observing or recording the results, and making an evaluation of some aspect of the system.
I.137. Third party		Party deriving no economic benefit and no control over risk associated with the UAS operation.
I.138. Threat		Occurrence that in the absence of appropriate threat barriers can potentially result in the hazard.
I.139. Total system error		All errors impacting the position of the UA. It includes the accuracy of the navigation solution, the flight technical error of the UAS, as well as the path definition error (e.g., map error) and latencies. Errors are usually determined by the interaction of several contributes, such as positioning sensors providing position, navigation and flight control systems, system and human latencies, and environment.
I.140. Transponder Mandatory Zone	TMZ	An airspace of defined dimensions wherein the carriage and operation of pressure-altitude reporting transponders is mandatory.

Term	Acronym	Definition
I.141. UA characteristic dimensions		The width of the UA in the direction transversal to the direction of flight (refer to Annex F, critical area). For example: — for fixed-wing UA, independent of the number of planes, including hybrid configurations, the UA characteristic dimension is the wingspan;  — for rotorcraft (e.g. helicopters or gyroplane) UA, the UA characteristic dimension is the diameter of the main rotor;  — for VTOL capable aircraft such as hexacopter UA, the UA characteristic dimension is defined by the maximum distance (i.e., the diagonal distance) between blade tips. 
I.142. UAS traffic management (UTM)	UTM	A specific aspect of air traffic management which manages UAS operations safely, economically and efficiently through the provision of facilities and a seamless set of services in collaboration with all parties and involving airborne and ground-based functions. In Europe it is referred as U-space.
I.143. UAS component design and production organisation		The organisation designing and producing a component to be installed on a UAS (e.g., parachute). It is also responsible for carrying out the test, check compatibility and interface with the UAS models listed in the component instruction manual.
I.144. UAS component installer		The organisation responsible for installing a component (e.g., parachute) on a UAS model listed in the component instruction manual, using the procedure defined in the same manual. Depending on the level of integration of the component, the component installer may be the UAS operator or in some cases the UAS production organisation or one designated by them.

Term	Acronym	Definition
I.145. UAS operation		It may consist in one or multiple flights, even in different locations and with different purposes, conducted with a UAS with the same features, characterised by the same final air risk, final ground risk, SAIL score, ground and air risk mitigations and containment level.
I.146. UAS operator		Refer to Article 2(2) See also point 2.5(c) of AMC 1 to Article 11.
I.147. Uncontrolled airspace		For the purposes of this assessment, uncontrolled airspace is defined as class G airspace.
I.148. Uninvolved persons		Refer to Article 2(18).
I.149. Unmanned aircraft	UA	An aircraft operating or designed to operate autonomously or to be piloted remotely.
I.150. Unmanned aircraft system	UAS	Refer to Article 2(1)
I.151. Urban air volume		In the context of the air risk, it is the volume above a town or a city, starting from ground, where there is a higher probability that air operations (with or without pilots on board) may take place for several purposes (e.g., aerial work, delivery, transport, emergency etc.).
I.152. U-space		The UTM concept defined in Europe.
I.153. Validated		A term used to describe controls/safety requirements that are unambiguous, complete, and verifiable.
I.154. Verified		A term used to describe controls/safety requirements that are objectively determined to have been met by the design solution.
I.155. Very high-level airspace	VHL	The airspace from FL600 and above. The altitude of FL600 is not a hard value, but an initial value used in this assessment as a starting point for discussion. It may be adjusted by the regulating authorities as needed. UAS operating in VHL airspace may have to comply with operating rules, procedures, and equipage not yet identified. VHL is airspace where manned aircraft operations are very infrequent.
I.156. Very low-level airspace	VLL	The airspace from ground level to 500 ft AGL. The altitude of 500 ft AGL is not a hard value, but an initial value used in this assessment as a starting point for discussion and may be adjusted by the regulating authorities as needed. UAS operating in VLL airspace may have to comply with operating rules, procedures, and equipage not yet identified. VLL is airspace where manned aircraft operations are very infrequent. VLL airspace excludes Class A, B, C, D, E, and F airspaces, and airport environments.
I.157. Visual line of sight	VLOS	Refer to Article 2(7).

AMC1 UAS.SPEC.030(2) is amended as follows:

AMC1 UAS.SPEC.030(2) Application for an operational authorisation

APPLICATION FORM FOR AN OPERATIONAL AUTHORISATION

The UAS operator should submit an application for an operational authorisation according to the following form. The application and all the documentation referred to or attached to the application should be stored for at least 2 years after the expiry of the related operational authorisation or submission of application in case of refusal. The UAS operator should ensure the protection of the stored data from unauthorised access, damage, alteration, and theft. The declaration may be complemented by the description of the procedures to ensure that all operations are in compliance with Regulation (EU) 2016/679 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, as required by point UAS.SPEC.050 (1)(a)(iv) of the UAS Regulation.

	Application for an operational authorisation for the 'specific' category
Data protection: Personal data included in this application is processed by the competent authority pursuant to Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation). Personal data will be processed for the purpose of the performance, management and follow-up of the application by the competent authority in accordance with Article 12 of Regulation (EU) 2019/947 of 24 May 2019 on the rules and procedures for the operation of unmanned aircraft. If the applicant requires further information concerning the processing of their personal data or exercising their rights (e.g. to access or rectify any inaccurate or incomplete data), they should refer to the point of contact of their competent authority. The applicant has the right to file a complaint regarding the processing of their personal data at any time to the national data protection supervisory authority.	
☐ New application	☐ Amendment to operational authorisation NNN-OAT-xxxxx/yyy
1. UAS operator data	
1.1 UAS operator registration number	
1.2 UAS operator name	
1.3 Name of the accountable manager	
1.~~3~~4 Operational point of contact Name Telephone Email	

2 Details of the UAS operation			
2.1 Expected date of start of the operation	DD/MM/YYYY	**2.2 Expected end date**	DD/MM/YYYY
~~**2.3 Intended location(s) for the operation**~~			
2.~~4~~3 Risk assessment reference and revision	☐ SORA version __ ☐ PDRA # __-__ ☐ other ________		
~~**2.5 Level of assurance and integrity**~~			
2.~~6~~4. Type of operation	☐ VLOS ☐ BVLOS ☐ BVLOS with AO		
2.~~7~~5 Transport of dangerous goods	☐ Yes ☐ No		
2.6 Dropping material	☐ Yes ☐ No		
~~**2.8 Ground risk characterisation**~~ — ~~**2.8.1 Operational area**~~			
~~**2.8.2 Adjacent area**~~			
~~**2.9 Upper limit of the operational volume**~~			
~~**2.10 Airspace volume of the intended operation**~~	~~☐A ☐B ☐C ☐D ☐E ☐F ☐G ☐U-space ☐Other, specify~~		
~~**2.11 Residual air risk level**~~ — ~~**2.12.1 Operational volume**~~	~~☐ARC-a ☐ARC-b ☐ARC-c ☐ARC-d~~		
~~**2.11.2. Adjacent volume**~~	~~☐ARC-a ☐ARC-b ☐ARC-c ☐ARC-d~~		
2.7 Does the remote pilot control more than one UA simultaneously?	☐ No ☐ Yes, up to ______		
2.8 Type of C2 Link			
2.~~12~~9 Operations manual reference			
2.~~13~~10 Compliance evidence file reference			

3. UAS data			
3.1 Manufacturer		**3.2 Model**	
3.3 Type of UAS	~~☐Aeroplane ☐Helicopter ☐Multirotor ☐Hybrid/VTOL ☐Lighter than air / other~~ ☐ Fixed-Wing ☐ Rotorcraft – Helicopter ☐ Rotorcraft – Gyroplane ☐ VTOL capable aircraft (including multirotor) ☐ Lighter than air	**3.4 Max characteristic dimensions**	_____ m
3.5 Take-off mass	_____ kg	**3.6 Maximum operational speed**	_____ m/s (_____ kt)
3.7 Is the UAS tethered during the operation?	☐ Yes ☐ No		

3.8 Type of propulsion system	☐ Electric ☐ Combustion ☐ Hybrid, specify type: ____________________ ☐ Other, please specify: ____________________
3.~~7~~9 Serial number or, if applicable, UA registration mark	
3.~~8~~10 Type certificate (TC) or design verification report, if applicable	
3.~~9~~11 Number of the certificate of airworthiness (CofA), if applicable	
3.1~~0~~2 Number of the noise certificate, if applicable	
3.13 Remote identification	☐ Direct ☐ Network ☐ Not available
3.14 Green flashing light	☐ Yes ☐ No
~~**3.11 Mitigation of effects of ground impact**~~	~~☐ No ☐ Yes, low ☐ Yes, medium ☐ Yes, high~~
~~**3.1213 Technical requirements for containment**~~	~~☐ Basic ☐ Enhanced~~

☐ **I declare that I have:**

— procedures to ensure that security requirements applicable to the area of operations are complied with in the intended operation;

— measures to protect against unlawful interference and unauthorised access;

— procedures to ensure that all operations are in respect of Regulation (EU) 2016/679 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data. In particular it shall carry out a data protection impact assessment, when required by the National Authority for data protection in application of Article 35 of Regulation (EU) 2016/679;

— guidelines for the remote pilot(s) to plan UAS operations in a manner that minimises nuisances, including noise and other emissions-related nuisances, to people and animals.

— record of:

  — all the relevant qualifications and training courses completed by the remote pilot(s) and the other personnel in charge of duties essential to the UAS operation and by the maintenance staff, for at least 3 years after those persons have ceased employment with the organisation or have changed their position in the organisation;

  — the maintenance activities conducted on the UAS for a minimum of 3 years;

  — the information on UAS operations, including any unusual technical or operational occurrences and other data as required by the declaration or by the operational authorisation for a minimum of 3 years;

— an up-to-date list of the designated remote pilots for each flight;

— an up-to-date list of the maintenance staff employed by the operator to carry out maintenance activities.

4. Specific Operations Risk Assessment
Step #1 Operations manual

Step#1.1 Description of proposed operation including the locations	• If location-specific: Give reference to the file: ______________________________ • If location-independent: Give reference to the file: ______________________________
Step#1.2 Short description of proposed operation	
Step#1.3 Dimensions of the operational volume and the adjacent volume (Rounded up to first decimal place)	Height of the flight geography H_{FGmax} ________ m Height of the contingency volume H_{CVmax} ________ m Width of the contingency volume S_{CVmax} ________ m Width of the ground risk buffer S_{GRBmax} ________ m Height of the adjacent volume H_{AV} ________ m Width of the adjacent volume S_{AV} ________ m
Step #2 UAS intrinsic ground risk class	
Step#2.1 Type of operational areas on the ground (including flight geography, contingency volume and ground risk buffer)	☐ Controlled ground area ☐< 5 People/km² (remote) ☐< 50 People/km² (lightly populated) ☐< 500 People/km² (sparsely populated) ☐< 5000 People/km² (suburban/low density metropolitan) ☐< 50.000 People/km² (high density metropolitan) ☐> 50.000 People/km² (assemblies of people)
Step #2.2 Specify the intrinsic ground risk class	
Step #2.3 Remarks/Reasoning for Step #2 (optional)	

Step #3 Final ground risk class determination

Step #3.1 Specify the applied ground risk Mitigations (if applicable)	**M1** (A) strategic mitigation - sheltering Specify the level of robustness: ☐None ☐Low
	M1 (B) strategic mitigation – operational restrictions Specify the level of robustness: ☐None ☐Medium ☐High **M1** (C) tactical mitigation – ground observation Specify the level of robustness: ☐None ☐Low
	M2 Effects on UA impact dynamics are reduced Specify the level of robustness: ☐None ☐Medium ☐High
Step #3.2 Specify the final ground risk class	
Step #3.2 Remarks/Reasoning for Step #3 (not needed if no mitigation applied)	
Step #4 Initial air risk class	
Step #4.1 Classification of the airspace where the operation is intended to be conducted (multiple answers possible)	☐A ☐B ☐C ☐D ☐E ☐F ☐G
	☐Restricted area ☐Danger area
	☐TMZ ☐RMZ ☐ATZ
Step 4.2 Specify the initial air risk of the operational volume class and the in the block below the reasoning for choosing it	☐ARC-a ☐ARC-b ☐ARC-c ☐ARC-d

Step #4.3 Remarks/Reasoning for Step #4	
Step #5 Strategic air risk mitigations and final air risk class	
Step #5.1 Specify, if strategic mitigations of the air risk class were applied	☐Yes ☐No
Step #5.2 Residual air risk class (after strategic mitigation)	☐ARC-a ☐ARC-b ☐ARC-c ☐ARC-d
Step #5.3 Remarks/Reasoning for Step #5 (not needed if no mitigation applied)	

Step #6 TMPR and robustness level	
Step #6 Tactical mitigations performance Requirements	☐VLOS ☐BVLOS ☐No requirement (ARC-a) ☐Low (ARC-b) ☐Medium (ARC-c) ☐High (ARC-d)
Step #6.1 Remarks/Reasoning for Step #6 (optional)	
Step #7 SAIL determination	
Step #7 Specific Assurance and Integrity Level	☐SAIL I ☐SAIL II ☐SAIL III ☐SAIL IV ☐SAIL V ☐SAIL VI
Step #8 Determination of containment requirements	
Step #8.1 Containment	☐Low ☐Medium ☐High ☐Tethered

Step #8.2 Remarks/Reasoning for Step #8 (optional)

45. Remarks	
56. Declaration of compliance	
I, the undersigned, hereby declare that the UAS operation will comply with: — *any applicable Union and national regulations related to privacy, data protection, liability, insurance, security, and environmental protection;* — *the applicable requirements of Regulation (EU) 2019/947; and* — *the limitations and conditions defined in the operational authorisation provided by the competent authority.* *Moreover, I declare that the related insurance coverage, if appliable, will be in place at the start date of the UAS operation.*	
Date DD/MM/YYYY	**Signature and stamp**

Instructions for filling in the application form

If the application relates to an amendment to an existing operational authorisation, indicate the number of the operational authorisation and fill out in red the fields that are amended compared to the last operational authorisation.

1.1 UAS operator registration number in accordance with Article 14 of the UAS Regulation.

1.2 UAS operator's name as declared during the registration process.

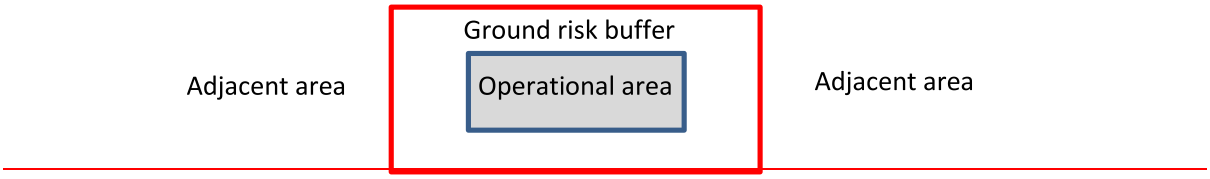
1.3 Name of the accountable manager or, in the case of a natural person, the name of the UAS operator.

1.4 Contact details of the person responsible for the operation, in charge to answer possible operational questions raised by the competent authority.

~~2.1 Date on which the UAS operator expects to start the operation.~~

2.2 Date on which the UAS operator expects to end the operation. The UAS operator may ask for an unlimited duration; in this case, indicate 'Unlimited'.

~~2.3 Location(s) where the UAS operator intends to conduct the UAS operation. The identification of the location(s) should contain the full operational volume and ground risk buffer (the red line in Figure 1). Depending on the initial ground and air risk and on the application of mitigation measures, the location(s) may be 'generic' or 'precise' (refer to GM2 UAS.SPEC.030(2)).~~



~~**Figure 1 — Operational area and ground risk buffer**~~

2.~~4~~3 Select one of the three options. If the SORA is used, indicate the version. In case a PDRA is used, indicate the number and its revision. In case a risk assessment methodology is used other than the SORA, provide its reference. In this last case, the UAS operator should demonstrate that the methodology complies with Article 11 of the UAS Regulation. In case PDRA is used section 4 of this form is not required to be completed.

~~2.5 If the risk methodology used is the SORA, indicate the final SAIL of the operation, otherwise the equivalent information provided by the risk assessment methodology used.~~

~~2.6 Select one of the two options.~~

~~2.7 Select one of the two options.~~

~~2.8 Characterise the ground risk (i.e. density of overflown population density, expressed in persons per km², if available, or 'controlled ground area', 'sparsely populated area', 'populated area', 'gatherings of people') for both the operational and the adjacent area.~~

~~2.9 Insert the maximum flight altitude, expressed in metres and feet in parentheses, of the operational volume (adding the air risk buffer, if applicable) using the AGL reference when the upper limit is below 150 m (492 ft), or use the MSL reference when the upper limit is above 150 m (492 ft).~~

~~2.10 Select one or more of the nine options. Select 'Other' in case none of the previous applies (i.e. military areas).~~

~~2.11 Select one of the four options.~~

2.~~12~~9 Indicate the OM's identification and revision number. This document should be attached to the application.

2.~~13~~10 Indicate the compliance evidence file identification and revision number. (e.g. the compliance matrix defined in chapter A4 of annex A to AMC 1 to Article 11 (SORA). This document should be attached to the application.

Section 3 may provide multiple UAS……

~~3.1 Name of the manufacturer of the UAS.~~

3.2 Model of the UAS as defined by the manufacturer.

3.3 ~~Select one of the five options.~~ Fixed wing includes configurations such as aeroplane, kites, glider etc.)

Rotorcraft helicopter includes all vertical lift configurations having up to 2 rotors.

Rotorcraft gyroplane is a special configuration with unpowered rotor

VTOL capable aircraft includes vertical-lift configurations with 3 or more rotors and fixed-wing aircraft capable of vertical take-off and landing.

Lighter than air configurations includes configurations such as airships, hot air balloons etc.

3.4 Indicate the maximum dimensions of the UA in metres (refer to definition I.141 in Annex I of AMC to Article 11 (SORA)) ~~e.g. for aeroplanes: the length of the wingspan; for helicopters: the~~

~~diameter of the propellers; for multirotors: the maximum distance between the tips of two opposite propellers) as used in the risk assessment to identify the ground risk.~~

3.5 Indicate the maximum value, expressed in kg, of the UA take-off mass (TOM), at which the UAS operation may be operated. All flights should then be operated not exceeding that TOM. The TOM may be different from (however, not higher than) the MTOM defined by the UAS manufacturer.

3.6 Maximum cruise airspeed, expressed in m/s and kt in parentheses, that the pilot will not exceed during the operation. This must always be lower than the maximum ~~as~~ defined in the manufacturer's instructions.

3.~~7~~9 This field is mandatory in case the UA is registered according to Article 14(7) of Regulation (EU) 2019/947. If the UA is not registered, the NAA may indicate the ~~U~~unique serial number (SN) of the UA defined by the manufacturer according to standard ANSI/CTA-2063-A-2019, *Small Unmanned Aerial Systems Serial Numbers*, 2019, ~~or the UA registration mark if the UA is registered~~. In case of privately built UAS or UAS not equipped with a unique SN, insert the unique SN of the remote identification system. For UAS operations classified in SAIL V or higher the serial numbers of all UAS should be provided and any change would require a prior approval from the CA. For UAS operations classified up to SAIL IV, a change in the serial number does not require a prior approval from the CA.

~~3.8 Include the EASA TC number, or the UAS design verification report number issued by EASA, if applicable.~~

3.~~9~~11 If a UAS with an EASA TC is required by the competent authority, the UAS should have a certificate of airworthiness (CofA).

3.~~10~~12 If a UAS with an EASA TC is required by the competent authority, the UAS should have a noise certificate.

~~3.11 Select one of the four options.~~

~~3.12 Select one of the two options.~~

4.Step#1.1:

- If location-specific: Please provide the geo-coordinates for each operational volume (flight geography and contingency volume), the ground risk buffer and the air risk buffer (if available) as a separate file using either .txt; .kmz or .kml
- If location-independent: Please provide a reference to the documented process for the determination of volumes and buffers and the assessment of the local conditions and their compliance limitations.

The identification of the location(s) should contain the full operational volume and ground risk buffer (the red line in Figure 1). Depending on the initial ground and air risk and on the application of mitigation measures, the location(s) may be 'generic' or 'precise' (refer to GM2 UAS.SPEC.030(2)).

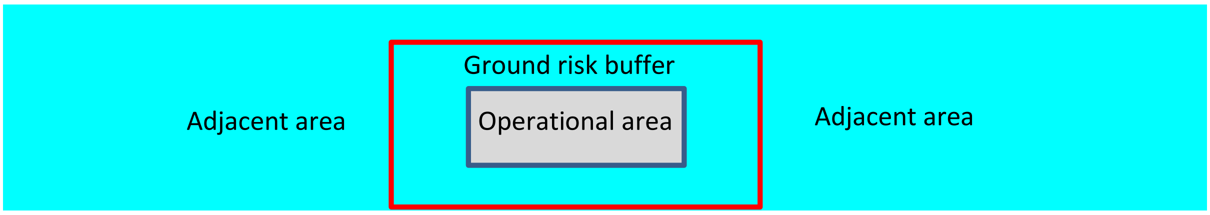


Figure 1 — Operational area and ground risk buffer

Please provide a list with the information if there are multiple locations.

4.Step#1.2 insert for example transport, inspection, filming, testing, etc.

4.Step#1.3 Please provide a list with this information if there are multiple locations.

45 Free-text field for the addition of any relevant remark.

Note 1: Section 3 may include more than one UAS. In that case, it should be filled in with the data of all the UASs intended to be operated. If needed, fields may be duplicated.
Note 2: The signature and stamp may be provided in electronic form.

AMC1 UAS.SPEC.030(3)(e) is amended as follows:

AMC1 UAS.SPEC.030(3)(e) Application for an operational authorization

OPERATIONS MANUAL — TEMPLATE

In order to comply with UAS.SPEC.030(3)(e), the OM should contain at least the information presented in AMC1 of Article 11, Annex A, chapter A.3.

~~When required in accordance with UAS.SPEC.030(3)(e), the OM should contain at least the information listed below, if applicable, customised for the area and type of operation.~~

~~0. Cover and contact.~~

~~0.1 Cover identifying the UAS operator with the title 'Operations Manual', contact information and OM revision number.~~

~~0.2 Table of contents.~~

~~**1. Introduction**~~

~~1.1 Definitions, acronyms and abbreviations.~~

~~1.2 System for amendment and revision of the OM *(list the changes that require prior approval and the changes to be notified to the competent authority).*~~

~~1.3 Record of revisions with effectivity dates.~~

~~1.4 List of effective pages *(list of effective pages unless the entire manual is re-issued and the manual has an effective date on it).*~~

~~1.5 Purpose and scope of the OM with a brief description of the different parts of the documents.~~

~~1.6 Safety statement *(include a statement that the OM complies with the relevant requirements of Regulation (EU) 2019/947 and with the authorisation or the terms of approval of the light UAS operator certificate (LUC), in the case of a LUC holder, and contains instructions that are to be complied with by the personnel involved in flight operations).*~~

~~1.7 Approval signature *(the accountable manager must sign this statement).*~~

~~**2. Description of the UAS operator's organisation** *(include the organigram and a brief description thereof).*~~

~~**3. Concept of operations (ConOps**~~

~~For each operation, please describe the following:~~

~~3.1 Nature of the operation and associated risks *(describe the nature of the activities performed and the associated risks).*~~

~~3.2 Operational environment and geographical area for the intended *operations (in general terms, describe the characteristics of the area to be overflown, its topography, obstacles etc., and the characteristics of the airspace to be used, and the environmental conditions (i.e. the weather and electromagnetic environment); the definition of the required operation volume and risk buffers to address the ground and air risks).*~~

~~3.3 Technical means used *(in general terms, describe their main characteristics, performance and limitations, including UAS, external systems supporting the UAS operation, facilities, etc.)*~~

~~3.4 Competency, duties and responsibilities of personnel involved in the operations such as the remote pilot, UA observer, visual observer (VO), supervisor, controller, operations manager, etc. *(initial qualifications; experience in operating UAS; experience in the particular operation; training and checking; compliance with the applicable regulations and guidance to crew members concerning health, fitness for duty and fatigue; guidance to staff on how to facilitate inspections by competent authority personnel).*~~

~~3.5 Risk analysis and methods for reduction of identified risks *(description of methodology used; bow-tie presentation or other).*~~

~~3.6 Maintenance *(provide maintenance instructions required to keep the UAS in a safe condition, covering the UAS manufacturer's maintenance instructions and requirements when applicable).*~~

~~**4. Normal procedures;**~~

~~*(The UAS operator should complete the following paragraphs considering the elements listed below. The procedures applicable to all UAS operations may be listed in paragraph 4.1.)*~~

~~4.1 General procedures valid for all operations~~

~~4.2 Procedures peculiar to a single operation~~

~~**5. Contingency procedures**~~

~~*(The UAS operator should complete the following paragraphs considering the elements listed below. The procedures applicable to all UAS operations may be listed in paragraph 5.1).*~~

~~**5.1 General procedures valid for all operations**~~

~~**5.2 Procedures peculiar to a single operation**~~

~~**6. Emergency procedures**~~

~~*(The UAS operator should define procedures to cope with emergency situations.)*~~

~~**7. Emergency response plan (ERP) (optional)**~~

~~**8. Security** (security procedures referred to in UAS.SPEC.050(a)(ii) and (iii); instructions, guidance, procedures, and responsibilities on how to implement security requirements and protect the UAS from unauthorised modification, interference, etc.]~~

~~**9. Guidelines to minimise nuisance and environmental impact referred to in** UAS.SPEC.050(a)(v);~~

~~**10. Occurrence reporting procedures according to Regulation (EU) No 376/2014.**~~

~~**11. Record-keeping procedures** (instructions on logs and records of pilots and other data considered useful for the tracking and monitoring of the activity).~~

AMC1 UAS.SPEC.040(1) is amended as follows:

AMC1 UAS.SPEC.040(1) Operational authorisation

OPERATIONAL AUTHORISATION TEMPLATE

The competent authority should produce the operational authorisation according to the following form:

	Operational authorisation for the 'specific' category	NAA Logo
1. Authority that issues the authorisation		
1.1 1 Issuing authority		
1.2 Point of contact **Name** **Telephone** **Email**		
2. UAS operator data		
2.1 UAS operator registration number		
2.2 UAS operator name		
2.3 Point of contact **Name** **Telephone** **Email**		
3. Authorised operation		
3.1 Authorised location(s)	☐ Generic ☐ Detailed, specify coordinates ______________________	
3.2 Extent of the adjacent area	____ km	
3.3 Risk assessment reference and revision	☐ SORA version __ ☐ PDRA # __-__ ☐ other __________	
3.4 Level of assurance and integrity	☐ SAIL I ☐ SAIL II ☐ SAIL III ☐ SAIL IV ☐ SAIL V ☐ SAIL VI	

		☐ Other ______
3.5 Type of operation		☐ VLOS ☐ BVLOS ☐ BVLOS with AO
3.6 Transport of dangerous goods		☐ Yes ☐ No
3.7 Dropping material		☐ Yes ☐ No
3.8~~7~~ Ground risk characterisation	**3. 8~~7~~.1 Operational area**	☐ controlled ground area ☐ sparsely populated area ☐ up to 5 people/km² ☐ up to 50 people/km² ☐ up to 500 people/km² ☐ populated area ☐ up to 5.000 people/km² ☐ gatherings of people ☐ up to 50.000 people/km² ☐ more than 50.000 people/km² ☐ no limit
	3. 8~~7~~.2 Adjacent area	☐ sparsely populated area ☐ up to 50 people/km² ☐ up to 500 people/km² ☐ populated area ☐ up to 5.000 people/km² ☐ gatherings of people ☐ up to 50.000 people/km² ☐ no limit Outdoor assemblies allowed within 1km of the operational volume: ☐ up to 40.000 ☐ up to 400.000 ☐ more than 400.000
3.9~~8~~ Ground risk mitigations	**3.9~~8~~.1 ~~Strategic mitigations~~ M1(A) - Sheltering**	☐ No ☐ Yes, low ☐ Yes, medium ~~☐ Yes, high~~
	3.9~~8~~.2. ~~ERP~~ M1(B) – Operational restrictions	☐ No ~~☐ Yes, low~~ ☐ Yes, medium ☐ Yes, high
	3.9.3. M1(C) – Ground observation	☐ No ☐ Yes low
	3.9.4 M2 - Mitigation to reduce effect of ground impact	☐ No ☐ Yes, medium ☐ Yes, high

3.10~~9~~ Height limit of the operational volume		_____ m (______ ft)
3.11~~0~~ Residual air risk level in the operational volume	~~**3.10.1 Operational volume**~~	☐ ARC-a ☐ ARC-b ☐ ARC-c ☐ ARC-d
	~~**3.10.2. Adjacent volume**~~	~~☐ ARC-a ☐ ARC-b ☐ ARC-c ☐ ARC-d~~
3.12~~1~~ Air risk mitigations	**3.12~~1~~.1 Strategic mitigations**	☐ No ☐ Yes If yes, please describe ________________
	3.12~~1~~.2 Tactical mitigation methods	
3.13~~2~~ Achieved level of containment		~~☐ Basic ☐ Enhanced~~ ☐ Low ☐ Medium ☐ High ☐ Tethered
3.14 Maximum number of UAS that may be simultaneously operated by a single remote pilot		
3.15 Type of C2 Link		
3.16~~3~~ Remote pilot competency		
3.17~~4~~ Competency of staff, other than the remote pilot, essential for the safety of the operation		
3.18~~5~~ Type of events to be reported to the competent authority (in addition to those required by Regulation (EU) No 376/2014)		
3.19~~6~~ Insurance		☐ No ☐ Yes
3.20~~17~~ Operations manual reference		
3.21~~8~~ Compliance evidence file reference		
3.22~~19~~ Remarks / additional limitations		

4. Data of authorised UAS			
4.1 Manufacturer		**4.2 Model**	
4.3 Type of UAS	~~☐ Aeroplane ☐ Helicopter~~ ~~☐ Multirotor ☐ Hybrid/VTOL~~ ~~☐ Lighter than air / other~~ ☐ Fixed-Wing ☐ Rotorcraft – Helicopter ☐ Rotorcraft – Gyroplane	**4.4 Maximum characteristic dimensions**	_____ m

	☐ VTOL capable aircraft (including multirotors) ☐ Lighter than air		
4.5 Take-off mass	_____ kg	**4.6 Maximum operational speed**	_____ m/s (_____ kt)
4.7 Additional technical requirements			
4.8 Serial number or, if applicable, UA registration mark			
4.9 Number of type certificate (TC) or design verification report, if required			
4.10 Number of the certificate of airworthiness (CofA), if required			
4.11 Number of the noise certificate, if required			
~~**4.12 Mitigation to reduce effect of ground impact**~~		~~☐ No ☐ Yes, low ☐ Yes, medium ☐ Yes, high~~ ~~Required to reduce the ground risk ☐ Yes ☐ No~~	
~~**4.13 Technical requirements for containment**~~		~~☐ Basic ☐ Enhanced~~ ~~☐ Low ☐ Medium ☐ High~~	
5. Remarks			
6. Operational authorisation			
_____________ (UAS operator name) is authorised to conduct UAS operations with the UAS(s) defined in Section 4 and according to the conditions and limitations defined in Section 3, for as long as it complies with this operational authorisation, with [Regulation (EU) 2019/947](), and with any applicable Union and national regulations related to privacy, data protection, liability, insurance, security, and environmental protection.			
6.1 Operational authorisation number			
6.2 Expiry date		DD/MM/YYYY	
Date DD/MM/YYYY		**Signature and stamp**	

<u>Instructions for filling in the operational authorisation form</u>

1.1 Name of the competent authority that issues the operational authorisation, including the name of the State.

1.2 Contact details of the competent authority staff responsible for the file.

2.1 UAS operator registration number in accordance with Article 14 of the UAS Regulation.

2.2 UAS operator's name, as registered in the UAS operator registration database.

2.3 Contact details of the person responsible for the UAS operation, in charge to answer possible operational questions raised by the competent authority.

3.1 Location(s) where the UAS operator is authorised to operate. The identification of the location(s) should contain the full operational volume and ground risk buffer (the red line in Figure 2). Depending on the initial ground and air risk and on the application of mitigation measures, the location(s) may be 'generic' or 'precise' (refer to GM2 UAS.SPEC.030(2)). When the UAS operation is conducted in a MS other than the State of registration, the competent authority of the MS of registration should specify the location(s) only after receiving confirmation from the State of operation, according to Article 13 of the UAS Regulation.

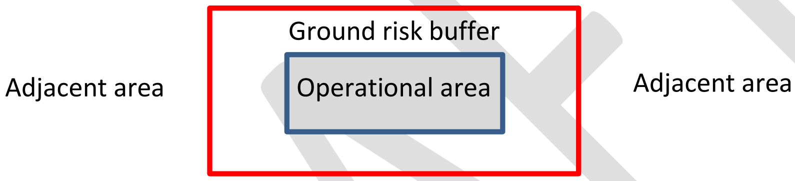


Figure 2 — Operational area and ground risk buffer

3.2 Provide the maximum distance in km to be considered for the adjacent area, starting from the limits of the ground risk buffer.

3.3 Select one of the three options. If the SORA is used, indicate the version. In case a PDRA is used, indicate the number and its revision. In case a risk assessment methodology is used other than the SORA, provide its reference. In this last case, the UAS operator should demonstrate that the methodology complies with Article 11 of the UAS Regulation.

3.4 If the risk methodology used is the SORA, indicate the final SAIL of the operation, otherwise select 'other' and provide the equivalent information provided by the risk assessment methodology used.

~~3.5 Select one of the two options.~~

~~3.6 Select one of the two options.~~

~~3.7 Characterise the ground risk (i.e. density of overflown population density, expressed in persons per km^2, if available, or 'controlled ground area', 'sparsely populated area', 'populated area', 'gatherings of people') for both the operational and the adjacent area.~~

~~3.8.1 Select one of the four options. In case the risk assessment is based on the SORA, this consists in M1(A)., this consists in M1 mitigation.~~

~~3.8.2 Select one of the four options. In case the risk assessment is based on the SORA, this consists in M1(B)., this consists in M3 mitigation.~~

3.10~~9~~. Insert the maximum flight altitude, expressed in metres and feet in parentheses, of the approved operational volume (adding the air risk buffer, if applicable) using the AGL reference when the upper limit is below 150 m (492 ft), or use the MSL reference when the upper limit is above 150 m (492 ft).

~~3.10 Select one of the four options.~~

~~3.11.1Select one of the two options.~~

3.121.2 Describe the tactical mitigation methods to be applied by the UAS operator.

~~3.12 Select one of the two options.~~

3.15 Indicate if the C2 link is based on radio line of sight, network such as LTE or 5G, SATCOM etc…

3.163 Specify the competency or the type of the remote pilot certificate, if required; otherwise, indicate 'Declared'.

3.174 Specify the competency or the type of the certificate for the staff, other than the remote pilot, essential for the safety of the operation, if required; otherwise, indicate 'Declared'.

3.185 List the type of events that the UAS operator should report to the competent authority, in addition to those required by Regulation (EU) No 376/2014, if applicable.

~~3.16 Select one of the options.~~

3.2017 Indicate the OM's identification and revision number.

3.218 Indicate the compliance evidence file identification and revision number (e.g. the compliance matrix defined in chapter A4 of annex A to AMC 1 to Article 11 (SORA).

3.2219 Additional limitations defined by the competent authority.

4. Only the UAS features/characteristics required to be used for the operation should be identified in the form (e.g. in case the UAS qualifies for enhanced containment but the operation requires a basic containment, and the operator developed consistent procedures, then the basic containment should be ticked).

4.1 Name of the manufacturer of the UAS.

4.2 Model of the UAS as defined by the manufacturer.

4.3 ~~Select one of the five options.~~ Fixed wing includes configurations such as aeroplane, kites, glider etc.

Rotorcraft helicopter includes all vertical lift configurations having up to 2 rotors.

Rotorcraft gyroplane is a special configuration with unpowered rotor.

VTOL capable aircraft (including rotorcraft) includes vertical-lift configurations with 3 or more rotors and fixed-wing aircraft capable of vertical take-off and landing.

Lighter-than-air configurations include configurations such as airships, hot-air balloons, etc.

4.4 Indicate the maximum dimensions of the UA in metres (refer to definition I.141 in Annex I of AMC to Article 11 (SORA)) ~~e.g. for aeroplanes: the length of the wingspan; for helicopters: the diameter of the propellers; for multirotors: the maximum distance between the tips of two opposite propellers) as used in the risk assessment to identify the ground risk.~~

4.5 Indicate the maximum value, expressed in kg, of the UA take-off mass (TOM), at which the UAS operation may be operated. All flights should then be operated not exceeding that TOM. The TOM maybe be different from (however, not higher than) the MTOM defined by the UAS manufacturer.

4.6 Maximum cruise airspeed, expressed in m/s and kt in parentheses, that the pilot will not exceed during the operation. This must always be lower than the maximum as defined in the manufacturer's instructions.

4.7 List any additional technical requirements established by the competent authority.

4.8 This field is mandatory only in case the UA is registered according to Article 14(7) of Regulation (EU) 2019/947.

If the UA is not registered, the NAA may not list the serial number(s). In case the NAA may indicate the Uunique serial number (SN) of the UA defined by the manufacturer according to standard ANSI/CTA-2063-A-2019, *Small Unmanned Aerial Systems Serial Numbers*, 2019, or the UA registration mark if the UA is registered. In case of privately built UAS or UAS not equipped with a unique SN, insert the unique SN of the remote identification system. For UAS operations classified in SAIL V or higher the serial numbers of all UAS should be provided and any change would require a prior approval from the CA. The list serial number(s) may also be in a separate annex or in the OM. For UAS operations classified up to SAIL IV, a change in the serial number does not require a prior approval from the CA.

4.9 Include the EASA TC number, or the UAS design verification report number issued by EASA, as required by the competent authority.

4.10 If a UAS with an EASA TC is required, the UAS should have a certificate of airworthiness (CofA), and the competent authority should require compliance with the continuing airworthiness rules.

4.11 If a UAS with an EASA TC is required, the UAS should have a noise certificate.

4.12 Select one of the options of the first row. In case the risk assessment is based on the SORA, this consists in M2 mitigation. Even if the UAS may be equipped with such system, this mitigation may not be required in the operation to reduce the ground risk. In this case, in the second row select 'NO'. If the mitigation is instead used to reduce the ground risk, select 'YES' and the operator is required to include in the OM the related procedures.

4.13 Select one of the two options.

5 Free-text for the addition of any relevant remark.

6.1 Reference number of the operational authorisation, as issued by the competent authority. The number

should have the following format:

NNN-OAT-xxxxx/yyy

Where:

— 'NNN' is the ISO 3166 Alpha-3 code of the Member State that issues the operational authorisation;

— 'OAT' is a fixed field meaning 'operational authorisation';

— 'xxxxx' are up to 12 alphanumeric characters defining the operational authorisation number; and

— 'yyy' are 3 alphanumeric characters defining the revision number of the operational authorisation;

each amendment of the operational authorisation will determine a new revision number.

6.2 The duration of the operational authorisation may be unlimited; in this case, indicate 'Unlimited'. The authorisation will be valid for as long as the UAS operator complies with the relevant requirements of the UAS Regulation and with the conditions defined in the operational authorisation.

Note 1: In section 4, more than one UAS may be listed. If needed, the fields may be duplicated.

Note 2: The signature and stamp may be provided in electronic form. The quick response (QR) code should provide the link to the national database where the operational authorisation is stored.