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

Annex to ED Decision 2025/018/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 Annex to Decision 2019/021/R of the Executive Director of the Agency of 9 October 2019 is amended as follows:

List of abbreviations

[…]

ATZ	aerodrome traffic zone
CAA	civil aviation authority
COTS	commercial off-the-shelf
CSP	comprehensive safety portfolio
CTR	controlled traffic region
CTA	controlled aerospace
FIZ	flight information zone
FTB	functional test-based
FTS	flight termination system
HF	human factors
iARC	initial air risk class
iGRC	intrinsic ground risk class
MSO	multiple simultaneous operations
RCM	remote crew member
RMZ	radio mandatory zone
SLA	service level agreement
SMS	safety management system
S&A	see and avoid
TLOS	target level of safety
TMZ	transponder mandatory zone
UTM	UAS traffic management
VHL	very-high-level airspace

[…]

GM1 AMC1 Article 11 Rules for conducting an operational risk assessment

GENERAL

[…]

~~For the purposes of the SORA, the following definitions should apply:~~

~~— ‘populated area’ should be understood as ‘congested area’, as defined in Regulation (EU) No 965/2012 (the ‘Air Operations Regulation’): ‘in relation to a city, town or settlement, any area which is substantially used for residential, commercial or recreational purposes’; and~~

~~— ‘rural area’ is used in the context of the air risk and it means the volume outside a populated area and not within the aerodrome traffic zone (ATZ) of an aerodrome.~~

[…]

AMC1 Article 11 Rules for conducting an operational risk assessment

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

Edition: September 2025

Section 0 Executive summary

S0.1 The SORA approach

The SORA process is intended to provide a risk-proportionate method for determining the evidence and assurance required for an unmanned aircraft system (UAS) to be acceptably safe when operating in the 'specific' category of UAS operations as defined in Article 3(b) of Implementing Regulation (EU) 2019/947.

The SORA process provides structure and guidance for 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 competent authority and the applicant can allocate their available resources and time proportionally to the risk of the intended UAS operation. After receiving an operational authorisation, the applicant becomes the UAS operator. For the sake of simplicity, the term 'UAS operator' is used throughout the rest of this AMC.

The SORA is a holistic safety risk management process used to evaluate the risks related to a given UAS operation and then establish proportionate requirements a UAS operation should comply with to ensure that a target level of safety (TLOS) is met. This TLOS is defined for people and aircraft that are not involved in the UAS operation and is commensurate with the existing level of safety for manned aviation. The TLOS-related values were chosen to ensure that the risk posed by UAS operations to third parties will not be greater than that posed by manned aviation, which are seen as socially acceptable values (see Section 5(f) of the Scoping Paper to AMC RPAS 1309 Issue 2[1] and Section 1.2.1 of Annex F[2] Edition 2.5):

i. for ground risk — fewer than one fatality per million hours (10^{-6} fatalities per flight hour) (for more details, see Annex F Edition 2.5[2] Section 1.2.1);

ii. for air risk — fewer than one mid-air collision per 10 million flight hours (10^{-7} mid-air collisions per flight hour) for operations that are primarily conducted under self-separation and see-and-avoid (primarily in uncontrolled airspace); for operations that are conducted with separation provided by an air navigation service provider (primarily in controlled airspace), the TLOS is one mid-air collision per billion flight hours (10^{-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, varying levels of the ability to maintain control of the operation to meet the TLOS will need to be demonstrated. To do this, the SORA has developed the specific assurance and integrity levels (SAIL), which map the maximum allowable loss-of-control rate to operational, organisational, personnel, design and production risk controls that, when implemented correctly at the required level, ensures

[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

that an operation meets the TLOS. This means that for a UAS operation conducted in a high-risk environment (e.g. over a large city near an airport) more evidence would need to be provided to the competent authority demonstrating that the operation is safe than for the same UAS operated in a low-risk environment (e.g. at a protected test range and below 30 m).

S0.2 The SORA methodology

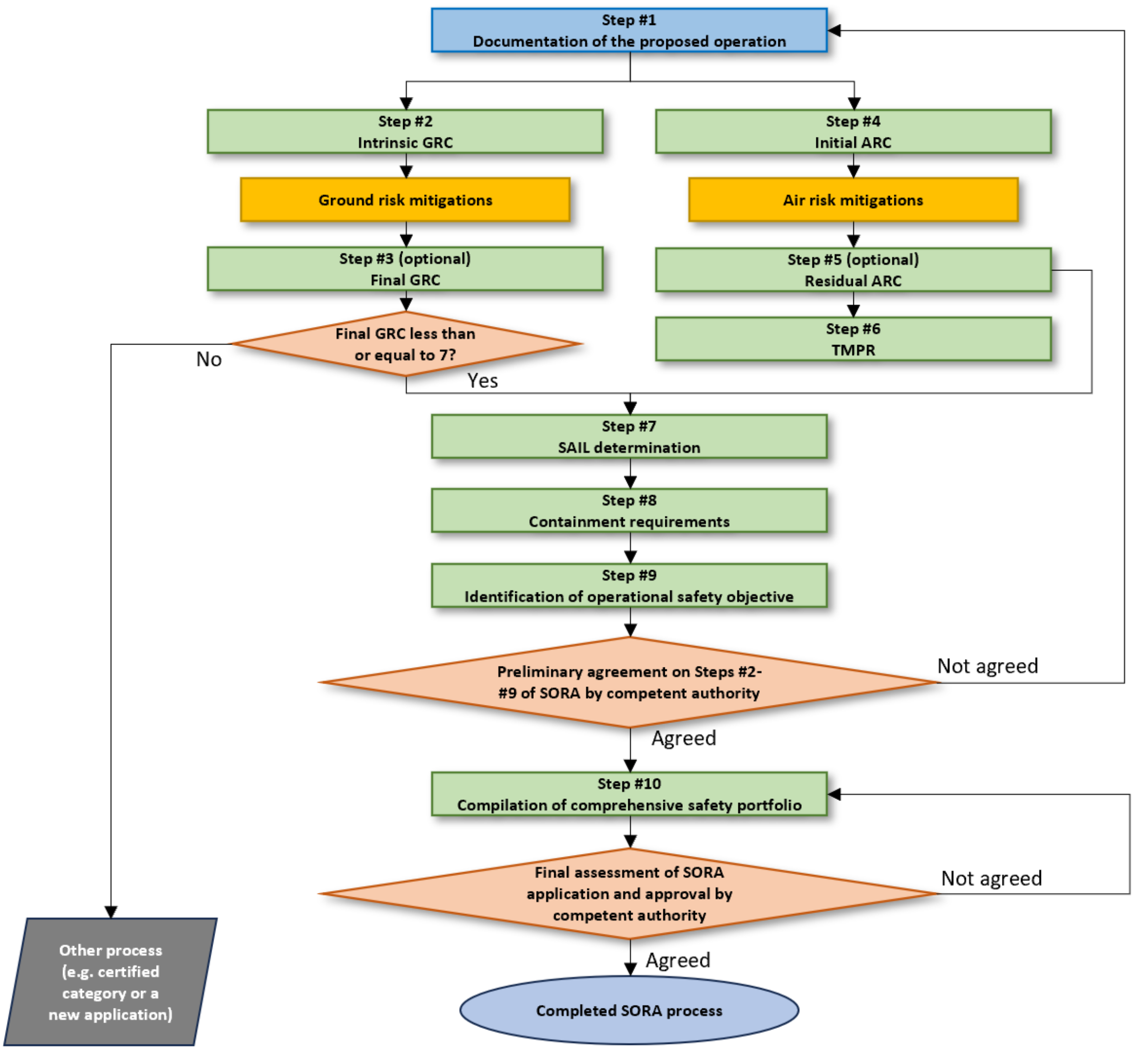

Figure 1 — The SORA process

Note: If UAS operations are conducted across different environments, some steps may need to be repeated for each particular environment (e.g. the operation includes a flight path partially in controlled and partially in uncontrolled airspace; in this case, steps #4 and #5 should be repeated for the two environments).

The SORA methodology consists of ten systematic steps:

Step #1: Documentation of the proposed operation

This is a preparatory step which is intended to ensure the UAS operator 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: Determination of the intrinsic ground risk class (iGRC)

The iGRC (scaled from 1 to 10) is determined by the UA characteristics (maximum characteristic dimension and maximum speed) as well as the population density at risk in the operational volume and ground risk buffer.

Step #3: Determination of the final ground risk class (GRC) (optional)

The final GRC is determined based on any mitigations put in place, as described in Annex B to this AMC, which may have a significant effect on the likelihood of a fatality after the loss of control of the operation, including:

(i) strategic mitigations intended to reduce the risk before the flight;

(ii) tactical mitigations intended to reduce the risk during the flight;

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

A final GRC higher than 7 is outside the scope of the SORA and should be handled in the 'certified' category of UAS operations, as defined in Article 6 of Implementing Regulation (EU) 2019/947.

Step #4: Determination of the initial air risk class (iARC)

The determination of the ARC is done in Steps #4 and #5. In Step #4, the iARC 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 the following: whether 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: Application of strategic mitigations to determine the residual air risk class (ARC)

The residual ARC is obtained after applying any relevant strategic mitigations in order to lower the iARC. Two types of strategic mitigations, 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 is controlled by the relevant authorities (e.g. U-space airspace).

Step #6: Tactical mitigation performance requirements (TMPRs) and robustness levels

Tactical mitigations for 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.

TMPRs address the functions of detect, decide, command, execute and feedback loop (see Annex D to this AMC) for each residual ARC.

Step #7: Determination of the SAIL

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

Step #8: Determination of containment requirements

The containment requirements aim to ensure that the TLOS can be met for both ground and air risk in the adjacent ground area.

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

Step #9: Identification of operational safety objectives (OSOs)

The SAILs define the level of integrity and assurance (low, medium, high) to be met for each OSO according to the criteria provided in Annex E to this AMC.

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, it may not be required to show compliance for some OSOs to the competent authority). 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 (CSP)

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

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

Section 1 Introduction

S.1.1 Preface

The SORA methodology guides both the UAS operator and the competent authority towards the determination of whether a UAS operation can be conducted safely. 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 intended UAS operation. This involves meeting or exceeding the target level of safety (TLOS) regardless of the complexity of the UAS operation, UA size, or area of operation. The TLOS of operations conducted under the 'specific' category covered by the SORA is equivalent to that of the 'open' and 'certified' categories. For this reason, it does not contain prescriptive requirements but rather safety objectives to be met at various levels of robustness commensurate with the risk of a given operation.

S.1.2 Purpose of the document

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

(d) This methodology may be applied where the traditional approach to aircraft certification (approving the design, issuing an airworthiness approval and a type certificate) may not be appropriate and proportionate to the safety risk presented for the intended operation. This methodology may also support activities necessary to determine the associated airworthiness requirements.

(e) The methodology is based on the principle of a holistic 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. The SORA then helps to evaluate the risks systematically and determine any operational limitation required for its safe operation. This method allows the UAS operator to determine acceptable risk levels and 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.

(f) The methodology, the related processes, and the values proposed in this document are intended to guide a UAS operator 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 when assessing the completeness and acceptability of an application for a UAS to be operated in the 'specific' category.

S.1.3 Applicability

(a) The methodology presented in this document is aimed at evaluating the safety risks involved in the operation of one or multiple UAS[3] of any class 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) 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 UAS operations and concurrent high-volume operators have a deconfliction strategy for their own UA.

(c) The carriage of people is outside the scope of the SORA. The carriage of dangerous goods (e.g. weapons, munitions of war, explosives, hazardous medical samples) on board the UAS that present additional hazards is excluded from the scope of this methodology and might require additional safety considerations (e.g. demonstration of the ability to contain the dangerous goods). For more information, please refer to GM1 Article 2(11).

(d) Privacy, data protection, liability, insurance, security and environmental protection are excluded from the scope of applicability of this methodology.

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

(f) The SORA can be used to obtain 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 requirements will be met for all flights performed under the operational authorisation obtained. If a UAS operator can demonstrate to have sufficient procedures in place to correctly allocate operational volumes, buffers, adjacent ground areas and airspace volumes, a generic location authorisation could be considered as described in GM2 UAS.SPEC.030(2).

S.1.4 SORA documents

The SORA consists of the following parts:

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

(b) Annex A to AMC1 to Article 11: guidelines for the UAS operator on collecting and presenting system and operation information for a specific UAS operation to the competent authority;

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

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

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

[3] Refer to definition I.94 'Multiple simultaneous UAS operations'.

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

(g) Annex F Edition 2.5[4]: theoretical basis for ground risk classification and containment requirements;

(h) Annex I to AMC1 to Article 11: glossary.

Section 2 Key concepts and definitions

S.2.1 'Risk' in the context of the SORA

(a) The definition of 'risk' used in the SORA is the combination of the frequency (probability) of an occurrence and its associated level of severity.

(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. UAS crash) that are short-lived and usually give rise to the 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 involve the potential for:

  (i) fatal injuries to third parties on the ground[5];

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

(d) As the SORA only addresses safety risks, 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.) as defined in point 2(c) of Article 12 of Implementing Regulation (EU) 2019/947.

(e) Fatal injury is a well-defined condition and known by 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 flight 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 organisations responsible for the infrastructure, as they are most knowledgeable of the threats.

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

[5] The risks to involved persons should be mitigated appropriately (e.g. through appropriate procedures). Involved persons should accept the risk of the UAS operation by informed consent and by explicitly agreeing to participate. For additional information, please refer to GM1 Article 2(18).

S.2.2 The SORA semantic model

(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 standardised use of terminology for phases of operation[6], 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.

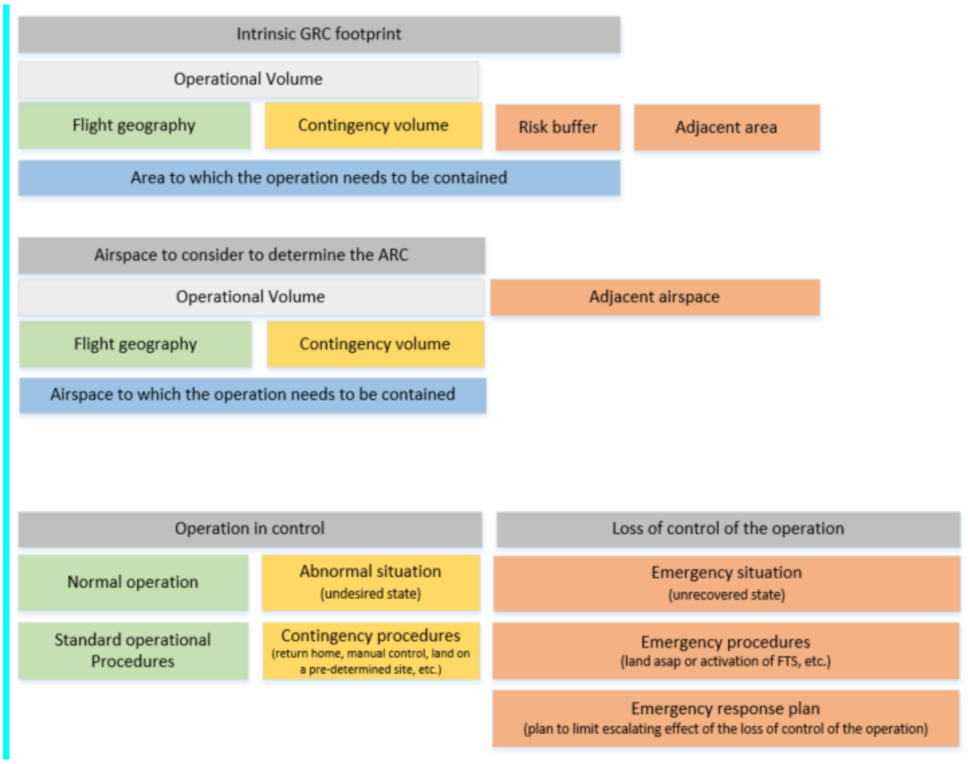

Figure 2 — The SORA semantic model

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

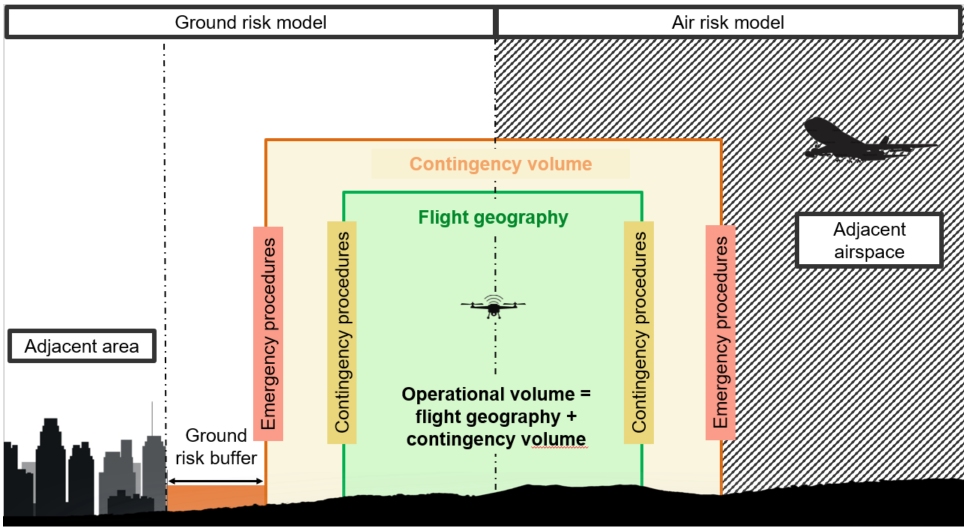

Figure 3 — Graphical representation of the SORA semantic model

(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 OSOs. The higher the SAIL score, the higher the level of integrity and assurance of the OSOs becomes, which should result in a decreased loss-of-control rate for the operation.

S.2.2.1 The operational volume

(a) 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 ground 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 to this AMC for additional information.

S.2.2.3 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 or perform a safe contingency landing. The size of the contingency volume should be determined based on the appropriate contingency procedures.

(c) The outer limit of the contingency volume should include sufficient margins for system and operational errors (refer to the definition of 'total system error' in I.139 of Annex I to this AMC).

(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 end its flight without exceeding 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 requirements 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 ground area

(a) The adjacent ground area represents the ground area adjacent to the ground risk buffer where it is reasonably expected that a UA may crash following a loss-of-control situation resulting in a fly-away.

(b) The lateral inner limit of the adjacent ground area is the outer limit of the ground risk buffer. The lateral outer limit of the adjacent ground area is computed starting from the outer limit of the contingency volume (see Figure 7).

(c) The size of the adjacent ground area depends on the UA performance. UAS operators should not design operational volume areas which are not intended for use but are only there for manipulation of the composition of the adjacent ground 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 following a loss-of-control situation resulting in a fly-away.

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

(c) The lateral outer limit of the adjacent airspace is defined by the lateral outer limit of the adjacent ground area as described in point S.4.8.3(b).

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 can manage 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 crew's duty to try to return the operation back to normal state by executing contingency procedures as soon as practically possible.

(c) Normal operation

The UAS operator utilises standard operational procedures consisting of a set of instructions covering policies, procedures and responsibilities set out by the UAS operator that support 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 operational procedures, but the safety of the aircraft and of the persons on the ground or in the air is not in immediate danger. In this case, contingency procedures should be applied. Abnormal situations require attention and corrective actions (e.g. reduced engine performance, a system failure that can be managed with the backup or redundant system, issues that do not require an immediate descent, tolerable minor flight control malfunction or navigation equipment malfunction described handled by the UAS flight manual). Abnormal situations should not be confused with emergency situations.

(ii) Contingency procedures are designed to prevent a significant event (e.g. loss of control of the operation) that has an increased likelihood to occur in the future due to the current abnormal state of the operation. These procedures should return the operation to normal state and allow the return to using standard operational procedures or allow the safe cessation of the flight.

S.2.3.2 Loss of control of the operation

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

(i) whose outcome highly relies on providence; or

(ii) which cannot be handled by a contingency procedure.

(b) In the context of the semantic model, this includes situations where a UA exits the operational volume and potentially operates 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 and 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 a 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 boundaries of the operational volume. However, as soon as the remote crew identifies a failure condition where the control of 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) minimise 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) The ERP 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 the activities needed to respond to incidents and accidents.

(f) Containment is a function that consists 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 fly-away.

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 the 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 Annexes B, C, D and E to this AMC. 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 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 requirements for the different levels of robustness. The SORA has three levels of robustness commensurate with the risk: low, medium and high.

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

(i) For **low-level assurance**, the applicant declares that the required level of integrity has been achieved. The competent authority may request relevant evidence for review (e.g. during oversight).

(ii) For **medium-level assurance**, the applicant declares that the required level of integrity has been achieved. The declaration should include a reference to the evidence and the evidence should be provided to the competent authority, unless the applicant uses a means of compliance[7] published by EASA. In this case, the applicant may not be required to submit evidence during the application process. However, the competent authority may request relevant evidence for review (e.g. during oversight).

(iii) For **high-level assurance**, the achievement of the required level of integrity is verified[8] to be acceptable by the competent authority or by an entity that is designated[9] by the competent authority.

(h) The specific criteria defined in the SORA annexes take precedence over the criteria defined in point (g).

(i) To accommodate national specificities, competent authorities may require different activities to substantiate the level of robustness. National specificities could include nationally sensitive infrastructure, protection of environmental areas, etc., and they are published by MSs as geographical zones according to Article 15 of Implementing Regulation (EU) 2019/947.

S.2.5 Roles and responsibilities

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

(a) **Applicant** — The applicant is the party that produces evidence for compliance with the operational safety objectives or mitigations. It may be the future UAS operator that seeks to obtain an operational authorisation or the organisation that designs or produces the UAS or a training organisation. Supporting material for the assessment may be provided by third parties (e.g. the designer of the UAS or the equipment, U-space service providers, etc.).

(b) **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 they are performed in accordance with the scope and limitations of the operational authorisation, based on at least the SORA compliance demonstration. The UAS operator is responsible for the safe operation of the UAS. Therefore, the compliant execution of the procedures, training and other applicable programmes as well

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[7] For example, an acceptable means of compliance (AMC).

[8] Refer to definition I.154 'Verified' of Annex I to AMC1 to Article 11.

[9] 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 grant to the designated entity the privilege to issue a certificate or an operational authorisation.

as the observation of the limitations and other requirements of the applicable concept of operations are the UAS operator's obligation.

(c) **UAS designer and UAS production organisation** — The UAS designer and the UAS 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 designer and installed by a UAS component integrator (that may also be the same entity designing the component or a different entity or the UAS operator itself). It may be expected that sometimes the design and production of the UAS or of the components is 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.) it may choose to share with one or more UAS operators or with the competent authority or with EASA to help substantiate the operator's SORA safety case. Alternatively, a design and production organisation may use the SORA process to target design objectives for specific or generic operations, tailored to the relevant SAIL. To obtain airworthiness approval(s), these design objectives could be complemented by the use of Light UAS certification specifications (CSs)[10] or industry consensus standards if they are found acceptable by EASA. The UAS designer or the UAS production organisation may also be a UAS operator (for example, during a test flight campaign).

(d) **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 Implementing Regulation (EU) 2019/947 to assess the safety case of UAS operations and to issue the operational authorisation in accordance with Article 12 of that Regulation. The competent authority may accept a UAS operator's submission of an operations manual with an associated SORA-based risk assessment. Through the SORA process, the UAS operator may need to consult with the competent authority to ensure consistent application or interpretation of individual steps. The competent authority should also oversee the UAS operator in accordance with point (h) of Article 18 of Implementing Regulation (EU) 2019/947. When required, the competent authority may decide to make use of 'recognised entities' for reviewing supporting evidence for mitigations and operational safety objectives of an application. In this case, the competent authority defines the process and the conditions on how to appoint the 'recognised entity' and the competent authority has responsibility when issuing an operational authorisation based on the recommendation provided by the 'recognised entity'. Alternatively, a competent authority may use a 'designated entity', also referred to as 'qualified entity', in accordance with Article 69 of Regulation (EU) 2018/1139. In this case, the 'designated entity' may be granted the privilege to issue the operational authorisation.

According to Article 77(1) of Regulation (EU) 2018/1139, 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 UAS design:

[10] For light UAS, please refer to *Special Condition Light UAS* at Special Condition Light UAS | EASA.

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

— M2 mitigation: criterion #1;

— TMPR (design aspects);

— verification of the system to contain the UAS to avoid 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 requirements defined by the SORA (i.e. design-related OSOs, mitigations 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[11], as defined in Article 40(1)(d) of Implementing Regulation (EU) 2019/945[12]. For the OSOs and mitigations, the competent authority may verify their compliance.

If the UAS operation is classified as SAIL IV, compliance with the design-related SORA requirements (i.e. design-related OSOs, mitigations linked with the design and containment function) should be demonstrated through a design verification report (DVR)[13] issued by EASA. Evidence of compliance with non-design-related OSOs and mitigations will be provided to the competent authority according to the level of robustness of the OSOs, which 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, as part of the operational authorisation process, a statement of compliance provided by the designer of the UAS or of a component with all OSOs and mitigations related to design.

Regardless of the SAIL defined at the end of the SORA process, when the claimed level of robustness of the mitigation M2 or of the 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 mitigation M2 and/or the containment requirements[14].

(e) **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 by the UAS operator whether the proposed operation can be safely conducted in the particular airspace the ANSP covers. Whether an ANSP approval would be required may depend on whether the particular proposed operation may be considered as being compliant with the rules of the air (thus being integrated in the airspace), national rules, or should be managed as a contained hazard (for example, through segregation according to the airspace policy of the Member State of operation)[15].

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[11] 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 of design and production organisations (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32012R0748&qid=1753894524265).

[12] 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).

[13] Design verification report | EASA

[14] If the UAS has a DVR that covers the full design, this may cover also the mitigations.

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

(f) **U-space service provider (USSP)** — USSPs are entities certified according to Implementing Regulation (EU) 2021/664[16] that provide services to support the efficient use of airspace as well as the safety of UAS operations. These services may support an operator's compliance with their safety obligation and risk analysis.

(g) **Remote pilot-in-command (RPIC)** — The remote pilot that is designated by the UAS operator as being in command of 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 pilot is responsible as RPIC.

UAS designed with a high level of automation may reduce the remote pilot's workload to the point that operations can be conducted without allowing the intervention of a remote pilot.

(h) **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 RPIC is part of the remote crew.

(i) **Maintenance staff** — Ground personnel in charge of maintaining the UAS before and after the flight in accordance with the UAS maintenance instructions.

[16] Commission Implementing Regulation (EU) 2021/664 of 22 April 2021 on a regulatory framework for the U-space (OJ L 139, 23.4.2021, p. 161) (http://data.europa.eu/eli/reg_impl/2021/664/oj).

Section 3 The SORA walk-through

This section provides a description for UAS operators of whether the SORA process applies to their operations and how to complete the required SORA steps.

S.3.1 Introduction to the SORA walk-through

(a) This section relates to how the SORA process is described in the document. The intent is to provide both the UAS operators and the competent authorities with clear guidance in terms of what is expected from the SORA process.

(b) The following headers are applied:

(i) **Outcome:** is the result achieved when the task has been completed. All outcomes are summarised in the comprehensive safety portfolio (CSP).

(ii) **Task description:** is a recommendation to be followed by UAS operators when completing the SORA process.

(iii) **Instructions:** is material provided to UAS operators to better identify and understand the steps contained in the task description.

S.3.2 Before starting the SORA process

S.3.2.1 Outcome

UAS operators will determine whether they should carry out the SORA process.

S.3.2.2 Task description

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

(i) whether the UAS operator uses a tethered aircraft for which Implementing Regulation (EU) 2019/947 does not apply[17];

(ii) whether the intended UAS operation falls under the 'open' category;

(iii) whether the intended UAS operation is covered by a standard scenario (STS) as defined by Appendix 1 to Implementing Regulation (EU) 2019/947 and the UAS bears an appropriate class identification label;

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

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[17] According to Annex I to Regulation (EU) 2018/1139, Implementing Regulation (EU) 2019/947 does not apply 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) an MTOM of not more than 1 kg.

In this case, national regulations apply.

(v) whether the operation involves the transport of people or the transport of dangerous goods posing a high risk to third parties[18]; in these cases, the operation falls under the 'certified' category;

(vi) whether the operation is subject to any local no-go criteria established by the competent authority (e.g. local conditions published by the competent authority of the State of operation).

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

S.3.3 The phases of the SORA process

(a) As part of the SORA process, it is critical to review the steps and validate the assumptions and derivations made throughout this process. The SORA process can be split into two phases (see Figure 4):

(i) Phase 1 (Step #1 to Step #9) focuses on the derivation of safety requirements and proposed means of compliance; and

(ii) Phase 2 (Step #10) focuses on compliance with the derived safety requirements from Phase 1.

(b) Upon completing Phase 1, it is advisable for the UAS operator to obtain confirmation from the competent authority regarding the correctness of the process conducted thus far. The phases ensure there is a review of the first-phase outputs for the UAS operator to determine whether 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[19].

(c) An additional benefit of the two phases is that they provide an opportunity for the UAS operator to engage 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.

[18] Refer to GM1 Article 6 for additional information.

[19] EASA created an automated platform in the IAM HUB to support UAS operators in conducting the SORA Phase 1. The platform may be reached at https://www.easa.europa.eu/en/domains/civil-drones.

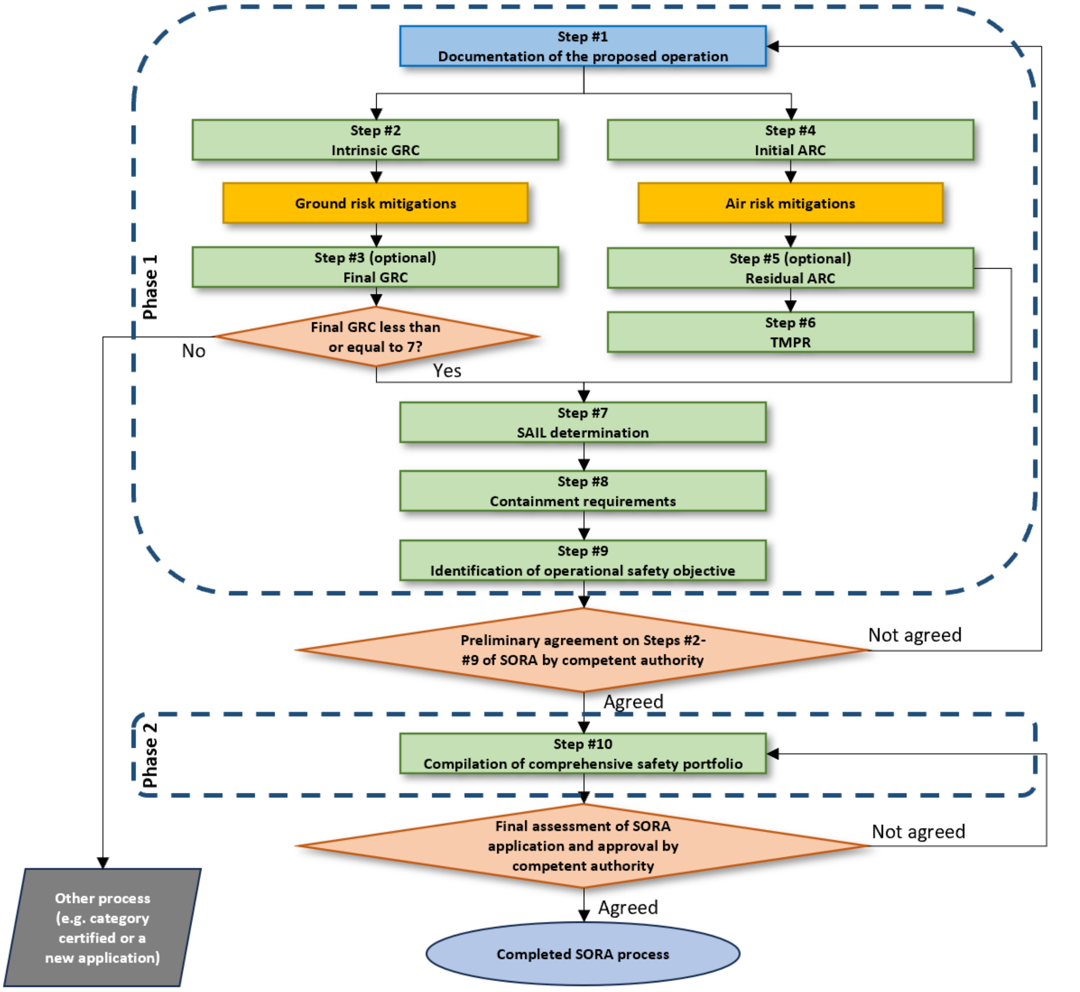

Figure 4 — The phases of the SORA process

S.3.3.1 Phase 1 (Derivation of requirements)

(a) The purpose of Phase 1 is to derive all relevant safety requirements based on the proposed operation(s) 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 UAS operator should collect explanations, but not the entire justification, of the means by which the UAS operator will demonstrate compliance with any safety claims. This can assist both the UAS operator and the competent authority in ensuring that any means of compliance proposed is/are valid and will result in satisfying the safety claims. This may take the form of an initial compliance matrix (an example is provided in Chapter A.4 of Annex A to this AMC).

(b) The results of Phase 1 may be the basis for the competent authority to conduct a preliminary evaluation. The competent authority may or may not be able to provide its formal agreement until final compliance evidence (covered in Phase 2) is submitted and reviewed.

(c) It is recommended that the UAS operator contact 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.

S.3.3.2 Phase 2 (Compliance with requirements)

(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, including evidence showing compliance with the SORA requirements.

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

Section 4 The SORA process

S.4.1 Step #1 — Documentation of the proposed operation

S.4.1.1 Introduction

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

S.4.1.2 Outcome

A sufficiently detailed operational concept that allows the UAS operator to continue through the SORA process.

S.4.1.3 Task description

(a) Compilation of operational, technical and organisational information. Such information may include:

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

(A) the intrinsic GRC (i.e. population density maps, information on land use),

(B) the initial ARC (i.e. information on airspace use, aerodromes, and airspace charts), and

(C) the adjacent ground areas;

(ii) information about the operational, technical and organisational elements of:

(A) the intended operation and functions during flight, including intended flight profiles, states and modes that provide for 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 the initial air risk.

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

(c) The UAS operator may use Chapter A.3 of Annex A to this AMC to gain an understanding of the type of data that needs to be presented, and any other information that supports the risk assessment, to the competent authority.

S.4.2 Step #2 — Determination of the intrinsic ground risk class (iGRC)

S.4.2.1 Introduction

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

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

S.4.2.2 Outcome

Calculation and documentation of the iGRC.

S.4.2.3 Task description

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 aircraft, rotorcraft-helicopters, rotorcraft-gyroplanes, VTOL-capable aircraft (including multirotors)[20].

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[20] For lighter-than-air configurations, the UAS operator may propose a GRC based on the model defined in Annex F Edition 2.5, available at http://jarus-rpas.org/wp-content/uploads/2024/06/SORA-v2.5-Annex-F-Release.JAR_doc_29pdf.pdf.

UAS iGRC						
Maximum UA characteristic dimension		1 m	3 m	8 m	20 m	40 m
and						
Maximum speed		*25 m/s*	*35 m/s*	*75 m/s*	*120 m/s*	*200 m/s*
Maximum iGRC population density (people/km^2)	**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 single UA with a take-off mass less than or equal to 250 g and having a maximum speed less than or equal to 25 m/s is considered to have an iGRC of 1 regardless of population density, unless operating over assemblies of people[21].

— A UA that is not expected to penetrate a standard dwelling will get a −1 GRC reduction in Step #3 from the M1(A) sheltering mitigation when not flying over large outdoor assemblies of people and most of the people overflown are protected by adequate structures; see Annex B of this AMC for additional details.

Table 1 — Intrinsic ground risk class (GRC) determination

(e) For UA with a maximum characteristic dimension greater than 40 m, the iGRC should be calculated following the guidance in Appendices A and B to Annex F Edition 2.5[22].

S.4.2.4 Instructions

UA characteristics

(a) For maximum UA characteristic dimension examples, refer to the definition of 'UA characteristic dimensions' in I.141 of Annex I to this AMC.

(b) Maximum speed

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

[21] Additional information may be found in Appendix II to NPA 2017-05 (B) 'Introduction of a regulatory framework for the operation of drones — Unmanned aircraft system operations in the open and specific category' (https://www.easa.europa.eu/en/downloads/22496/en).

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

(ii) This is not the flight-specific maximum commanded airspeed of the UA as reducing the flight airspeed may not necessarily reduce the impact area[23]. Mitigations that limit airspeed below the maximum speed value during an impact can be considered in Step #3, referring to Annex B to AMC1 Article 11.

iGRC Footprint

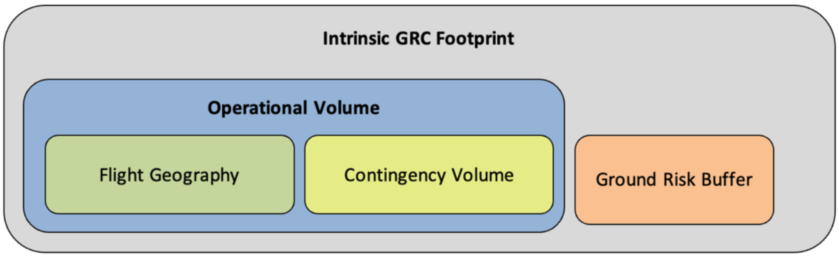

Figure 5 — Visualisation of the iGRC footprint

(c) The UAS operator should have defined the area at risk when conducting the operation. This is defined as the iGRC footprint. It is composed of the operational volume plus the ground risk buffer as shown in Figure 5 above.

(d) The operational volume is composed of the flight geography and the contingency volume (refer to Sections S.2.2.1, S.2.2.2 and S.2.2.3 respectively for additional information). To determine the operational volume, the UAS operator 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 considered when determining the operational volume.

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

Identification of the iGRC

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

(b) The UAS operator may provide substantiation to the competent authority for a different iGRC. See Appendix A of Annex F Edition 2.5[24] for further guidance.

(c) UAS operations that do not have a corresponding iGRC (i.e. grey cells on the table) are outside the scope of the SORA methodology. In this case, UAS operators should consider the 'certified' category.

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[23] The reduction may not be guaranteed in case of a loss of control of the UA.
[24] http://jarus-rpas.org/wp-content/uploads/2024/06/SORA-v2.5-Annex-F-Release.JAR_doc_29pdf.pdf

(d) If population density values are not available or not accurate, the UAS operator may use qualitative descriptors for the iGRC table; the following approximations may 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 uninvolved people are not allowed to enter. Refer to point (21) of Article 2 of Implementing Regulation (EU) 2019/947 and related GM1.
< 5	Remote	Areas where people may be, such as forests, deserts, large farm parcels, etc. Areas where there is approximately one 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	Refer to point (3) of Article 2 of Implementing Regulation (EU) 2019/947 and related GM1.

Table 2 — Correspondence between quantitative and qualitative assessment of the iGRC

Ground risk buffer

(a) An appropriate initial ground risk buffer should be defined considering the principles outlined in criterion #3 of Section E.4 of Annex E of this AMC:

(i) with the 1-to-1 principle[25]; or

(ii) a different ground risk buffer value may be proposed by the UAS operator using the principles outlined in Section 4, criterion #3 of Annex E of this AMC.

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

[25] For the evaluation of the size of the ground risk buffer based on the 1:1 principle, see Section A.5.2.4 of Annex A.

(i) medium and high level of containment[26];

(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 of how the UAS operator will ensure control of the ground area during operation.

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 significant effect on the iGRC. Such cases may not be well represented in the iGRC table and may lead to an increase or decrease in the iGRC. See Section 1.8 of Annex F Edition 2.5[27] for further guidance.

(b) A UAS operator may consider that the iGRC is too conservative for its UA. Therefore, a UAS operator may decide to calculate the iGRC by applying the mathematical model defined in Section 1.8 of Annex F Edition 2.5[26]. 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 this AMC. An automatic tool to calculate the critical area of a UA is available on the EASA website[28].

Information on population density

(a) Determining the population density to calculate the iGRC in Step #2 should be done using maps with appropriate grid size based on the intended 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 competent authority, the qualitative population density descriptors (see Table 3) may be used to estimate the population density band in the operational volume and the ground risk buffer. Alternatively, the competent authority may require, or permit, UAS operators to provide appropriate population density maps. Table 4 below presents the suggested optimal grid size for different maximum heights of the operational volume.

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[26] For additional information, refer to criterion #3 in Chapter E.4 of Annex E.

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

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

Max. height (AGL) of the operational volume		Suggested optimal grid size (metre × metre)
Feet	Metres	
500	152	200 × 200
1 000	305	400 × 400
2 500	762	1 000 × 1 000
5 000	1 524	2 000 × 2 000
10 000	3 048	4 000 × 4 000
20 000	6 096	5 000 × 5 000
60 000	18 288	10 000 × 10 000

Table 4 — Suggested grid size for population density 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 competent 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 UAS operator identifies inaccuracies in the designated static population density map, it can provide alternative data (for example, by using other mapping products, satellite imagery, on-site inspections, local knowledge of the area, etc.) that demonstrates the correction in the estimated average population density of the area. If accepted by the competent authority, the UAS operator may use the alternative data to determine the iGRC. Use of time-based restriction arguments (e.g. flying at night) for the reduction of the number of people at risk on the ground are addressed in SORA Step #3.

(e) Additional information may be found in Section 3.2 of Annex F Edition 2.5[29].

S.4.3 Step #3 — Final ground risk class (GRC) determination (optional)

S.4.3.1 Introduction

(a) The intrinsic risk of a person being struck by a UA during the 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.

S.4.3.2 Outcome

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

(b) Identification of the applicable mitigations.

(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).

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

S.4.3.3 Task description

(a) Identify the applicable mitigations listed in Table 5 that could lower the iGRC of the iGRC footprint. All mitigations should 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**[30]
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 the determination of the final GRC

(b) Identify in Annex B to AMC1 Article 11 the requirements to be complied with in order to receive appropriate credit for the mitigation.

(c) If an M2 mitigation that affects the UA's descent behaviour is used, assess whether 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.

S.4.3.4 Instructions

Ground risk mitigations

(a) Step #3 is optional.

(b) The mitigations used to modify the iGRC have a direct effect on the safety objectives associated with an operation. 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 should be applied in numeric sequence to perform the assessment. Annex B to this AMC 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 population at risk 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

[30] The competent authority may decide to require UAS operators to use static population density maps augmented with the identification of the areas where the population density data is most probably incorrect and provide a corrective value (e.g. static population density maps may use as source census data where typically commercial, recreational, industrial and other areas are defined as unpopulated even if during some part of the day they may have a high population density value). In this case, the UAS operator may be allowed to claim a reduction of the iGRC higher than 2.

mitigations are applied. Such quantitative criteria should be used to validate the risk reduction that is claimed when applying Annex B to this AMC.

(e) In rare situations, iGRC reductions greater than the ones shown in Table 5 may be possible. Refer to Annex B to this AMC 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) If 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 mitigations.

(h) Additional information may be found in Chapter A.3 of Annex A to this AMC regarding guidance on presenting the data that supplements the risk assessment to the competent authority.

What if the final GRC is greater than 7?

If the final GRC is greater than 7, the operation is considered to pose a greater risk than the SORA is designed to support. The UAS operator may consider other options such as using the 'certified' category or changing the characteristics of the UAS operation in Step #1 (as stated in Figure 1).

S.4.4 Step #4 — Determination of the initial air risk class (iARC)

S.4.4.1 Introduction to the air risk assessment process

(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 iARC. The iARC may be modified (lowered) by applying strategic and tactical mitigations. An example of strategic mitigations to reduce mid-air collision risk may be by operating during certain times or within certain boundaries. After applying strategic mitigations, any residual mid-air collision risk is addressed by means of tactical mitigations.

(b) Tactical mitigations take the form of detect-and-avoid systems or alternative collaborative means, such as ADS-B, systems transmitting on the SRD 860 frequency band, U-space services[31] or operational procedures. Depending on the residual mid-air collision risk, 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 (e.g. ANSP or U-space service provider) for the airspace it intends to operate 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 the ANSP may impose additional strategic or tactical mitigations on airspace authorisations, taking into account uncertainties relating 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 airspace.

[31] Some U-space services could also be used as strategic mitigations.

Therefore, technical solutions that improve the electronic conspicuousness or detectability of the UAS are recommended.

S.4.4.2 Outcome

(a) Identification of the risk of mid-air collision between the UA and a manned aircraft.

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

S.4.4.3 Task description

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 exceeds 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 whether there are official airspace collision risk maps available. The competent authority or the ANSP may elect to directly map the airspace collision risks using airspace characterisation studies. These maps would directly show the initial/residual air risk class (ARC) for a particular airspace. If the competent authority, the ANSP or the U-space service provider provides an air collision risk map (static or dynamic), the UAS operator should use that service to determine the initial/residual ARC and go directly to Section S.4.5 'Application of strategic mitigations' to reduce the iARC, provided that a further reduction is still possible.

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

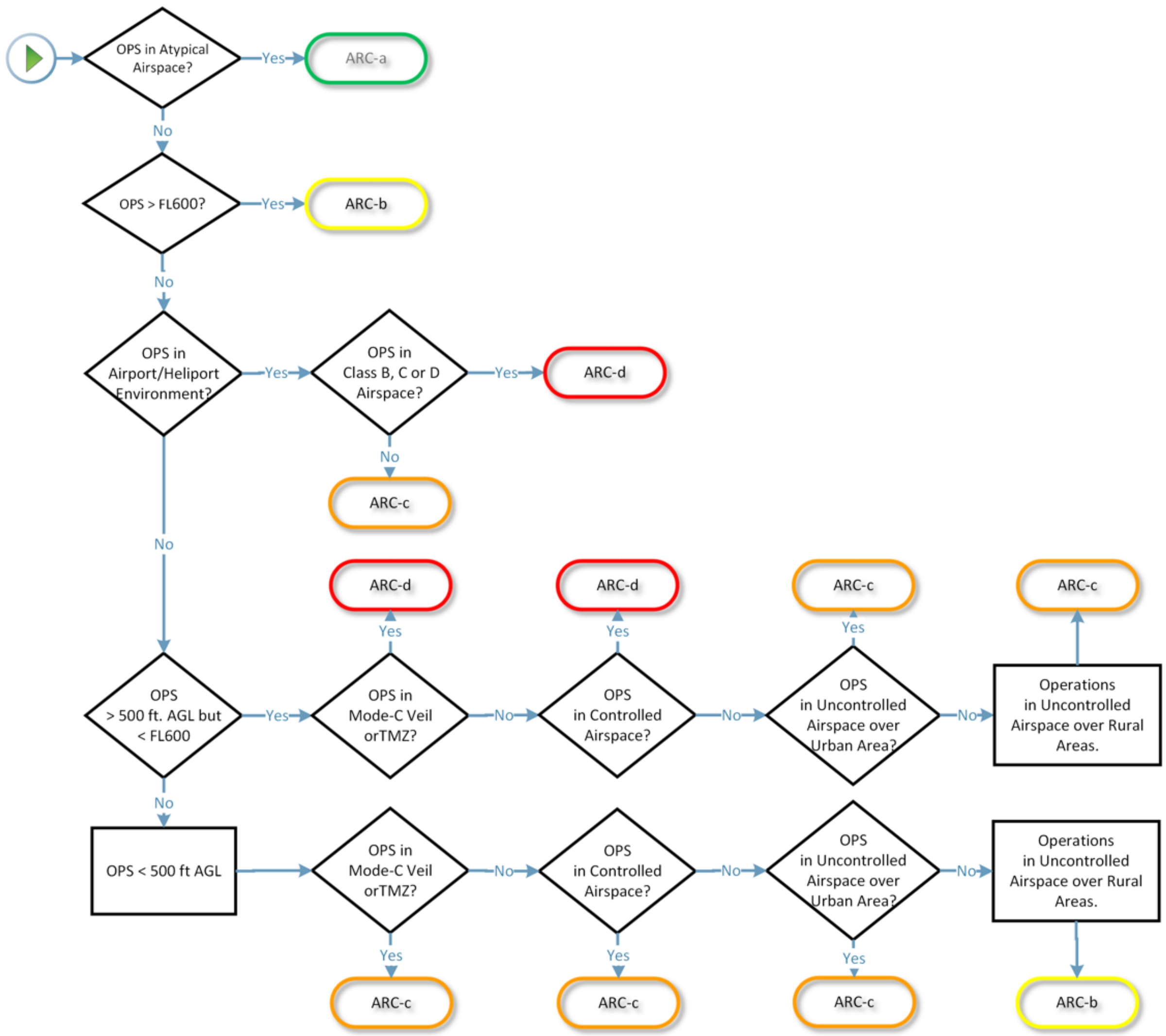

Figure 6 — ARC assignment process

S.4.4.4 Instructions

Identification of the iARC

(a) As seen in Figure 6, the airspace is categorised into 12 aggregated collision risk categories. These categories are characterised 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 non-mitigated collision risk that is elaborated in Annex C to this AMC.

(b) During a UAS operation, the operational volume may span many different airspace environments. The UAS operator should conduct 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 this AMC.

(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. The actual collision risk for 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 Step #5 in Section S.4.5).

(d) Although the non-mitigated 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 the 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's initial ARC to a level which is higher than that indicated in Figure 6. The ANSP should be consulted to assure that the assumptions related to the operational volume are accurate.

(e) The competent authority may designate parts of its airspace as atypical. ARC-b, ARC-c and ARC-d generally define airspace with an 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 planned 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 application of any tactical mitigations. This is usually the case when it can be generally expected that no manned aircraft use the airspace volume that is intended for the operation.

(b) Examples may include operation in reserved or restricted airspace (e.g. by means of a temporary segregated airspace), or operation at very low altitudes (including in close proximity to obstacles) in those areas where manned aircraft generally do not operate[32].

S.4.5 Step #5 — Application of strategic mitigations to determine residual ARC (optional)

S.4.5.1 Introduction

(a) The ARC is a qualitative classification of the rate at which a UA would encounter a manned aircraft in a given airspace environment. However, it is recognised that the operational volume may have a collision risk that differs from the iARC assigned.

(b) If the UAS operator considers that the iARC assigned is too high for the condition in the local operational volume, then refer to Annex C to this AMC for the ARC reduction process.

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

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[32] Refer to definition I.19 'Authority' in Annex I to AMC1 to Article 11.

S.4.5.2 Outcome

(a) Identification of the strategic mitigations applied to reduce the iARC 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

(a) Identify the applicable strategic mitigations listed in Section 5 of Annex C to this AMC.

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

(c) Refer to Chapter A.3 of Annex A to this AMC for further guidance on how to present the data that supplements the risk assessment to the authority.

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

S.4.5.4 Instructions

Application of strategic mitigations

For VLOS operations, or for BVLOS 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 from the remote pilot or from one airspace observer that is able to scan the sky and communicate in real time with the remote pilot informing them of possible other manned or unmanned aircraft flying in the area of operation[33]), the initial ARC can be reduced by one class. In these conditions, the crew is assumed to have the ability to assess other aircraft activity in the airspace concerned and therefore is able to lower the encounter rate by applying this mitigation both before and during the operation. The mitigation cannot be used to reduce the ARC to ARC-a. In ARC-d environments, agreement with ATC may be required[34].

S.4.6 Step #6 — Tactical mitigation performance requirement (TMPR) and robustness levels

S.4.6.1 Introduction

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

S.4.6.2 Outcome

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

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

S.4.6.3 Task description

Identify whether flying in VLOS, BVLOS or BVLOS with AOs.

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33 This type of operations is sometimes referred to as 'EVLOS'.

34 This information will be reflected in a future version of Annex C.

VLOS operations or BVLOS with airspace observers (AOs)

(a) Develop and document a VLOS deconfliction 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. If the remote pilot relies on AOs for detection, 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 this AMC.

Refer to Chapter A.3 of Annex A to this AMC for further guidance on how to present the data that supplements the risk assessment to the authority.

Residual ARC	TMPR and corresponding level of robustness
ARC-d	High
ARC-c	Medium
ARC-b	Low
ARC-a	No requirement

Table 6 — Tactical mitigation performance requirements (TMPR) and assignment of the TMPR level of robustness

S.4.6.4 Instructions

Application of tactical mitigations

Tactical mitigations will take the form of either 'see and avoid' (i.e. operations in 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 AMC1 Article 11 provides the method for applying tactical mitigations.

VLOS operations or BVLOS with airspace observers (AOs)

(a) VLOS operations or BVLOS with AOs are 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 flight segments, those segments flown in VLOS or in BVLOS with AOs do not have to meet the TMPR nor the TMPR robustness requirements, whereas those flown in BVLOS do need to meet the TMPR and the TMPR robustness requirements.

(d) In general, the VLOS requirements are applicable when one or more airspace observers are employed. In this case, additional requirements beyond VLOS should be proposed, including the definition of procedures and phraseology. The communication latency between the remote pilot and the airspace observer(s) should be less than 15 seconds.

(e) For BVLOS operations with AOs, it is assumed that an airspace observer is not able to detect traffic beyond 2 NM (approximately 3,7 km). (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 the procedures accordingly.

Tactical mitigation performance requirement (TMPR) levels

(a) **High TMPR (ARC-d)**: The ARC-d level is assigned to 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 level is also high. In such airspace, the UA may be operating in integrated airspace (e.g. integrated with manned aircraft) 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. These are the same requirements as 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 encountering manned aircraft and/or where the available strategic mitigations have medium robustness. Operations with a medium TMPR will likely be supported by systems currently used in aviation to aid the remote pilot in detecting other manned aircraft or by systems which are designed to support aviation and which are built to a corresponding level of robustness. Traffic avoidance manoeuvres for a medium TMPR 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 a 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 technologies that are designed to aid the remote pilot in detecting other traffic, but which may be built to lesser standards. For example, for operations below 500 ft 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 UA 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 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 this AMC provides information on how to satisfy the TMPR based on the available tactical mitigations and the TMPR level of robustness.

Guidance on airspace/operational requirements

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

(b) The operator and the competent authority need to be aware that ARCs are a generalised qualitative classification of collision risks. 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 the 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 airspace, operational and equipment requirements which have a direct impact on the collision risk of all aircraft that operate in a particular airspace volume. Some of these requirements are general and apply to all airspace volumes, while some are local and are required only for a particular airspace volume. 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 UAS operator 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 UAS operations in a given airspace volume without the UAS being equipped with the required equipment for operations in that airspace volume (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, in an airport/heliport environment or in a Transponder Mandatory Zone (TMZ) will likely require prior approval from the ANSP. The UAS operator should ensure that it coordinates with the relevant ANSP/authority prior to commencing operations in these environments.

S.4.7 Step #7 — Determination of the specific assurance and integrity level (SAIL)

S.4.7.1 Introduction

(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 remain in control.

S.4.7.2 Outcome

Identification of the SAIL.

S.4.7.3 Task description

Identify the SAIL associated with the proposed operation deriving it from the final GRC and the 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 3 — SAIL determination

S.4.7.4 Instructions

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

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

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

(ii) the description of activities that might support compliance with the OSOs; and

(iii) the evidence that indicates the OSOs have been satisfied.

S.4.8 Step #8 — Determination of the containment requirements

S.4.8.1 Introduction

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

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

(c) There are three possible levels of robustness for containment: 'low', 'medium' and 'high', each with a set of safety requirements described in Annex E to this AMC.

S.4.8.2 Outcome

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

(b) A derived level of robustness for containment.

S.4.8.3 Task description

(a) If the UA has a take-off mass of less than 250 g, apply low containment with no required operational limitations for the population in the adjacent ground area and go to Step #9. Otherwise, apply point (b).

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

(i) calculate the size of the adjacent ground area for the operation; the lateral outer limit of the adjacent ground area is calculated from the operational volume as the distance flown by the UA in 3 minutes at maximum speed:

(A) if the distance is less than 5 km, use 5 km;

(B) if the distance is between 5 and 35 km, use the distance calculated;

(C) if the distance is greater 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 ground area;

(iii) develop procedures to assess the potential 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 limitations appropriate for the UAS operation using the columns in Tables 8 to 13.

(i) Choose an operational limitation for the acceptable average population density in the established adjacent ground area.

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

(d) Use Tables 8 to 13 to identify the required containment robustness level based on the characteristic dimension of the UA and the SAIL of the operation, considering the most stringent between the value of the average population density and the outdoor assembly of people.

1 m UA (< 25 m/s) Sheltering assumed applicable for the UA in the adjacent ground area[35]			
Average population density allowed	No upper limit		< 50 000 people/km^2
Outdoor assemblies allowed within 1 km of the operational volume	> 400k	Assemblies of 40k to 400k	Assemblies of < 40k
SAIL			
I & II	High	Medium	Low
III	Medium	Low	Low
IV, V -& VI	Low	Low	Low

Table 8 — Containment requirements for a UA up to 1 m UA with shelter assumption

[35] Refer to Table B.2 'Level of integrity assessment criteria for M1(A) mitigation' of Annex B to AMC1 Article 11 for guidance on how to evaluate the applicability of the sheltering effect.

3 m UA (< 35 m/s) Shelter assumed applicable for the UA in the adjacent ground area[32]				
Average population density allowed	No upper limit		< 50 000 people/km²	< 5 000 people/km²
Outdoor assemblies allowed within 1 km of the operational volume	> 400k	Assemblies of 40k to 400k	Assemblies of < 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 requirements for a UA up to 3 m with shelter assumption

3 m UA (< 35 m/s) Shelter assumed **not** applicable for the UA in the adjacent ground area				
Average population density allowed	No upper limit	< 50 000 people/km²	< 5 000 people/km²	< 500 people/km²
Outdoor assemblies allowed within 1 km of the operational volume	> 400k	Assemblies of 40k to 400k	Assemblies of < 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 requirements for a UA up to 3 m without shelter assumption

8 m UA (< 75 m/s) Sheltering assumed **not** applicable for the UA in the adjacent ground area					
Average population density allowed	No upper limit	< 50 000 people/km²	< 5 000 people/km²	< 500 people/km²	< 50 people/km²
Outdoor assemblies allowed within 1 km of the operational volume	> 400k	Assemblies of 40k to 400k	Assemblies of < 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 requirements for a UA up to 8 m

20 m UA (< 120 m/s) Sheltering assumed **not** applicable for the UA in the adjacent ground area					
Average population density allowed	No upper limit	< 50 000 people/km²	< 5 000 people/km²	< 500 people/km²	< 50 people/km²
Outdoor assemblies allowed within 1 km of the operational volume	> 400k	Assemblies of 40k to 400k	Assemblies of < 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 requirements for a UA up to 20 m

< 40 m UA (< 200 m/s) Sheltering assumed **not** applicable for the UA in the adjacent ground area					
Average population density allowed	No upper limit	< 50 000 people/km²	< 5 000 people/km²	< 500 people/km²	< 50 people/km²
Outdoor assemblies allowed within 1 km of the operational volume	> 400k	Assemblies of 40k to 400k	Assemblies of < 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 requirements for a UA up to 40 m

(e) Ensure the operation complies with the containment requirements listed in Annex E Section 4.

S.4.8.4 Instructions

Refer to Chapter A.3 of Annex A to this AMC for further guidance on how to present the data that supplements the risk assessment to the competent authority.

Adjacent ground area

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

(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) As regards the situation in point (b), the direction and duration of the fly-away is assumed to be random, thus the average population density of the adjacent ground 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 limitations can be assured.

Calculating the size of the adjacent ground area

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

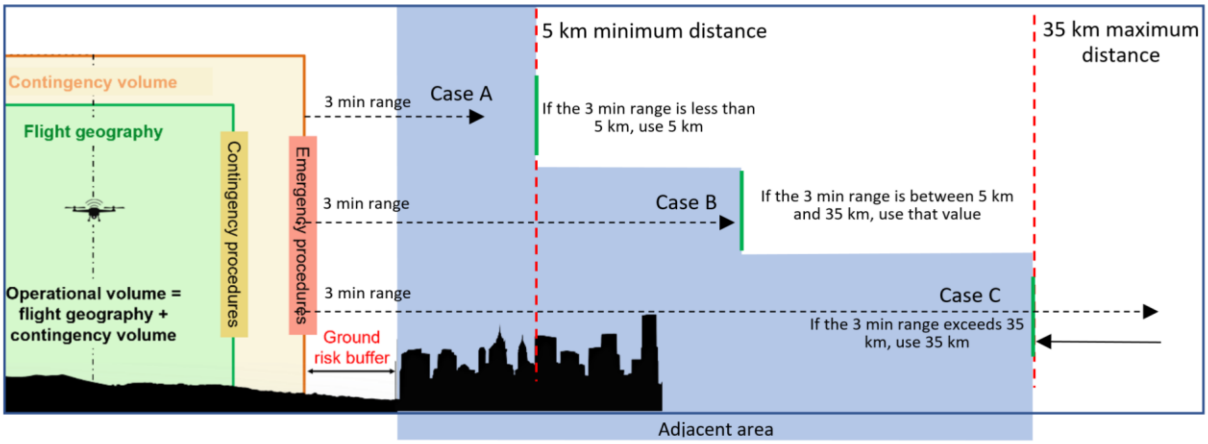

Figure 7 — Lateral limits — Adjacent ground area

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

Adjacent ground area containment requirements

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

(i) select the correct table based on the maximum characteristic dimensions of the UA used in Step #2;

(A) for a 3 m UA determine whether sheltering can be applied in the adjacent ground area, using similar considerations applied in Step #3;

(B) if sheltering applies for a UA greater than 3 m, the operator may use Annex F Edition 2.5[36] to apply the credit and determine the appropriate containment requirements;

(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 ground area population density;

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

(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 UA with a maximum speed of 30 m/s, sheltering is applicable, the outer limit of the adjacent ground area is 5.4 km from the boundary of the operational volume. An assessment of the adjacent ground area shows no large outdoor assemblies of people within 1 km and such area spans mostly rural and suburban areas, expecting an average population density between 1–4k people/km^2. This results in low containment requirements. If the UAS operator decides to use a UA with low containment, the operator should document the operational limitations for the low containment SAIL III UA:

(i) no assemblies of people > 40k within 1 km of the operational volume;

(ii) the adjacent ground area (5.4 km from the operational volume) average population density should not exceed 50 000 people/km^2.

Operational limitations regarding adjacent ground area

(a) The UAS operator should define operational limitations that 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 outdoor assemblies of people in excess of the operational limitations within 1 km of the outer limit of the operational volume. The values for the size of assemblies of people are to be understood as rough order of magnitude guidelines since measuring the actual values is not practical.

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

Inclusion of the containment feedback loop into the definition of the ground risk buffer and operational volume

(a) If the UAS operator determines that a medium or high robustness containment is required for its operational objectives, there might be a recursive effect. If a high level of containment is required, the calculation of the ground risk buffer size may need to be repeated using the requirements defined in criterion #3 of Chapter E.4 of Annex E to this AMC. It is possible that this results in a bigger ground risk buffer size compared to the one defined by the UAS operator in Step #1.

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

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

Containment requirements for adjacent airspace

By containing the flight within 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 to be conducted adjacent to all airspace volumes.

S.4.9 Step #9 — Identification of the operational safety objectives (OSOs)

S.4.9.1 Introduction

This step of the SORA process is to map the operation's SAIL score to the required levels of robustness of the OSOs.

S.4.9.2 Outcome

(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 requirements.

S.4.9.3 Task description

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

OSO ID		SAIL						Dependencies (Criteria references as per Annex E)		
		I	II	III	IV	V	VI	Operator	Training organisation	Designer
OSO #01	Ensure that the UAS operator is a competent and/or proven organisation	NR	L	M	H	H	H	x		
OSO #02	UAS designed and produced by a competent and/or proven organisation	NR	NR	L	M	H	H			x[37]
OSO #03	UAS maintenance	L	L	M	M	H	H	Crit. #2 Crit. #3		Crit. #1
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	L	M	H	H			x
OSO #06	C3 link characteristics (e.g. performance spectrum use) are appropriate for the UAS operation	NR	L	L	M	H	H	Crit. #1		Crit. #2
OSO #07	Conformity check of the UAS configuration	L	L	M	M	H	H	x		
OSO #08	Operational procedures are defined, validated and adhered to	L	M	H	H	H	H	Crit. #2 Crit. #3 Crit. #4		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 for the UAS 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		

[37] Annex E of this AMC includes requirements for both design and production organisations.

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 intended UAS operation	NR	L	L	M	M	H			x
OSO #23	Environmental conditions for safe operations defined and measurable	L	L	M	M	H	H			x
OSO #24	UAS designed and qualified to operate in adverse environmental conditions	NR	NR	M	H	H	H			x

Table 14 — Recommended operational safety objectives (OSOs)

(b) Refer to Annex E to this AMC for the integrity and assurance requirements of each OSO based on its level of robustness:

(i) identify the requirements for procedures and document them accordingly;

(ii) identify the technical requirements for the UAS and document them accordingly;

(iii) identify the training requirements for the personnel essential for the safety of the operation and document them accordingly.

(c) For OSO #5, see further guidance in Annex E to this AMC regarding UAS designs that employ novel or complex features for which very limited operational experience is available and are intended to be operated in SAIL II.

S.4.9.4. Instructions

(a) Table 14 is a consolidated list of common OSOs that historically have been used to ensure safe UAS operations. It represents the gained 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 with all OSOs, some of the evidence may be developed by other organisations such as the UAS designer or the training organisation, 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 encouraged 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 (CSP)

S.4.10.1 Introduction

(a) The final step of the SORA involves the compilation of the 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

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

(b) By documenting all the 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

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

(i) The finalised **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 requirement**s based on the safety claims; the final GRC, the residual ARC, TMPRs, the OSOs associated with the SAIL, and the containment requirements.

(iv) **Compliance evidence**, which comprises of data, facts and information that provide the necessary justification for each of the safety claims and derived requirements 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 ensure the CSP makes a **justified safety case** that demonstrates the operation has satisfied all required SORA safety claims and derived requirements.

(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 requirements to the compliance evidence.

(b) Refer to Annex A to this AMC for more guidance on how to structure documentation as part of the CSP.

S.4.10.4 Instructions

(a) The UAS operator should only put information into the CSP as required by the items mentioned in paragraph S.4.10.3. If a requirement has a low robustness (refer to Section S.2.4), it is mostly sufficient to self-declare the compliance by a statement in the CSP. The SORA requirements for self-declaration in no way prevent 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 UAS operation(s). It can be modularised and can consist of multiple documents and subsections to accommodate the need to perform the UAS operation(s).

(c) Appropriate references and version/configuration control apply to all documents in the CSP, including subsections and other documents. Chapter A4 of Annex A to this AMC provides a template that could be used for developing the CSP that is in line with the requirements of this AMC. The competent authority may require a separate process for any change to be made. The management of any change 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) If the operator uses external service(s), reference(s) to the service level agreement(s) (SLA(s)) providing a delineation of responsibilities between the service provider(s) and the operator should be included in the CSP. It should also detail the functionality, limitations and performance of the external service(s).

Annex A to AMC1 Article 11

GUIDELINES ON COLLECTING AND PRESENTING INFORMATION ON SYSTEMS AND OPERATIONS REGARDING UAS OPERATIONS CONDUCTED IN THE 'SPECIFIC' CATEGORY

The purpose of this Annex is to provide guidance to UAS operators for collecting and presenting evidence and data required when compiling an application to obtain operational authorisation for UAS operations in the 'specific' category.

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

This document is composed of the following five chapters:

— **A.1: Key principles for completing the application documents for UAS operations to be conducted in the 'specific' category**

It explains the different documents and how to use them to compile an application.

— **A.2: SORA risk assessment template**

It is intended to support UAS operators in compiling all the information necessary to perform a risk assessment.

— **A.3: Structure of the operations manual**

It provides an operations manual model structure for UAS operators to follow in order to present their operations manual in an appropriate manner.

— **A.4: Compliance matrix**

It provides a template for UAS operators on how to present the reference between the SORA-driven requirements and the operations manual.

— **A.5: How to document and present a flight area**

It contains guidance for UAS operators on how to create and include a flight area into the operations manual.

A.1 Key principles for completing the application documents for UAS operations to be conducted in the 'specific' category

How does an application generally work?

The operations manual serves as the basis for an operational authorisation for UAS operations to be conducted in the 'specific' category. When the competent authority issues the operational authorisation, it accepts the related operations manual.

General workflow

Before starting collecting information and describing procedures, the UAS operator should outline a preliminary operational concept (refer to Section S.4.1 of this AMC). This preliminary operational concept ensures that the UAS operator can effectively explore all available options, and select the most suitable approach for its specific needs.

Key considerations for this initial plan include the following:

— the intended flight location(s);

— the maximum operational flight altitude and speed;

— the flight mode: either VLOS or BVLOS with or without AOs;

— the type of UAS to be used;

— environmental limitations (time of day, weather).

In the next step, the UAS operator assesses the risk for the operation and develops a high-level overview of the SORA requirements. For this, the UAS operator should apply the requirements of Section A.2 and follow each step of the SORA process.

When SORA phase 1 (see Figure A.1) is completed, it is considered best practice for a UAS operator to liaise with the competent authority before moving to the data collection and procedure description (refer to Section S.3.3 of this AMC) to share its preliminary operational information and initial risk assessment. The competent authority and the UAS operator 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 the UAS operator on its expectations on how to achieve an operational authorisation considering the resulting SAIL.

Once the risk assessment (i.e. the outcome of SORA Phase 1) has been validated and the UAS operator has secured confirmation from the competent authority, the next step involves identifying the specific requirements that arise from the risk assessment (i.e. conduct SORA phase 2 and develop the evidence in support of compliance with the applicable OSOs, mitigations and containment). Following this identification, the UAS operator should then collect the relevant evidence and information, as well as describe the procedures that will be implemented. The UAS operator should ensure that all integrity and corresponding assurance requirements are met. These can be found in Annexes B to E to this AMC. It is recommended to use the operations manual structure provided in Chapter A.3 for this purpose.

The UAS operator should use the template provided in Chapter A.4 (Compliance matrix) once all procedures are described and evidence is collected. This is done by providing the corresponding reference to the integrity and/or assurance evidence for each requirement. This document serves as a checklist for the UAS operator to review before submitting an application. The competent authority may use this document as a reference to assist the review process.

The competent authority reviews the application in accordance with the requirements 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 the UAS operator to revise the documents and resubmit them, or ask for additional supporting documentation.

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

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

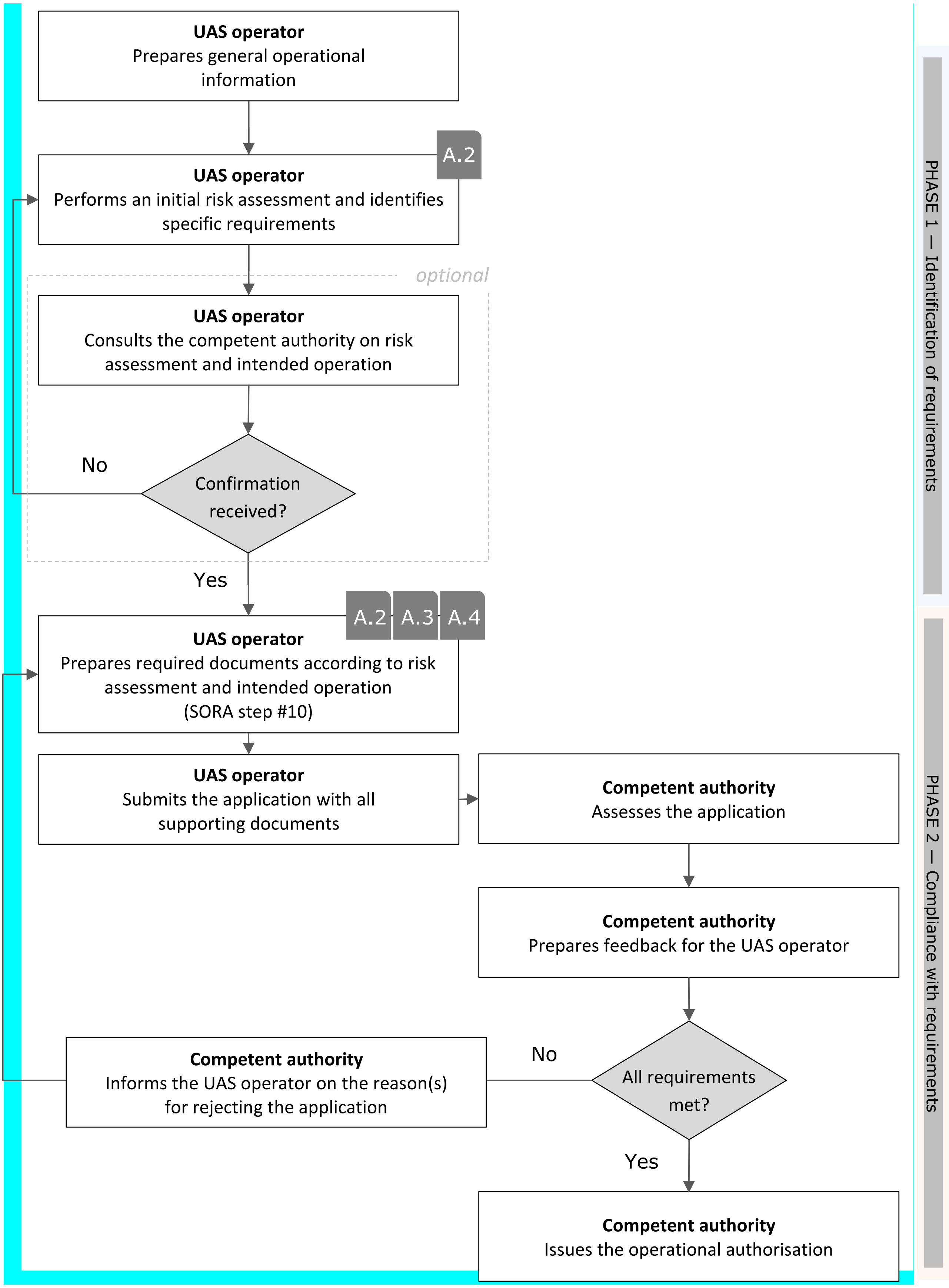

Figure A.1 — Recommended level of detail and use of supporting documents and references

The operations manual and its associated annexes should enable the UAS operator to describe how to conduct the operation safely for the benefit of its staff. It should include the identification of the flight area, all normal, contingency and emergency procedures and additional information derived by the compliance with the required OSOs, mitigations and containment requirements.

Supporting documents serving as evidence for the compliance with the required OSOs, mitigations and containment requirements may be referenced in the operations manual and can be linked in the compliance matrix (see Section A4) and be included in a separate document. Evidence developed in support of requirements having a low level of robustness (related to the OSOs, based on the SAIL of the operation or to the level of mitigation and or to the containment chosen by the UAS operator) may be kept internal to the UAS operator's organisation. The same applies in case the level of robustness of the requirements is medium and the UAS operators decided to use AMC published by EASA. The competent authority may require those evidence during the oversight audit or anytime. In case the level of robustness of the requirements is high or it is medium and the UAS operators decided not to use AMC published by EASA, then the evidence should be provided with the application of the operational authorisation.

The competent authority may request further documents if considered necessary by the competent for the given operation.

Document set-up for additional flight areas, UAS or UAS operations

When a UAS operator seeks to expand its approved operations manual(s) to include a new flight area, a UAS or a UAS 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(s). Otherwise, it is considered best practice to establish new parts for such information.

When dealing with complex UAS operations (e.g. multiple types of UAS operations and multiple UAS employed), the UAS operator may find it useful to use a different structure of the operations manual compared to that proposed by this Annex. In this case, it is recommended to discuss the proposed manual's structure with the competent authority to ensure it meets both national and industry standards.

Operation-specific details should typically be organised into separate parts for clarity during approval and ease of use. Conversely, general or related information can be consolidated into a common 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 existing Part B; for illustration purposes, see Figure A.2.

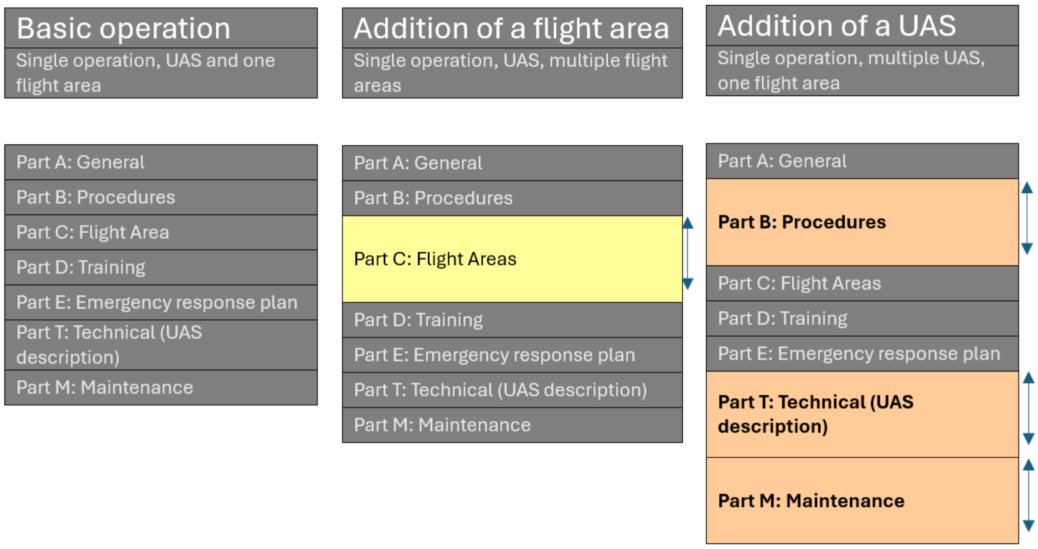

Figure A.2 — Common scenarios and how they may impact the operations manual

A.2 SORA risk assessment template

Introduction

This chapter serves as a guide to assist UAS operators in compiling all the necessary information for conducting a risk assessment. UAS operators should submit an application for an operational authorisation using the form provided in AMC1 UAS.SPEC.030(2). By providing this questionnaire-style template for documenting the risk assessment, UAS operators 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 is designed for UAS operators to provide additional information when needed, helping to prevent misunderstandings. At this stage, no evidence is required as the requirements are determined by the risk analysis process.

Once the application form is completed, both the UAS operator and the competent authority will have all the necessary information to complete Phase 1 assessment (for reference, see Figure A.1). 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 in yet.

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

Evidence should not be included in the application form. Instead, it should be incorporated into the operations manual (Chapter A.3 'Structure of the operations manual') and referenced in the CSP (Chapter A.4 'Compliance matrix').

A.3 Structure of the operations manual

Introduction

The intention of this chapter is to provide a standardised framework for documenting essential information that relates to a specific operation. It serves only as an example structure for UAS operators to create a comprehensive document that outlines the procedures and relevant details necessary for the safe and efficient execution of a UAS operation[38].

In the example structure, the operations manual is divided into logical subject parts, which in turn offer a structure as regards where to include specific topics that are crucial for creating a standardised manual for the safe operation of UAS.

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 the safe operation of UAS. It is advisable to adhere to the provided structure, as it aligns with the expectations and practices of most competent authorities. An example of an operations manual may be found on the EASA website[39].

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

The main purpose of this structure is the following:

1. **Standardisation:** It ensures that all critical aspects of the UAS operation are documented consistently, following applicable industry standards and regulations, and best practices.
2. **Compliance:** It helps operators meet regulatory requirements by specifying the information and procedures needed to obtain necessary approvals and certification.
3. **Clarity:** It provides a clear and organised structure for conveying operational procedures, safety protocols and other essential information, thus reducing the risk of misunderstandings and errors.
4. **Safety:** It emphasises safety measures, emergency procedures and risk-mitigation strategies to enhance the overall safety during the operation.
5. **Efficiency:** It streamlines the process of creating an operations manual by providing predefined sections and guidelines, helping UAS operators save time and effort.
6. **Consistency:** It ensures that all UAS operators that are involved in the operation of the same UAS type 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, competent authorities and other stakeholders involved in, or overseeing, the UAS operation.

[38] An example of an operations manual and modules providing dedicated procedures may be found on the EASA website at https://www.easa.europa.eu/en/domains/drones-air-mobility/operating-drone/specific-category-civil-drones/predefined-risk-assessment-pdra#group-easa-downloads.

[39] https://www.easa.europa.eu/en/domains/drones-air-mobility/operating-drone/specific-category-civil-drones#group-easa-downloads

8. **Documentation:** It aids in the systematic recording of operational details, making it easier to track changes, updates, and compliance with evolving regulatory requirements.

Recommended structure for the operations manual

Cover page

Document control

Other applicable documents

Purpose and scope of this document

List of contents

List of definitions and abbreviations

1 Part A — General Part

- 1.1 Opening statement
- 1.2 Security and privacy statement
- 1.3 Environmental statement
- 1.4 The operating organisation
  - 1.4.1 Structure / organisation chart
  - 1.4.2 Duties and responsibilities of the personal
- 1.5 Change management
- 1.6 Retention periods
- 1.7 Document control
- 1.8 Requirements and qualifications for personnel
  - 1.8.1 Remote pilot
  - 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 information
  - 2.2.2 Geographical zones
- 2.3 External services and systems
  - 2.3.1 Services
  - 2.3.2 Systems
- 2.4 Procedures for obtaining information about and evaluating weather conditions

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 personnel trained in the emergency response plan (ERP)

8.2.6 Operator flight logbook

8.2.7 Technical logbook

8.3 Checklists

8.3.1 ERP template

8.3.2 Pre-flight inspection — Checklist

8.3.3 Post-flight inspection — Checklist

8.4 Manuals

8.4.1 Maintenance manual for UAS 1

8.4.2 Maintenance manual for UAS 1

Reference table for the requirements specified in the annexes to AMC1 (SORA)

The following table offers a comprehensive overview of the suitable locations within the operations manual where the requirements specified in the annexes to AMC1 (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 1.7 Annex 8.1.1.2
		#3	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

TMPRs	**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

Introduction

This chapter provides a template for UAS operators on how to present the reference between the SORA-driven requirements and the operations manual from Chapter A.3 of Annex A to this AMC to the competent authority.

For all the requirements that should be fulfilled in order to conduct a safe UAS operation, the UAS operator should put the specific reference into the compliance matrix table where it can be found.

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

Example:

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

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

Compliance matrix		
Requirement	**Level of robustness**	**Reference to documentation**
Ground risk mitigations		
M1(A) Strategic mitigations — Sheltering	☐ None ☐ Low ☐ Medium	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 (ARC) mitigation	☐ ARC-d (AEC 1 or 2) → ARC-c ☐ ARC-d (AEC 1 or 2) → ARC-b ☐ ARC-d (AEC 3) → ARC-c ☐ 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	Document name: ________________ Chapter or page number: ________________

Tactical mitigation performance requirements (TMPRs)		
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 requirements		
Containment	☐ Low ☐ Medium ☐ High ☐ Tethered	Document name: ______ Chapter or page number: ______

Operational safety objectives (OSOs)		
OSO #01 **Ensure that the UAS operator is a competent and/or proven organisation**	☐ NR ☐ Low ☐ Medium ☐ High	Document name: __________ Chapter or page number: __________
OSO #02 **UAS designed and produced by a competent and/or proven organisation**	☐ 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 for its safe operation 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 UAS 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 UAS 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) has been found appropriate for the intended UAS operation**	☐ NR ☐ Low ☐ Medium ☐ High	Document name: ____________________ Chapter or page number: ____________________
OSO #23 **Environmental conditions for safe operations are defined and measurable**	☐ Low ☐ Medium ☐ High	Document name: ____________________ Chapter or page number: ____________________
OSO #24 **The UAS is designed and qualified to operate in adverse environmental conditions**	☐ NR ☐ Medium ☐ High	Document name: ____________________ Chapter or page number: ____________________

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

A.5 How to document and present a flight area

Introduction

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

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

For better usability, Chapter A.5 is divided into two sections:

— **Section 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.

— **Section 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 may also employ sophisticated flight-mechanics-based computations. These calculations can be incorporated into the operations manual annex. UAS operations covered by standard scenarios (STS) or predefined risk assessments (PDRAs) should use at least the values defined in the STS or the PDRA.

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

A.5.1 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 pilots' position (for VLOS operations);

— a position: remote pilots' position and AO position (for BVLOS operations with AOs);

— a position: take-off / landing position (optional).

The UAS operator 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 is 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’ computation of the flight area.

Inside out: Reverse:

Figure 9 — ‘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 Chapter 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 operations manual annex.

Example:

Detailed information for each flight area is typically located under Part C, following the recommended format outlined in Chapter A.3 ‘Structure of the operations manual’.

In a structured chapter layout, this may appear as follows:

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 8 — Graphical representation of a 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, etc.]

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

Calculation of the contingency volume (CV) and the ground risk buffer (GRB)

The CV and the GRB were determined using the formulas described in paragraph A.5.2 of this annex.

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:

— height 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 $\boldsymbol{S}_{\mathbf{GNSS}}$: **[0,5 m]**;

— position holding error $\boldsymbol{S}_{\mathbf{Pos}}$: **[3,0 m]**;

— map error $\boldsymbol{S}_{\mathbf{K}}$: **[1,0 m]**;

— reaction time $\boldsymbol{t}_{\mathbf{R}}$: **[1,0 s]**;

— altitude measurement error $\boldsymbol{H}_{\mathbf{AM}}$: **[$H_{Baro}$ = 1,0 m]**;

— additional distance (horizontal) $\boldsymbol{S}_{\mathbf{Add}}$: **[0,0 m]**;

— additional distance (vertical) $\boldsymbol{H}_{\mathbf{Add}}$: **[0,0 m]**.

Reasons for deviations from the standard values:

— S_{GNSS} (**[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 $\boldsymbol{H}_{\mathbf{FG}}$: **[100,0 m]**.

Contingency volume:

— Horizontal $\boldsymbol{S}_{\mathbf{CV}}$: **[34,5 m]**;

— Vertical $\boldsymbol{H}_{\mathbf{CV}}$: **[113,1 m]**.

Ground risk buffer:

— Horizontal $\boldsymbol{S}_{\mathbf{GRB}}$: **[113,8 m]**.

Adjacent ground area:

— Horizontal $\mathbf{S}_{\mathbf{AA}}$: **[5000 m]**.

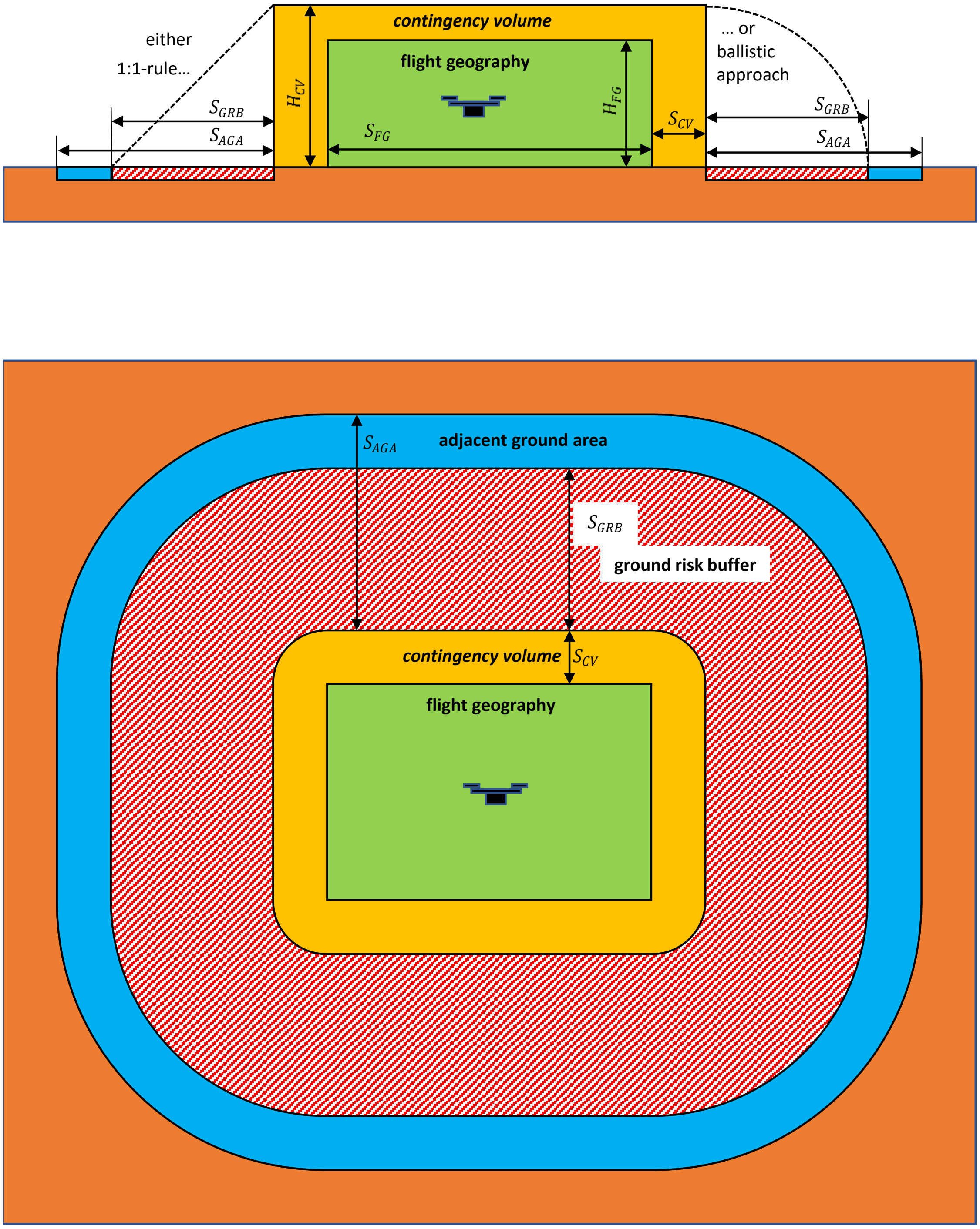

Figure 9 — Schematic representation of the flight geography, the contingency volume and the ground risk buffer

A.5.2 Calculations used in the example case in the paragraph above

A.5.2.1 Information required for the calculations

V_0, m/s	Maximum operational speed that is flown. This corresponds to the information in point 3.6 in the operational authorisation application form provided in AMC1 UAS.SPEC.030(2). *Note: A speed below 3 m/s for multirotor and 1.25 · $V_{\text{Stall,clean}}$ for fixed-wing aircraft is not considered realistic.*
CD, m	For the 'maximum UA characteristic dimension (CD)', please refer to definition I.141 'UA characteristic dimensions' in Annex I to this AMC. Propellers and rotors are part of the geometry, whereby their most unfavourable position is considered. This corresponds to the information in point 3.4 of the operational authorisation application form provided in AMC1 UAS.SPEC.030(2).
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

A.5.2.2 Computation of the 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 the flight geography, the contingency volume and the ground risk buffer should 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 (FG) horizontal	
Width of the flight geography: S_{FG}	$S_{\mathrm{FG}} \geq 3\ \mathrm{CD}$
Flight geography (FG) vertical	
Height of the flight geography: H_{FG}	$H_{\mathrm{FG}} \geq 3\ \mathrm{CD}$
Note: Values smaller than $H_{\mathrm{FG}} = 3\ \mathrm{CD}$ and $S_{\mathrm{FG}} = 3\ \mathrm{CD}$ are considered unrealistic, also for automated waypoint flights.	

A.5.2.3 Computation of the 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}	$S_{\mathrm{GNSS}} = 3\ \mathrm{m}$
Position holding error: S_{Pos}	$S_{\mathrm{Pos}} = 3\ \mathrm{m}$
Map error: S_{K}	$S_{\mathrm{K}} = 1\ \mathrm{m}$
Reaction distance: S_{R}	Manual initiation of measures Reaction time: $t_{\mathrm{R}} = 1$ s, with V_0 results in $S_{\mathrm{R}} = V_0\ t_R$ *Note: t_{R} may 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: $S_{CM} = \frac{V_0{}^2}{g \tan(\Phi)}$
Alternative contingency manoeuvre parachute: S_{CM}	Flight terminated with parachute triggered when leaving the FG t_P = Time to open the parachute $S_{CM} = V_0\, t_P$
Horizontal extension of the contingency volume: S_{CV}	$S_{CV} = S_{GPS} + S_{Pos} + S_K + S_R + S_{CM}$
Examples	
Example: multirotors $V_0 = 10\ \frac{m}{s}, \Theta = 45^\circ, [\tan(45°) = 1]$	$S_{CV} = 3\text{ m} + 3\text{ m} + 1\text{ m} + 10\text{ m} + \frac{1}{2} \cdot \frac{\left(10\ \frac{m}{s}\right)^2}{9{,}81\ \frac{m}{s^2} \cdot 1} = 22{,}1\text{ m}$
Example: fixed-wing aircraft $V_0 = 30\ \frac{m}{s}, \Phi = 30^\circ$	$S_{CV} = 3\text{ m} + 3\text{ m} + 1\text{ m} + 30\text{ m} + \frac{\left(30\ \frac{m}{s}\right)^2}{9{,}81\ \frac{m}{s^2} \cdot \tan(30°)}$ $= 195{,}9\text{ m}$
Contingency volume vertical	
Altitude measurement error: H_{AM}	$H_{AM} = H_{Baro} = 1\text{ m}$ for barometric altitude measurement

	or $H_{\mathrm{AM}} = H_{\mathrm{GNSS}} = 4\ \mathrm{m}$ for GNSS-based altitude measurement. *Note: When operating close to large buildings or between buildings in narrow streets, the altitude information provided by GNSS may not be reliable.*
Reaction distance: H_{R}	Manual initiation of measures Reaction time: $t_{\mathrm{R}} = 1$ s, with 45° pitch angle $H_{\mathrm{R}} = V_0 \cdot 0{,}7 \cdot t_{\mathrm{R}}$ *Note: t_{R} may also be smaller in fully automatic systems (e.g. geofence). If external services are used for command and control, their system latency should be taken into consideration.*
Contingency manoeuvres: H_{CM}	For multirotor The forward kinetic energy is completely converted into potential energy. This results in $H_{\mathrm{CM}} = \frac{1}{2}\frac{{V_0}^2}{g}$ 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 $H_{\mathrm{CM}} = \frac{{V_0}^2}{g} \cdot 0{,}3$
Alternate contingency manoeuvre parachute: H_{CM}	Flight terminated with parachute triggered when leaving the FG Exit FG with 45° pitch angle t_{P} = Time to open the parachute $H_{\mathrm{CM}} = V_0 \cdot t_{\mathrm{P}} \cdot 0{,}7$
Contingency volume: H_{CV}	$H_{\mathrm{CV}} = H_{\mathrm{FG}} + H_{\mathrm{AM}} + H_{\mathrm{R}} + H_{\mathrm{CM}}$

Examples	
Height of the flight geography	$H_{\mathrm{FG}} = 100\ \mathrm{m}$
Example: multirotor: $V_0 = 10\ \frac{\mathrm{m}}{\mathrm{s}}$	$H_{\mathrm{CV}} = 100\ \mathrm{m} + 1\ \mathrm{m} + 7\ \mathrm{m} + \frac{1}{2} \cdot \frac{\left(10\ \frac{\mathrm{m}}{\mathrm{s}}\right)^2}{9{,}81\ \frac{\mathrm{m}}{\mathrm{s}^2}} = 113{,}1\ \mathrm{m}$
Example: fixed-wing a/c: $V_0 = 30\ \frac{\mathrm{m}}{\mathrm{s}}$	$H_{\mathrm{CV}} = 100\ \mathrm{m} + 1\ \mathrm{m} + 21\ \mathrm{m} + \frac{\left(30\ \frac{\mathrm{m}}{\mathrm{s}}\right)^2}{9{,}81\ \frac{\mathrm{m}}{\mathrm{s}^2}} \cdot 0{,}3 = 149{,}52\ \mathrm{m}$

A.5.2.4 Computation of the 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 rotorcraft and multirotors!***	$S_{\mathrm{GRB}} = V_0 \sqrt{\frac{2\,H_{\mathrm{CV}}}{g}} + \frac{1}{2}\ \mathrm{CD}$
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 in $S_{\mathrm{GRB}} = V_0\, t_{\mathrm{P}} + V_{\mathrm{Wind}} \frac{H_{\mathrm{CV}}}{V_{\mathrm{z}}}$
Termination with fixed-wing aircraft: S_{GRB}	• Power is switched off: A glide ratio of $E = \frac{1}{\varepsilon} = \frac{C_{\mathrm{L}}}{C_{\mathrm{D}}}$ results in $S_{\mathrm{GRB}} = E\ H_{\mathrm{CV}}$ • Power is switched off and the flight control surfaces are permanently set in a way that no gliding is possible: The simplified approach can be chosen (1:1 rule).
Examples	
Simplified approach:	$S_{\mathrm{GRB}} = 113{,}1\ \mathrm{m} + \frac{1}{2} \cdot 1{,}5\ \mathrm{m} = 113{,}85\ \mathrm{m}$

Multirotor: $V_0 = 10\ \frac{\text{m}}{\text{s}}$, $\text{CD} = 1{,}5\ \text{m}$, $H_{\text{CV}} = 113{,}1\ \text{m}$	
Ballistic approach: Multirotor: $V_0 = 10\ \frac{\text{m}}{\text{s}}$, $\text{CD} = 1{,}5\ \text{m}$, $H_{\text{CV}} = 113{,}1\ \text{m}$	$S_{\text{GRB}} = 10\ \frac{\text{m}}{\text{s}} \sqrt{\frac{2 \cdot 113{,}1\ \text{m}}{9{,}81\ \frac{\text{m}}{\text{s}^2}}} + \frac{1}{2} \cdot 1{,}5\ \text{m} = 48{,}77\ \text{m}$
Fixed-wing aircraft if only power is switched off: $V_0 = 30\ \frac{\text{m}}{\text{s}}$, $\text{CD} = 3\ \text{m}$, $H_{\text{CV}} = 149{,}52\ \text{m}$, E=20	$S_{\text{GRB}} = 149{,}52\ \text{m} \cdot 20 = 2990{,}4\ \text{m}$
Fixed-wing aircraft if power is switched off and flight control surfaces set so that no gliding is possible: $V_0 = 30\ \frac{\text{m}}{\text{s}}$, $\text{CD} = 3\ \text{m}$, $H_{\text{CV}} = 149{,}52\ \text{m}$	$S_{\text{GRB}} = 149{,}52\ \text{m} + \frac{1}{2} \cdot 3\ \text{m} = 151{,}02\ \text{m}$
GRB vertical	— not applicable —

A.5.2.5 Examples of computation of maximum distance(s) for VLOS / BVLOS with AOs

When determining the operating range for VLOS or BVLOS with AO operations, care should be taken to ensure that the remote pilot can actually operate the UAS within their visual range or within the visual range of the AOs.

To check whether the described UAS operation is in VLOS or in BVLOS, the following calculations may be used.

VLOS / BVLOS with AO limit	In VLOS or in BVLOS with AOs the air risk is mitigated by having the UA in sight of the remote pilot or of the AO. The maximum possible distance between the remote pilot or the AO and the UA results from the **<u>smaller</u> value of ALOS and DLOS**. Anything beyond that is considered **BVLOS**.
ALOS	Attitude line of sight (ALOS) The ALOS 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 (DLOS) The DLOS defines the distance up to which the UA could theoretically fly while at the same time other aircraft in the same direction can be visually detected, and

	sufficient time is available for an avoidance manoeuvre. The ground visibility is crucial for this.
GV	Ground visibility (GV) The GV depends on the operational area and the meteorological conditions, and should be determined at the respective time of operation. The procedure for precisely determining GV should be described in a section of the OM related to procedures (e.g. Section 2.4 of the OM structure provided in A.3 of this annex). The use of landmarks or the use of a transmissometer is possible. The maximum ground visibility to be assumed is **5 km**, analogue to the visibility according to the VFR rules in airspace G[40].

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

If the largest possible distance between the remote pilot's location and the outer side of the CV (boundary between CV and GRB) is greater than the VLOS distance, no VLOS operation may take place. UAS operations should then take place in BVLOS.

[40] As any larger GV value is not deemed possible to extend the bare eye DLOS beyond the 1.5 km, provided that sufficient time for avoidance is still available.

A.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	1 010 m
3 m	1 000 m	1 500 m
3,5 m	1 164,5 m	1 500 m
4 m	1 328 m	1 500 m
4,53 m	1 500 m	1 500 m
> 4,53 m	1 500 m	1 500 m

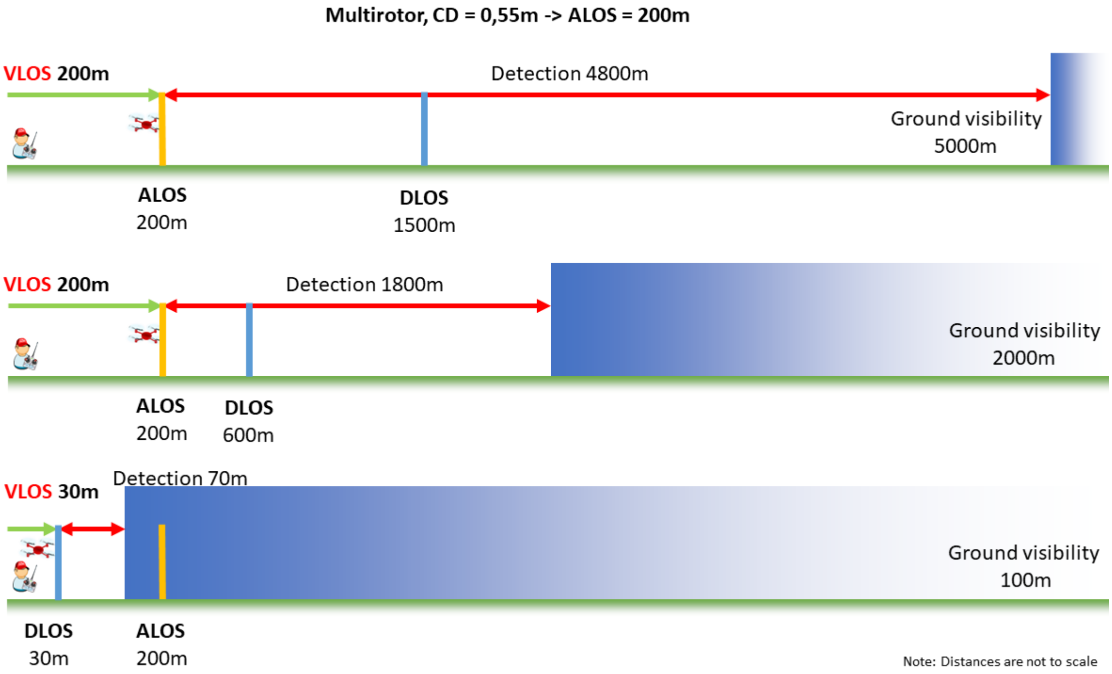

Figure 10 — Multirotor VLOS range

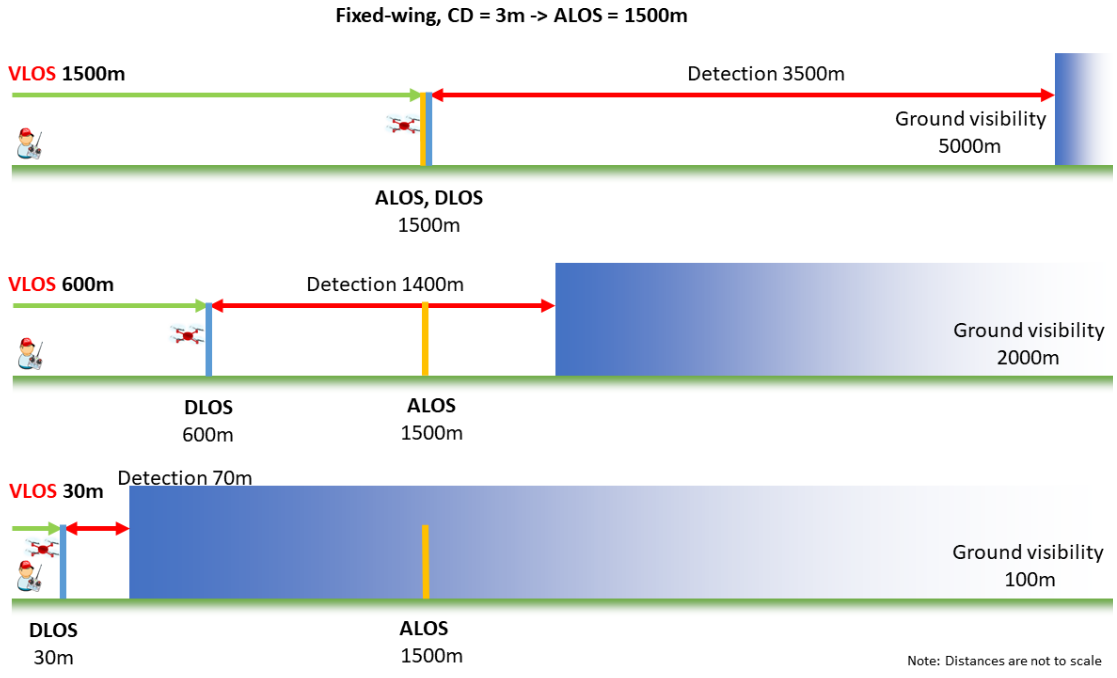

Figure 11 — Fixed-wing VLOS range

Annex B to AMC1 Article 11

INTEGRITY AND ASSURANCE LEVELS FOR THE MITGATIONS USED TO REDUCE THE INTRINSIC GROUND RISK CLASS (iGRC)

B.1 How to use Annex B

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

#	Principle description	Additional information
#1	Annex B provides the 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 iGRC associated with a given operation.	The identification and implementation of mitigations is the responsibility of the applicant.
#2	A proposed mitigation should have a positive effect on reducing the ground risk associated with defined operational limitations. In the case where a mitigation is available but does not reduce the ground risk, its level of integrity should be considered equivalent to 'None'.	
#3	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).
#4	Annex B intentionally uses non-prescriptive terms (e.g. suitable, reasonably practicable) to provide flexibility to both applicants and 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.	
#5	Annex B in its entirety also applies to single-person organisations.	
#6	Annex B mitigations are applied to the operational volume and ground risk buffer. Annex B mitigations may be applied to the adjacent ground area.	Details of mitigation application to adjacent ground area can be found in Annex F Edition 2.5[41].
#7	All bullet points within all tables in this Annex are meant to be fulfilled unless followed by 'or'.	

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

#8	The GRC cannot be lowered to a value less than the equivalent for controlled ground area.	
#9	Any criterion labelled 'technical design' will most likely require the support of the UAS or component designer for providing statements of compliance and, if applicable, gathering the required evidence.	
#10	The applicant may claim more points of GRC reduction than indicated in Table 11 (Table 5 in this AMC (SORA 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 'high' robustness level.	

Table B.1 — Basic principles

B.2 M1(A) — Strategic mitigations — Sheltering

The 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 that use 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 UAS operator claims a reduction due to a sheltered operational environment, the UAS operator: a) flies over operational environments generally consisting of structures providing shelter (e.g. buildings); 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 flying over outdoor assemblies of people or over areas with no shelter.	Same as low. In addition, the UAS operator 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. UAS operators and/or competent authorities may consider adapting this ratio based on other evidence.* *Please, see GM2 UAS.SPEC.030(2) to identify whether the application of M1 triggers the need to apply for an operational authorisation with precise or generic locations.*
	Criterion #2 (Evaluation of penetration hazard)	The UAS operator uses a UA that is not expected to penetrate structures and fatally injure people under the shelter[2].
	Comments	[2] *Guidance on how to evaluate the sheltering effect can be found in the following:* • *ASSURE UAS Ground Collision Severity Evaluation A4 report section '4.12. Structural Standards for Sheltering (KU)', pp. 103–111, 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 cases where the UAS speed or building materials are unusual (e.g. 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 UAS operator declares that the operation is in an environment that has structures[1] providing shelter where the vast majority of people are generally expected to be, and the UA does not fly over large outdoor assemblies of people.	Same as 'low'. In addition, the UAS operator 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 most 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 a take-off mass higher than 25 kg[1], the UAS operator 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 before the flight.

Improvements in the data included in the static data population density maps are not part of M1(B) mitigations 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.

A competent 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.

		LEVEL of INTEGRITY	
		Medium	**High**
M1(B) — Operational restrictions	Criterion #1 (Evaluation of people at risk)	The UAS operator provides space-time-based restrictions (e.g. flying over a market square when it is not crowded) to substantiate that the actual density of people during the operation is lower than that in Step #2. This can be done by means of: a) an analysis or appraisal of the characteristics of the location[1] and the time[2] of operation; AND/OR b) the 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.	
	Comments	*[1] The characteristics of the location should be understood as land use that relates to the presence of people, e.g. industrial area, urban park or shopping centres.* *[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.*	
	Criterion #2 (Impact on population at risk)	The population at risk 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.	The population at risk 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.
	Comments	*[3] The iGRC population band is described in '4.2.3 Step #2' of the SORA Main Body.*	

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

<table>
<tr><th colspan="2" rowspan="2"></th><th colspan="2">LEVEL of ASSURANCE</th></tr>
<tr><th>Medium</th><th>High</th></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 population at risk)</td><td>The UAS operator has supporting evidence that the required level of integrity is achieved. This is typically done by means of analyses, surveys or through operational experience.</td><td>The claimed level of integrity is validated by the competent authority of the Member State 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 populations at risk 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

The 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[42].

		LEVEL of INTEGRITY Low
M1(C) — Ground observation	Criterion #1 (Procedures)	To achieve a reduction of the number 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 lower risk on the ground (e.g. presence of uninvolved people and obstacles); b) the remote pilot reduces the number of people at risk by adjusting the flight path while the operation is in progress (e.g. flying away from the area with a higher risk on the ground or overflying only the identified area(s) of lower risk on the ground).
	Comments	*[1] The iGRC population band is described in Chapter 4.2.3 Step #2 of this AMC (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 observers on the ground with radios/phones), these should provide data of reliable quality allowing the reliable detection of uninvolved people on the ground.
	Comments	*[1]Criterion #2 may require support from the UAS or the component designer to gather the required evidence.*

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 UAS operator declares that the required level of integrity has been achieved.
	Comments	*N/A*
	Criterion #2 (Technical means)	Competent authorities may allow the use of technical means[1] for ground observation with assurance criteria acceptable to them.

[42] The size of the area where the remote crew is required to have ground observation should cover at least the projection on ground of the VLOS distance defined in Section A.5.2.5.

	Comments	*[1]Criterion #2 may require support from the UAS or the component designer to gather the required evidence.*

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

B.5 M2 Effects of 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 by either reducing the probability of lethality of a UA impact (i.e. energy, impulse, transfer of energy dynamics, etc.) and/or by reducing the size of the expected critical area (see Table B.8 below). Examples include but are not limited to parachutes, autorotation, frangibility, stalling the aircraft to slow the descent and increase the impact angle. UAS designers should demonstrate the required total amount of reduction (see integrity criteria) in either or for both factors.

The base assumption in the SORA for UAS impact lethality before mitigation M2 is applied is that most impacts are lethal[43]. Based on the characteristic dimensions of a UA, the related critical areas are displayed in Table B.8 below. Depending on whether the mitigation is passive, manually activated or automatically activated, UAS designers should provide correspondingly adequate evidence and procedures for a given level of robustness. The reduction of the inherent critical area of a UA by way of analysis should be conducted already in Step #2 of the SORA and is not part of mitigation M2.

Critical area calculations are defined in Annex F Edition 2.5[44] Chapter 1.8[45]. The table provided in Section S.4.2 of this AMC (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	6 500	65 000

Table B.8 — Critical areas associated with the maximum characteristic dimension (non-mitigated)

UAS designers that claim a mitigation by reducing the critical area shall use the values above as the baseline for comparison to show the appropriate mitigation.

If a UAS operator or a UAS designer has used the modifications according to Annex F Edition 2.5[45] in Step #2, or has used the automatic critical area assessment tool available on the EASA website[46], to

[43] 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 metre;
- any impacts during slide of UA with total kinetic energy below 290 joules.

See Annex F Edition 2.5 (http://jarus-rpas.org/wp-content/uploads/2024/06/SORA-v2.5-Annex-F-Release.JAR_doc_29pdf.pdf) *for more details on calculation.*

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

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

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

show a corrected critical area for its UAS and matched the corrected critical area to a column in Table B.8, then this table value is used as the baseline against which the mitigation is assessed.

If a UAS operator or a UAS designer has used the modifications according to Annex F Edition 2.5[45] in Step #2 to show both a corrected critical area and a 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 should be used as a limitation in the UAS operation.

		LEVEL of INTEGRITY	
		Medium[1]	**High**
M2 — Effects of UA impact dynamics are reduced	Criterion #1 (Technical design)	(a) The effects of impact dynamics and immediate post-impact hazards[2], the critical area or the combination of these are reduced such that the risk to population is reduced by an approximate 1 order of magnitude (90 %)[3]. (b) When applicable, in case of malfunctions, failures or a combination of these that could lead to a crash, the UAS contains all the elements required for the activation of the mitigation[4]. (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.	Same as 'medium'. In addition: (a) When applicable, the activation of the mitigation is automated[4,5,6]. (b) The effects of impact dynamics and immediate post-impact hazards[2], the critical area or the combination of these are reduced such that the risk to the population is reduced by an approximate 2 orders of magnitude (99 %)[3].

	Comments	*[1] MoC to Light-UAS.2512[47] is an acceptable means to comply with the 'medium' level of robustness for M2. Moreover, it provides additional explanation of the M2 criteria.* *[2] Examples of immediate post-impact hazards include fires and release of high-energy debris.* *[3] Latest research on UAS impacts estimates injuries using the Abbreviated Injury Scale (AIS) developed for automotive impact tests and test dummies. An impact that has a 30 % chance of causing 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.* *[4] For 'medium' robustness, the UAS designer is expected to address only probable malfunctions, failures and their combinations. No single failure should lead simultaneously to a loss of control of the operation and a reduction of the effectiveness of the M2 mitigation.* *[5] An automated activation may be required when reaction time is critical or when the operator cannot determine the need for activation.* *[6] The UAS designer may nevertheless implement an additional manual activation function.*
	Criterion #2 (Procedures)	Any piece of equipment used to reduce the effect of the UA impact dynamics is installed, operated and maintained in accordance with the UAS/mitigation designer instructions.
	Comments	*N/A*
	Criterion #3 (Training)	When the use of the mitigation requires action from the remote crew, then the UAS operator should provide appropriate training to the remote crew. The UAS operator should ensure that the personnel (internal or external) responsible for the installation and maintenance of the mitigations are qualified for the task.
	Comments	*N/A*

Table B.4 — Level of integrity assessment criteria for M2 mitigation

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

		LEVEL of ASSURANCE	
		Medium	**High**
M2 — Effects of UA impact dynamics are reduced	Criterion #1 (Technical design)	The UAS designer has supporting evidence to claim that the required level of integrity and reliability is achieved. This is typically done by means of testing, analysis, simulation[1], inspection, design review or through operational experience. A UAS with a C0 or C1 class mark or with an MTOM lower or equal to 900 g and a maximum speed of 19 m/s fulfils the assurance criterion 1. The UAS designer may provide a statement of compliance with MoC to Light-UAS.25122 by providing the supporting evidence defined in it.	The UAS operator should use a UAS for which EASA has verified the claimed integrity through a design verification report (DVR) issued following an application from the UAS designer.
	Comments	*[1] When simulation is used, the validity of the targeted environment used in the simulation needs to be justified.* [2] 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 that are considered adequate by the competent authority of the Member State and/or in accordance with means of compliance acceptable to that authority. (b) The adequacy of the operator's procedures is justified 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; (iii) any other means acceptable to the competent authority of the MS. (c) The UAS/mitigation designer provides the instructions necessary for the correct operation of the mitigations.	(a) the DVR covers the operating instructions of the mitigations; (b) the competent authority of the Member State or an entity that is designated by the competent authority verifies that the procedures developed by the UAS operator are acceptable.

	Comments	*UAS operators may directly use the procedures provided by the UAS/mitigation designer and rely on the adequacy verification performed by them.* *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 UAS operator provides theoretical and practical training for the remote crew. (c) Personnel responsible for installation and maintenance of the mitigations have completed relevant training.	Same as 'medium'. In addition, the competent authority of the Member State 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

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 the OSOs proposed by an applicant.	The identification of OSOs for a given operation is the responsibility of the ~~applicant~~ UAS operator. The relationship between the SAIL and the low/medium/high level of robustness of an OSO can be found in Step #9, see Section S.4.9 of this AMC (SORA Main Body).
#2	Annex E does not cover the LoI of the competent authority. The 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 Section S.4.9.3 of this AMC (SORA ~~m~~Main ~~b~~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.~~ UAS operators are encouraged to consider also the OSOs classified as 'NR', at least with 'low' level of integrity and assurance.
#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 from~~in~~ proposing mitigations, nor the competent authority from~~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 Operational safety objectives (OSOs)~~ related to technical issues with the UAS~~

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

TECHNICAL ISSUE WITH THE UAS		**~~Level of integrity~~ LEVEL of INTEGRITY**		
		Low (SAIL II)	**Medium (SAIL III)**	**High (SAIL IV to VI)**
OSO #01 Ensure that the UAS operator is a competent and/or proven organisation	~~Criteria~~ Criterion	The ~~applicant~~ UAS operator 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 ~~L~~'low'. In addition, the ~~applicant~~ UAS operator has set up an organis~~z~~ation appropriate[~~1~~3] for the ~~intended~~ UAS 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 authorisation and check whether the mitigations proposed as part of the operational authorisation are still appropriate; (b) occurrence analysis procedures and reporting to the UAS designer in case of design-related in-service events.	~~Same as medium~~ The UAS operator has an adequate organisational management system.
	Comments	~~*N/A*~~ *[1] Including monitoring of any related airworthiness directives or recommendations issued by national aviation authorities and UAS designer*	*[~~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*

		recommendations (service bulletins, service information letters, etc.). [2] *Operational procedures (checklists, maintenance, training, etc.) can be justified in the context of other applicable OSOs.*		

TECHNICAL ISSUE WITH THE UAS		~~Level of assurance~~ LEVEL of ASSURANCE		
		Low (SAIL II)	**Medium (SAIL III)**	**High (SAIL IV to VI)**
OSO #01 Ensure that the UAS operator is a competent and/or proven organisation	~~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 Member State or an entity that is designated by the competent authority performs an audit of the organisation.	The ~~applicant~~UAS operator holds a light UAS operator certificate (LUC) according to PART C of Implementing Regulation (EU) 2019/947 or an air operator certificate (AOC) according to Regulation (EU) No 965/2012 or equivalent or, if the applicant is a design or production organisation, holds an approval according to Subpart J or P of Annex I (Part 21) to Regulation (EU) No 748/2012. ~~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 organisation 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 organisation ~~entity~~

TECHNICAL ISSUE WITH THE UAS		~~Level of integrity~~ 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 organisation ~~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; and (c) configuration control.	Same as 'low'. In addition, design documentation also covers~~:~~ ~~(a) the configuration control; and~~ ~~(b)~~ identification and traceability.	The UAS designer ~~organisation~~ complies with Subpart J of Annex I (Part 21) to Regulation (EU) No 748/2012.
	~~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 and~~&~~ 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**~~ **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 organisation ~~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.~~ The UAS operator should use a UAS for which the UAS designer has issued a statement of compliance with MoC to OSO #02[1] using the form attached to the MoC.	~~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~~ UAS operator should use a UAS for which EASA has verified the claimed integrity through a design verification report (DVR) issued following an application from the UAS designer.	~~Same as medium.~~ ~~In addition:~~ ~~In addition, the competent authority should request the applicant~~ The UAS operator should ~~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 following an application from the UAS designer.
	Comments	[1] https://www.easa.europa.eu/en/document-library/product-certification-consultations/means-compliance-moc-design-uas-operated-sail *Note:* EASA is in the process of developing the means of compliance for all OSOs. Once developed, they will be made available at the link above.		
	Criterion for production	The declared production procedures are developed to a standard that is considered adequate by the competent authority that issues the operational authorisation and/or in accordance with ~~a~~ means of compliance acceptable to the ~~that~~ competent authority.	Same as ‘low’. In addition, evidence is available that the UAS has been produced in conformity~~ance~~ with its design.	Same as ‘medium’. In addition~~:~~, the competent authority of the Member State or an entity that is designated by the competent authority validates compliance with the production organisation~~al~~ requirements that are defined in Subpart F or G of Annex I (Part 21) to Regulation (EU) No 748/2012

				following an application from the UAS production organisation.
	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~~ 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's maintenance instructions and requirements to ensure a safe operation are defined.	Same as 'low'. In addition, the UAS designer's scheduled maintenance requirements are defined.	
	~~Criteria~~ Criterion #2 (Procedure)	(a) The UAS operator's[1] maintenance instructions[2] and requirements[3] are defined, ~~and, when applicable,~~ covering the applicable UAS designer's instructions and requirements[4,5], and are adhered to. (b) The maintenance staff is competent and has received an authorisation by the UAS operator 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's maintenance programme, established on the basis of the UAS designer's scheduled maintenance requirements[4] and adapted to the specificities of the intended 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 that ~~who~~ has received by the UAS operator a maintenance release authorisation for a~~that~~ particular UAS model/family.	Same as 'medium'. In addition, the maintenance staff work in accordance with a maintenance procedures manual that provides information and procedures relevant to the maintenance facility, records, maintenance instructions, release, tools, materials, components, defect deferral, etc. The UAS operator complies with Delegated Regulation (EU) 2024/1107.
	Comments	~~*N/A*~~		

		[1] The maintenance may be carried out by an organisation other than the UAS operator (e.g. use of a third party). *[2] The UAS operator's maintenance instructions are the information establishing how to carry out the required maintenance/repairs. These instructions are used by maintenance staff while performing maintenance.* *[3] The UAS operator's maintenance requirements are the needs for maintenance of 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's instructions and requirements for maintenance.* *[5] The UAS designer's instructions and requirements for maintenance are sometimes referred to as 'ICAs' (Instructions for Continuing Airworthiness).*

<table>
<tr><th colspan="2" rowspan="2">TECHNICAL ISSUE WITH THE UAS</th><th colspan="3">~~Level of assurance~~ LEVEL of ASSURANCE</th></tr>
<tr><th>Low
(SAIL I & II)</th><th>Medium
(SAIL III & IV)</th><th>High
(SAIL V & VI)</th></tr>
<tr><td rowspan="3">OSO #03
Maintenance of UAS ~~maintained by a competent and/or proven entity (e.g. industry standards)~~</td><td>Criterion #1
(Design)</td><td>The UAS designer’s maintenance instructions and requirements to ensure a safe operation are documented.</td><td colspan="2">Same as ‘low’.
In addition, the UAS designer’s scheduled maintenance requirements are developed and documented in accordance with standards considered adequate by the competent authority of the Member State and/or in accordance with means of compliance acceptable to that authority.
If the operation is classified as SAIL III, the UAS operator should use a UAS for which the UAS designer has issued a statement of compliance with MoC to OSO #03 and Light-UAS.2625[1] using the form attached to the MoC.
If the operation is classified as SAIL IV, the UAS operator should use a UAS for which EASA has issued a design verification report (DVR) issued following an application from the UAS designer.
If the operation is classified as SAIL V and VI, the UAS operator should use a UAS for which EASA has issued a type certificate or a restricted type certificate in accordance with Annex I (Part 21) to Regulation (EU) No 748/2012, following an application from the UAS designer.</td></tr>
<tr><td>*Comments*</td><td>N/A</td><td colspan="2">[1] https://www.easa.europa.eu/en/document-library/product-certification-consultations/means-compliance-moc-design-uas-operated-sail</td></tr>
<tr><td>Criterion #~~1~~2
(Procedure)</td><td>(a) The UAS operator’s maintenance instructions are documented[1].
(b) The maintenance carried out ~~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.</td><td>Same as ‘low’.
In addition:
(a) The UAS operator’s maintenance programme covers the UAS designer’s scheduled maintenance requirements and is developed in accordance with standards considered adequate by the competent authority of the Member State and/or in accordance with a means of compliance acceptable to that authority. ~~In addition, if the UAS has a DVR or a (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.</td><td>Same as ‘medium’.
In addition, the maintenance programme and the maintenance procedures manual are validated by the competent authority of the Member State or by an entity that is designated by the competent authority.

The UAS operator complies with Delegated Regulation (EU) 2024/1107.</td></tr>
</table>

	Comments	*[1] The UAS operator may just reuse the UAS designer's instructions and requirements for maintenance.* *[2~~1~~] The objective is to record all the maintenance performed on the UA~~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 initial 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 authoris~~z~~ation, the initial training is specific to a~~that~~ particular UAS model/family. (c) All maintenance staff have undergone initial training.	Same as 'medium'. In addition: (a) ~~A~~ a programme for the recurrent training of staff holding a maintenance release authorisation is established; and (b) ~~This~~ that programme is validated by the Member State or by an entity that is designated by the competent authority. The UAS operator complies with Delegated 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) Within the scope of OSO #4, UAS components essential to safe operations are those whose failure would significantly impair the capability of the operator to meet the required 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 an 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 standards (ADSs) to be complied with through OSO #04 is not intended to duplicate the 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 (for example, the design and construction, structure, and flight performance is part of the ADS, but not of other OSOs), other design-related OSOs focus on particular systems/functionalities of the UAS and or technical disciplines (e.g. safety):

— OSO #05 (system safety related),

— OSO #06 (C3 link),

— OSO #07 (conformity check),

— OSO #13 (external services),

— OSO #18 (automatic protection of envelope),

— OSO #20 (HMI),

— OSO #23/#24 (adverse environmental conditions).

TECHNICAL ISSUE WITH THE UAS		~~Level of integrity~~ 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 that are essential to safe operations are ~~is~~ designed to an airworthiness design standard~~s~~[1] considered adequate by EASA ~~the competent authority~~ and/or in accordance with a means of compliance acceptable to EASA ~~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 that are essential to safe operations are ~~is~~ designed to an airworthiness design standard~~s~~[1] considered adequate by EASA ~~the competent authority~~ and/or in accordance with a means of compliance acceptable to EASA ~~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 that are essential to safe operations are ~~is~~ designed to an airworthiness design standard~~s~~[1] considered adequate by EASA ~~the competent authority~~ and/or in accordance with a means of compliance acceptable to EASA ~~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.* *When aspects of an airworthiness design standard are covered by an OSO (for instance, OSO #05), the OSO requirement takes precedence.*		

TECHNICAL ISSUE WITH THE UAS		~~Level of assurance~~ 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~~	~~Criteria~~ Criterion	The ~~competent authority should request the applicant~~ UAS operator should ~~to~~ use a UAS for which EASA has verified the claimed integrity through a design verification report (DVR) issued following an application from the UAS designer.	~~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~~ UAS operator should 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, following an application from the UAS designer.

~~recognised design~~ standard~~s~~	*Comments*	*N/A*	*N/A*	*N/A*
	Comment	In case the UAS designer decides to apply OSO #4 for UAS operated in SAIL I to III, MoC Light UAS.FTB may be used (https://www.easa.europa.eu/en/document-library/product-certification-consultations/final-means-compliance-special-condition-light).	N/A	

OSO #05 — The 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 with the acceptable level of risk associated with each SAIL. The 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 event.

(b) Note on SAIL II operations: some UAS designs may employ novel or complex features with which the UAS designer has very limited operational experience. If such features are identified by the competent authority or the UAS designer, the UAS designer should assure that the equipment, systems and installations are designed to minimise 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 statement of compliance with a simple written justification from the UAS designer including functional diagrams and a description of how the system functions.

TECHNICAL ISSUE WITH THE UAS		Level of integrity LEVEL of INTEGRITY		
		Low (SAIL III)	**Medium (SAIL IV)**	**High (SAIL V & VI)**
OSO #05 The UAS is designed considering system safety and reliability	Criteria Criterion	The equipment, systems, and installations are designed to minimise[1] hazards[21] in the event of a probable[32] 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; (b) Hazardous failure conditions are not more frequent than extremely remote[3]; (c) Catastrophic failure conditions are not more frequent than extremely improbable; (d) No single failure can lead to a catastrophic failure condition; and (ed) 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.
	Comments	*[1] The minimisation of the 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 %*	*N/A UAS designers may achieve compliance by using MoC Light UAS.2510* (https://www.easa.europa.eu/en/document-library/product-certification-consultations/means-compliance-moc-design-uas-operated-sai).	

		contribution of the technical aspects to the safety of an operation. *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'.*		

TECHNICAL ISSUE WITH THE UAS		**~~Level of assurance~~ LEVEL of ASSURANCE**		
		Low (SAIL III)	**Medium (SAIL IV)**	**High (SAIL V & VI)**
OSO #05 The 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. The UAS operator should use a UAS for which the UAS designer has issued a statement of compliance with MoC to OSO #05[4] using the form attached to the MoC.	Same as SAIL III. In addition: (a) The ~~S~~safety ~~analyses~~ assessment is conducted in line with standards considered adequate by EASA ~~the competent authority~~ and/or in accordance with a means of compliance acceptable to EASA~~ that authority~~. (b) A strategy for the detection of single failures of concern includes pre-flight checks.	The ~~competent authority should request the applicant~~ UAS operator should ~~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 following an

TECHNICAL ISSUE WITH THE UAS		Level of assurance LEVEL of ASSURANCE		
		Low (SAIL III)	**Medium (SAIL IV)**	**High (SAIL V & VI)**
			The ~~competent authority should request the applicant~~UAS operator should ~~to~~ use a UAS for which EASA has validated the claimed integrity through a design verification report (DVR) issued following an application from the UAS designer.	application from the UAS designer.
	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 to support compliance with this criterion (through a functional hazard analysis (FHA)).* *[3] A simple written justification from the UAS designer including functional diagrams and a description of how the system works explaining why the integrity claim is met is an acceptable means of compliance.* *[4] https://www.easa.europa.eu/en/document-library/product-certification-consultations/means-compliance-moc-design-uas-operated-sail*	~~*N/A*~~ *EUROCAE ED-280 'Guidelines for UAS safety analysis for the specific category (low and medium levels of robustness)' may be considered acceptable to support compliance with this criterion.*	*N/A*

OSO #06 — C3 link characteristics (e.g. performance, spectrum use) are appropriate for the UAS 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~~ UAS operator or the UAS designer, as described in the table below, should identify the following:

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

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

<u>Note 1</u>: The specification of the performance and the RF spectrum for a C2 ~~L~~link is typically documented by the UAS designer in the UAS flight manual.

<u>Note 2</u>: 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~~ UAS operation (including the need for authorisation if required).

<u>Note</u>: 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~~UAS operator should check the local requirements and request authorisation when needed since there may be national differences and specific allocations (e.g. national ~~sub-~~subdivisions of ITU allocations). Some aeronautical bands (e.g. AM(R)S, AMS(R)S 5030-5091 MHz) were allocated for potential use in UAS operations ~~under~~ within the ICAO scope for UAS operations classified as category~~. C (~~'certified'~~)~~, but their use may be authorised for operations in~~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

in~~under~~ the 'specific' category. Some ~~un-~~unlicensed bands (e.g. industrial, scientific and medical (ISM) or short-range devices (SRDs)) may also be acceptable in~~under~~ the 'specific' category; for instance, for operations with lower integrity requirements.

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

TECHNICAL ISSUE WITH THE UAS		**~~Level of integrity~~ 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 UAS operation	~~Criteria~~ Criterion #1 (Operator)	The UAS operator: (a) ~~The applicant~~ determines that the performance, RF spectrum ~~usage~~use[1] and environmental conditions for C3 links, as identified in the UAS flight manual[2], are adequate to safely conduct the ~~intended~~ UAS operation. (b) has procedures for the ~~The~~ remote pilot ~~has the means~~ to continuously monitor the C3 link performance and ensures that the performance continues to meet the operational requirements~~[2]~~[3].	Same as 'low'~~[3]~~[4].	Same as 'low'. In addition, the use of licensed~~[4]~~[5] frequency bands for C2 ~~L~~links is required.
	Comments	*[1] For a low level of integrity, unlicensed frequency bands may~~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-~~deconfliction by procedure).* *[2] The UAS designer may provide technical information also in other documentation.* *~~[2]~~[3] The remote pilot has continu~~al~~ous and timely access to the relevant C3 links information that could affect the safety of flight. For operations*	*~~[3]~~[4] Depending on the operation, the use of licensed frequency bands may~~might~~ be necessary. In some cases, the use of non-aeronautical bands (e.g. licensed bands for cellular network) may be acceptable.*	*~~[4]~~[5] 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 a C2 ~~L~~link (e.g. 5030–5091 MHz).* *In any case, the use of licensed frequency bands requires ~~needs~~ authorisation.*

TECHNICAL ISSUE WITH THE UAS		~~Level of integrity~~ LEVEL of INTEGRITY Low (SAIL II & III)	Medium (SAIL IV)	High (SAIL V & VI)
		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.		
	Criterion #2 (Designer)	The UAS designer determines: (a) the performance and the RF spectrum use[1] for C3 links and specifies them in the UAS flight manual; (b) that the means to continuously monitor the C3 link performance are available and are defined in the UAS flight manual[2].	Same as 'low'[3].	Same as 'low'. In addition, the use of licensed[4] frequency bands for C2 links is required.
		[1] For a low level of integrity, unlicensed frequency bands may be acceptable under certain conditions, e.g.: *(a) the UAS designer demonstrates compliance with other RF spectrum use 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).* *[2] The remote pilot has continuous and timely access to the relevant C3 link 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.*

<table>
<tr><th colspan="2" rowspan="2">TECHNICAL ISSUE WITH THE UAS</th><th colspan="3">~~Level of assurance~~ LEVEL of ASSURANCE</th></tr>
<tr><th>Low
(SAIL II & III)</th><th>Medium
(SAIL IV)</th><th>High
(SAIL V & VI)</th></tr>
<tr><td rowspan="4">OSO #06
C3 link characteristics (e.g. performance, spectrum use) are appropriate for the UAS operation</td><td>~~Criteria~~ Criterion #1 (Operator)</td><td>The UAS operator ~~applicant~~ declares that the required level of integrity has been achieved.</td><td>The ~~competent authority should request the applicant to~~ UAS operator should use a UAS for which EASA has verified the claimed integrity through a design verification report (DVR) issued following an application from the UAS designer.</td><td>The ~~competent authority should request the to~~ UAS operator should use a UAS for which EASA has issued a type certificate or a restricted type certificate in accordance with Annex I (Part 21) to Regulation (EU) No 748/2012 following an application from the UAS designer.</td></tr>
<tr><td>Comments</td><td>N/A~~.~~</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Criterion #2 (Designer)</td><td>The UAS designer declares that the required level of integrity has been achieved.

If the operation is classified as SAIL III, the UAS operator should use a UAS for which the UAS designer has issued a statement of declared designer has issued a statement of declared with the MoC to OSO #06[1] using the form attached to the MoC.[2]</td><td>The UAS designer should obtain a design verification report (DVR) issued by EASA.</td><td>The UAS designer should obtain a type certificate or a restricted type certificate issued by EASA in accordance with Annex I (Part 21) to Regulation (EU) No 748/2012.</td></tr>
<tr><td>Comments</td><td>[1] https://www.easa.europa.eu/en/document-library/product-certification-consultations/means-compliance-moc-design-uas-operated-sail
[2] For UAS operations classified in SAIL II, the UAS operator may still use an UAS for which the UAS designer issued a statement of compliance with the MoC to OSO #6. However, the UAS designer should be allowed to experiment new solutions. In this case a statement of compliance not referring to a published MoC might be acceptable.</td><td>N/A</td><td>N/A</td></tr>
</table>

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 that the UAS operator assure~~s~~ that the UAS used for the operation conforms to the UAS data used to support the approval/authorisation of the ~~intended~~ UAS 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~~ 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 in place ensuring periodically that: (a) the UAS intended to be used for the operation is in a condition for safe operation; and (b) the UAS configuration conforms to the information contained in the UAS flight manual and to the authorised configuration[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).~~* The allowed UAS configuration should be defined by the UAS designer according to the configuration control criteria as per OSO #2.		

TECHNICAL ISSUE WITH THE UAS		~~Level of assurance~~ LEVEL of ASSURANCE		
		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	Criterion #1 (Procedures)	~~Product inspection is~~ The UAS operator declares it has UAS conformity check procedures in place ~~documented and~~ which take into consideration ~~accounts for~~ the ~~manufacturer's~~ UAS designer'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 Member State or by an entity that is designated by the competent authority.
	Comments	*N/A*	*N/A*	*N/A*
	Criterion #2 (Training)	The UAS operator declares that 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 evidence of the ~~competency-based,~~ theoretical and practical training.	The competent authority of the Member State 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 from external systems supporting the UAS operation, human error or adverse environmental conditions.

(b) Standard operational procedures are a set of instructions covering policies, procedures and responsibilities set out by the UAS operator that support 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 operational procedures or allow the safe cessation of the flight.

(d) Emergency procedures are intended to mitigate the effect of failures that could cause or could lead to an emergency situation.

(e) The emergency response plan (ERP) deals with the potential hazardous secondary or escalating effects following a loss of control of the operation (e.g. in the case of ground impact, mid-air collision or fly-away) and is decoupled from the emergency procedures as it does not deal with the control of the UA during operation.

OPERATIONAL PROCEDURES		~~Level of integrity~~ 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 (UAS flight manual)	The UAS designer develops a UAS flight manual, including the relevant information (e.g. limitations).		
	Comments	*N/A*		
	Criterion #2 (~~p~~Procedure definition)	(a) The UAS operator develops operational procedures[1] appropriate for the proposed operation, taking into account the relevant information (e.g. limitations) listed in the UAS flight manual ~~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 flight ~~mission~~ (i.e. real-time evaluation), including the assessment of meteorological conditions (METAR, TAF, etc.) with a simple recording system;		

OPERATIONAL PROCEDURES		~~Level of integrity~~ LEVEL of INTEGRITY		
		Low (SAIL I)	Medium (SAIL II)	High (SAIL III to VI)
		(4) Procedures to cope with unexpected adverse operating conditions (e.g. when ice is encountered during an operation that is not approved for icing conditions); (5) Normal procedures; (6) Contingency procedures (to cope with abnormal situations); (7) Emergency procedures (to cope with emergency situations), including an ERP; (8) Pre-flight procedures, including briefing of any involved persons about the potential risks and actions to take in case the UA misbehaves; (~~8~~9) Occurrence-reporting procedures; and (b) The limitations of the external systems supporting the UAS operation[2] are defined in ~~an~~the OM.		
	Comments	*[1] Operational procedures cover the deterioration of the UAS itself and of any external system supporting the UAS operation. Please, refer to Part B of the* OM example for UAS operations *published on the EASA website at* [*https://www.easa.europa.eu/en/downloads/139674/en*](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) to be 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.~~

OPERATIONAL PROCEDURES		**~~Level of integrity~~ LEVEL of INTEGRITY**		
		Low (SAIL I)	**Medium (SAIL II)**	**High (SAIL III to VI)**
	~~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*~~
	Criterion #3 (Consideration of ~~P~~potential ~~H~~human ~~E~~error)	As~~t~~ a minimum, operational procedures[1] ~~provide~~: (a) include a clear distribution and assignment of tasks, and (b) rely on ~~an internal~~ checklists to ensure staff are adequately performing their assigned tasks.	Operational procedures take human error into consideration.	Same as 'medium'. In addition, the remote crew[3] receives crew resource management (CRM)[4] training.
	Comments	~~*N/A*~~ *[1] Please, refer to Part B of the* OM example *published on the EASA website at https://www.easa.europa.eu/en/downloads/139674/en.*	*N/A*	*[3] In the context of SORA, the term 'remote crew' refers to any person involved in the operation ~~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. Elements of the CRM training may be found in the AMC and GM to point ORO.FC.115 to Regulation (EU) No 965/2012.*
	Criterion #4 (Emergency response plan (ERP))	The ERP: (a) is suitable for a given situation[6]; (b) effectively mitigates all anticipated hazardous secondary effects after the initial crash; (c) clearly delineates the duties of the remote crew member(s); (d) is practical to use and for training purposes, so that the remote crew can execute the procedures effectively under stress. The ERP contains as a minimum: (a) the list of anticipated emergency situations with secondary effects;		

OPERATIONAL PROCEDURES		~~Level of integrity~~ LEVEL of INTEGRITY		
		Low (SAIL I)	**Medium (SAIL II)**	**High (SAIL III to VI)**
		(b) the procedures for each of the identified anticipated emergency situations (including criteria to identify each of these situations); (c) the list of relevant contacts to reach (e.g. ATC, police, fire brigade, first responders).		
	Comments	[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). AMC3 UAS.SPEC.030(3)(e) provides additional information. The ERP chapter of the OM published on the EASA website (https://www.easa.europa.eu/en/domains/drones-air-mobility/operating-drone/specific-category-civil-drones#group-easa-downloads) may be considered as a reference.*		

OPERATIONAL PROCEDURES		~~Level of assurance~~ 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	Criterion #1	The UAS operator should use a UAS for which the UAS designer has issued a statement of compliance with MoC to OSO #08[1] using the form attached to the MoC.		SAIL III same as SAIL I and II. SAIL IV: EASA has verified the claimed integrity through a design verification report (DVR) issued following an application from the UAS designer. SAIL V and VI: EASA has verified the claimed integrity through the issuance of a type certificate according with Annex I (Part 21) to Regulation (EU) No 748/2012 issued following an application from the UAS designer.
	Comments	[1] *https://www.easa.europa.eu/en/document-library/product-certification-consultations/means-compliance-moc-design-uas-operated-sail*		*N/A*

	Criteria #2, #3 and #4	~~(a) Operational procedures 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 the ERP. ~~is declared, except for~~ As a minimum, the emergency procedures~~, which~~ are tested.	~~(a) Normal, contingency, and emergency procedures are documented and part of the operations manual (OM).~~ (a~~b~~) Operational procedures and the ERP are ~~validated against~~ developed according to AMC2 UAS.SPEC.030(3)(e) and AMC3 UAS.SPEC.030(3)(e) respectively. ~~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~~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 the 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 Member State or by an entity that is designated by the competent authority. (c) The representativeness of the tabletop exercise[1] of the ERP is validated by the competent authority of the Member State 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.*~~ *The tabletop exercise may involve the third parties identified in the ERP.*	
	Alternative criteria #2, #3 and #4 taking credit for functional-test-based (FTB) methods	FUNCTIONAL-TEST-BASED (FTB) METHODS (for SAILs up to and including IV) If the UAS operator has evidence of the FTB flight hours proportionate to the risk/SAIL of the UAS operation meeting either set of conditions described either in Section E.3(c) or in Section E.3(d) and executed: (a) within the full operational scope/envelope intended by the UAS operator; and (b) following the operational procedures included in the operation manual,		

		then the assurance that the operational procedures are adequate is fulfilled at the level corresponding to the SAIL being demonstrated by the FTB approach[2].
	Comments	[2]*As an example, if the number of test cycles supporting the FTB flight hours is proportionate to the risk of a SAIL III operation (i.e. 3 000 FH), the assurance level for OSO #08 is fulfilled at 'high' level.*

OSO #09 — Remote crew trained and current

(a) The UAS operator 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 from external systems supporting the UAS operation, human errors or adverse environmental conditions; and

(2) includes proficiency requirements and recurrent training.

(b) The entire remote crew (i.e. any person involved in the operation) should receive~~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.).

REMOTE CREW COMPETENCIES		**~~Level of integrity~~ LEVEL of INTEGRITY**		
		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	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 Regulations; (~~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) the UAS; ~~and~~ (~~h~~8) ~~operating~~ operational procedures and the ERP~~.~~; and (9) the use of external services, including service limitations and system recovery, if any[1]; (b) is adequate for the UAS operation, i.e. allows the remote crew to control the normal, abnormal and emergency situations potentially resulting from technical issues with the UAS or from external systems supporting the UAS operation, human errors or adverse environmental conditions[2,3]; (c) specifies 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 services as intended.*		

		[2] The details of the areas to be covered for the different subjects listed above are provided in 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', in 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 in AMC3 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~~ 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) The ~~T~~training syllabus is available and kept up to date. (b) ~~The UAS operator provides competency-based,~~ Evidence of the theoretical and practical training is available.	The competent authority of the Member State 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~~ ~~(b) particular risks relevant to the ConOps (e.g. hail, ice, snow, electromagnetic interference, etc.) do not violate the independence claims, if any.~~	~~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 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*~~

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

OSO #13 — External services supporting UAS operations are adequate for the UAS operation

For the purpose of the 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;

— navigation service providers (e.g. GNSS);

— ~~and~~ U-space service providers[48];

— 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 supply).

The interface between the UAS operator and the external service provider(s) may take the form of a service level agreement (SLA) or a similar document.

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

~~[48] 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		**~~Level of integrity~~ LEVEL of INTEGRITY**		
		Low (SAIL I & II)	**Medium (SAIL III)**	**High (SAIL IV to VI)**
operations are adequate for the UAS operation		Roles and responsibilities between the ~~applicant~~UAS operator and the external service provider are defined.		
	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(s) may be derived from ICAO Standards and Recommended Practices (SARPs) that are currently under development.*

DETERIORATION OF EXTERNAL SYSTEMS SUPPORTING UAS OPERATIONS		**~~Level of assurance~~ 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 UAS operation	~~Criteria~~ Criterion	The ~~applicant~~UAS operator 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~~UAS operator 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 operation ~~mission~~. This may take the form of an SLA or any official commitment that prevails between a ~~S~~service ~~P~~provider and the ~~applicant~~UAS operator on relevant aspects of the service (including quality, availability and responsibilities). The ~~applicant~~UAS operator has means to monitor externally provided services that affect flight-critical systems and takes 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 Member State 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*	*N/A*	*N/A*

		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 UAS operator on relevant aspects of the service (including quality, availability and responsibilities).* *As an example, if a UAS operator uses an external surveillance service, it should have evidence available supporting the claim that the service meets the performance requirements of Annex D to this AMC.*		

~~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~~ LEVEL of INTEGRITY**		
		Low (SAIL I & II)	**Medium (SAIL III & IV)**	**High (SAIL V & VI)**
OSO #16 Multi-crew coordination	Criterion #1 (Procedures)	The UAS operator develops ~~P~~procedures~~(s)~~ to ensure coordination between the crew members, and robust and effective communication channels ~~is (~~are~~)~~ available and as~~t~~ a minimum cover: (a) assignment of tasks to the crew;~~,~~ and (b) establishment of step-by-step communications, including the establishment and use of proper phraseology between the remote crew members involved in the aerial part of the operation[1].~~[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 definition I.110 'Remote pilot (in command)' provided in Annex I to this AMC, the term 'remote crew' refers to any person that performs duties essential to the safety of flight (e.g. AOs, 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.~~ The UAS operator determines that the performance of communication devices is adequate to safely conduct the UAS operation.	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 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 throughout the operation.	
	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 Member State. (b) The adequacy of the procedures and checklists is declared.	(a) Procedures are validated against standards considered adequate by the competent authority of the Member State 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 Member State or an entity 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*
	Alternative criterion #1 taking credit for functional-test-based (FTB) methods	FUNCTIONAL-TEST-BASED (FTB) METHODS (for SAILs up to and including IV): If the UAS operator has evidence of the FTB flight hours proportionate to the risk/SAIL of the operation meeting either set of conditions described either in Section 3(c) or in 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 authorisation,		N/A[3]

HUMAN ERROR		LEVEL of ASSURANCE		
		Low (SAIL I & II)	**Medium (SAIL III & IV)**	**High (SAIL V & VI)**
		then the assurance that the operational procedures are adequate is fulfilled at the level corresponding to the SAIL being demonstrated by the FTB approach[2].		
	Comments	*[2] As an example, if the number of test cycles supporting the FTB flight hours is proportionate to the risk of a SAIL III operation (i.e. 3 000 FH), the assurance level for OSO #16 Criterion #1 is fulfilled at 'medium' level.*		*[3] FTB methods 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,~~ Evidence of the theoretical and practical training is available.	The competent authority of the Member State 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~~UAS operator 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.	Unless the communication device is included in the UAS type design, ~~T~~ the competent authority or an entity that is designated by the competent authority validates the claimed level of integrity. ~~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.~~
	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 ofSORA, 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 contributing~~ory~~ 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)[49];

(5) workplace environment, including ergonomics of the workstation[49]; and

(~~4~~6) handover/takeover procedures.

HUMAN ERROR		~~Level of integrity~~ 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~~UAS operator has a policy defining the criteria[1] and the means on how the remote crew can declare themselves fit to operate before starting their duty, and on how to 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~~UAS operator and are adequate for the operation. (b) The UAS operator defines requirements appropriate for the remote crew to operate the UAS.	Same as ~~M~~'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 national legislation and may cover drugs (including prescriptions) and alcohol consumption.*	*N/A*	*N/A*

[49] In accordance with national occupational safety and health regulations.

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 to 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 as~~t~~ a minimum: ~~1.~~(1) when the remote crew members'~~s~~ duty day commences;~~,~~ ~~2.~~(2) when the remote crew members are free from duties;~~,~~ and ~~3.~~(3) resting times within the duty cycle.	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 Member State or an entity that is designated by the competent authority verifies that the remote crew is medically fit. (b) The competent authority of the Member State or an entity that is designated by the competent authority validates the duty/flight duty times. (c) ~~If an~~ The FRMS ~~is used, it~~ is validated ~~and monitored~~ by the competent authority of the Member State or by an entity that is designated by the competent authority and internally monitored by the UAS operator.
	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 operational 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~~UAS operator demonstrates that the ~~remote-pilot~~ 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 UA ~~aircraft~~ are exceeded.

(e) Failures or development errors of the flight envelope protection are addressed in OSO~~s~~ #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	*N/A*	*[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 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 UAS designer develops 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 UAS operator should use a UAS for which the UAS designer has issued a statement of compliance with the MoC to OSO #18[1] using the form attached to the MoC.	The ~~competent authority should request the applicant~~ UAS operator should ~~to~~ use a UAS for which EASA has verified the claimed integrity through a design verification report (DVR) issued following an application from the UAS designer.	The ~~competent authority should request the~~ UAS operator should ~~to~~ use a UAS for which EASA has issued a type certificate or a restricted type certificate in accordance with Annex I (Part 21) to Regulation (EU) No 748/2012 following an application from the UAS designer.
	Comments	~~*N/A*~~ [1] *https://www.easa.europa.eu/en/document-library/product-certification-consultations/means-compliance-moc-design-uas-operated-sail*	*N/A*	*N/A*

OSO #19 — Safe recovery from human error~~s~~

(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: ~~t~~The flight envelope protection is excluded from this OSO since it is specifically covered by OSO #18.

(b) This OSO covers~~:~~ the 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, etc.).

~~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 Hhuman Eerror	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. (b) The adequacy of the procedures and checklists is declared.	(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 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~~ UAS designer declares that the required level of integrity has been achieved~~[1]~~. The UAS operator should use a UAS for which the UAS designer has issued a statement of compliance with MoC to OSO #19/#20[1] using the form attached to the MoC.	The ~~applicant~~ UAS designer 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~~ UAS operator should ~~to~~ use a UAS for which EASA has verified the claimed integrity through a design verification report (DVR) issued following an application from the UAS designer. If the operation is classified as SAIL V, the ~~competent authority should request the applicant~~ UAS operator should ~~to~~ use a UAS for which EASA has issued a type certificate or a restricted type certificate in accordance with	The ~~competent authority should request the applicant~~ UAS operator should ~~to~~ use a UAS for which EASA has issued a type certificate or a restricted type certificate in accordance with Annex I (Part 21) to Regulation (EU) No 748/2012 following an application from the UAS designer.

HUMAN ERROR		LEVEL of ASSURANCE Low (SAIL III)	Medium (SAIL IV & V)	High (SAIL VI)
			Annex I (Part 21) to Regulation (EU) No 748/2012 following an application from the UAS designer.	
	Comments	~~*1 Supporting evidence may or may not be available.*~~ [1]*https://www.easa.europa.eu/en/document-library/product-certification-consultations/means-compliance-moc-design-uas-operated-sail*	[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 intended UAS operation ~~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 has been found appropriate for the intended UAS operation ~~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); (c) analyses to check if prioritisation of alarms and emergency

			procedures should be put in place to organise 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 the remote crew members ~~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 remote crew members ~~potential airspace observer(s)) VO~~ to determine the position of the UA during operation; and* *— does not degrade the remote crew members' ~~potential 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 ~~H~~human ~~F~~factors evaluation has been performed and the HMI has been found appropriate for the intended UAS operation ~~mission~~	~~Criteria~~ Criterion	The ~~applicant~~ UAS designer conducts a human factors evaluation of the UAS to determine whether the HMI is appropriate for the intended UAS operation ~~mission~~. The HMI evaluation is based on inspection or analyses. The adequacy of the result of the HMI evaluation is declared. The UAS operator should use a UAS for which the UAS designer has issued a statement of compliance with MoC to OSO #19/#20[1] using the form attached to the MoC.	Same as ~~L~~'low' but the HMI evaluation is based on demonstration~~s~~ or simulations.[1] ~~The competent authority should request EASA to witness the HMI evaluation of the UAS.~~ For operations classified in SAIL IV, the UAS operator should use a UAS for which EASA has issued a design verification report (DVR) following an application from the UAS designer. For operations classified in SAIL V, the UAS operator should use a UAS for which EASA has issued a type certificate or a restricted type certificate in accordance with Annex I (Part 21) to Regulation (EU) No 748/2012 following an application from the UAS designer.	Same as ~~M~~'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 UAS operator should use a UAS for which EASA has issued a type certificate or a restricted type certificate in accordance with Annex I (Part 21) to Regulation (EU) No 748/2012 following an application from the UAS designer.
	Comments	~~*N/A*~~	*[1] When simulation is performed, the validity of the targeted environment that*	*N/A*

		[1]*https://www.easa.europa.eu/en/document-library/product-certification-consultations/means*	*is used in the simulation needs to be justified.*	
	Alternative criterion for taking credit for functional-test-based (FTB) methods	If the UAS designer has evidence of the FTB flight hours proportionate to the risk/SAIL of the operation meeting either set of conditions described either in Section 3(c) or in Section 3(d) and executed: (a) within the full operational scope/envelope intended by the UAS operator; and (b) following the operational procedures and the remote crew training referred to in the operational authorisation, then the assurance that the operational procedures are adequate is fulfilled at the level corresponding to the SAIL being demonstrated by the FTB approach[2].	N/A	
	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. 3 000 FH), 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 UAS flight manual or equivalent ~~-~~document~~.[1]~~[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). For SAL III, compliance with the EASA MoC to OSO #24 already determines compliance with OSO #23. Refer to OSO #24.*		
	~~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 are defined, measurable and adhered to	Criterion #1 (Definition)	The ~~applicant~~ UAS designer declares that the required level of integrity has been achieved.	The ~~applicant~~ UAS designer 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~~ UAS operator should ~~to~~ use a UAS for which EASA has issued a design verification report (DVR) following an application from the UAS designer.	The ~~competent authority should request the applicant~~ UAS operator should ~~to~~ use a UAS for which EASA has issued a type certificate or a restricted type certificate in accordance with Annex I (Part 21) to Regulation (EU) No 748/2012 following an application from the UAS designer.
	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 — The UAS is designed and qualified ~~for~~ to operate in adverse environmental conditions (e.g. UA controllability and performance, adequate sensors, DO-160 qualification)

(a) To assess the integrity of this OSO, the ~~applicant~~ UAS designer 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~~ UAS designer 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 the envisaged environmental envelope?

(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 piece of an equipment installed in the UAS has only a partial environmental qualification and/or a partial demonstration by similarity and/or parts with no qualification at all.

ADVERSE ENVIRONMENTAL ~~OPERATING~~ CONDITIONS		**LEVEL of INTEGRITY**		
		N/A	**Medium (SAIL III)**	**High (SAIL IV to VI)**
OSO #24 The UAS is designed and qualified ~~for~~ to operate in adverse environmental conditions	~~Criteria~~ Criterion	N/A	The UAS is designed to limit the effect of the environmental conditions defined and reflected in the UAS flight manual.	The UAS is designed according to ~~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 necessary to comply with DO-160G waterproof conditions; the rain threshold may be limited as long as it is*	*N/A*

			representative of the envisaged environmental conditions.	

ADVERSE ENVIRONMENTAL ~~OPERATING~~ CONDITIONS		LEVEL of ASSURANCE		
		N/A	**Medium (SAIL III)**	**High (SAIL IV to VI)**
OSO #24 The UAS is designed and qualified ~~for~~ to operate in adverse environmental conditions	~~Criteria~~ Criterion	N/A	The ~~applicant~~ UAS designer has supporting evidence that the required level of integrity has been achieved. This is typically done by testing, analysis, simulation[1]~~[2]~~, inspection, design review or through operational experience. The UAS operator should use a UAS for which the UAS designer has issued a statement of compliance with the MoC to OSO #24[2] using the form attached to the MoC.	If the operation is classified as SAIL IV, the ~~competent authority should request the applicant~~ UAS operator should ~~to~~ use a UAS for which EASA has issued a design verification report (DVR) following an application from the UAS designer. If the operation is classified as SAIL V or VI, the ~~competent authority should request the applicant~~ UAS operator should ~~to~~ use a UAS for which EASA has issued a type certificate or a restricted type certificate in accordance with Annex I (Part 21) to Regulation (EU) No 748/2012 following an application from the UAS designer.
	Comments	*N/A*	*[1]~~[2]~~ When simulation is performed, the validity of the targeted environment that is used in the simulation needs to be justified.* *[2] https://www.easa.europa.eu/en/document-library/product-certification-consultations/means-compliance-moc-design-uas-operated-sail*	*N/A*
	Alternative criterion	*N/A*	FUNCTIONAL-TEST-BASED (FTB) METHODS: If the UAS designer has evidence of the FTB flight	*N/A*

ADVERSE ENVIRONMENTAL ~~OPERATING~~ CONDITIONS		LEVEL of ASSURANCE		
		N/A	Medium (SAIL III)	High (SAIL IV to VI)
			hours proportionate to the SAIL of the operation meeting either set of conditions described either in Section E.3(c) or in Section E.3(d) and executed (a) within the full operational scope/envelope intended by the UAS operator; and (b) following the maintenance instructions, the operational procedures and the remote crew training referred to in the operational authorisation, then the assurance that the operational procedures are adequate is fulfilled at the level corresponding to the SAIL being demonstrated by the FTB approach[1].	
	Comments	*N/A*	[1] *As an example, if the number of test cycles supporting the FTB flight hours is proportionate to the risk of a SAIL III operation (i.e. 3 000 FH), 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 FTB approach referenced throughout Annex E to this AMC. This is articulated around three different but complementary perspectives:

(1) FTB as a means of compliance (MoC) to support **UAS designers** in demonstrating UAS operational reliability for the purpose of obtaining an FTB design appraisal;

(2) FTB design appraisal performed by UAS designers supporting **UAS operators** when showing compliance with some of the OSOs of Annex E to this AMC;

(3) 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 points (b), (c) and (d).

(b) For FTB as a MoC to support **UAS designers** in demonstrating UAS operational reliability, please refer to the EASA MoC SC Light-UAS FTB[50].

(c) FTB design appraisal performed by UAS designers supporting **UAS operators** when showing compliance with some of the OSOs of Annex E to this AMC:

(1) An FTB design appraisal obtained by a UAS designer presents several benefits both for the UAS operator going through the operational authorisation process and the competent authority issuing such operational authorisation, in particular when the UAS operator does not have a strong cooperation with the UAS designer or does not have all the design details.

(2) In order for a UAS operator to take credit for an FTB design appraisal obtained by a UAS designer, the following conditions as a minimum should be met:

(i) The functional tests supporting the FTB design appraisal obtained by the UAS designer have been performed within the full operational scope/envelope intended by the UAS operator; this means that the test cycles are fully representative of the UAS operator's operations with test points to verify safe operation at the operational limits and corners of the UA envelope.

(ii) The functional tests supporting the FTB design appraisal obtained by the UAS designer have been performed following the operational procedures and the remote crew training referred to in the operational authorisation (and meeting the integrity assurance of the associated OSOs).

(iii) The UAS operator's maintenance instructions are established based on the UAS designer's instructions and requirements which were used for maintenance, repair or replacement of the UAS subsystems during the functional tests supporting the FTB design appraisal obtained by the UAS designer.

(iv) Any UAS configuration differences compared to the initial configuration used by

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

the UAS designer to obtain the FTB design appraisal are confirmed by the UAS designer in order not to impair the validity of the FTB design appraisal.

(v) The minimum number of test cycles are proportionate to the risk of the UAS operation, with at least:

— 30 hours for SAIL I;

— 300 hours for SAIL II; and

— 3 000 hours for SAIL III

in order to achieve a 95 % confidence (assuming a binomial/Poisson distribution for the operational level hazard rate and no failures during the test)[51].

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

(vi) The functional tests supporting the FTB design appraisal obtained by the UAS designer have been performed by the UAS designer according to the principles/standards considered adequate by the competent authority in charge of granting the operational authorisation, including as a minimum the following principles:

— The functional tests supporting the FTB design appraisal obtained by the UAS designer have been performed using an acceptable sample size of the UA.

— 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.

(3) Additionally, induced-failure tests may help demonstrate compliance with the following OSOs and Step #8:

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

(ii) OSO #06: C3 link performance appropriate for the UAS 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 required);

(iii) OSO #18: Automatic protection of the flight envelope from human error.

However, induced-failure testing is not addressed in this version of Annex E to this AMC 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 obtained by the UAS designer.

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[52] See the Rule of Three at 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'):

(1) 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 meeting the conditions of point E.3(c).

(2) 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 UAS operators. This approach would only be valid <u>under representative operating conditions, not requiring additional strategic or tactical mitigations</u>.

Note 1: The competent authority may accept accumulation of FTB hours between operators if the UAS configuration, operational procedures, training, etc., are demonstrated to be equivalent.

Note 2: 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 people/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 people/km^2).

(3) To be relevant, the UAS operator would need to show that:

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

(ii) the reliability demonstrated through operational testing demonstrates the required operational reliability at the higher SAIL level desired;

(iii) any UAS configuration differences compared to the initial configuration do not impair the validity of the argument.

E.4 Containment requirements

(a) Section S.4.8 of this AMC (SORA Main Body, Step #8) 'Determination of the 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 ground area) determines 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 three levels of containment: low, medium and high.

Containment of untethered UA	**LEVEL of INTEGRITY**		
	Low	**Medium**	**High**[2]
Criterion #1 (Operational volume containment)	The UAS should be designed such that: • (qualitative) no **probable**[1] single failure of the UAS or of any external system supporting the operation could lead to operation outside the operation volume; OR • (quantitative) the probability of the failure condition 'UA leaving the operational volume' should be less than 10^{-3}/FH.		The UAS should be designed such that: • (qualitative) no remote single failure[3] of the UAS or of any external system supporting the operation could lead to operation outside the operational volume; OR • (quantitative) the probability of the failure condition 'UA leaving the operational volume' should be less than 10^{-4}/FH[3].
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 UA from exiting the operational volume (see containment of tethered UA below).* *[3] 'failure' needs to be understood as an*

		occurrence that affects the operation of a component, part or element such that it can no longer function as intended. Errors may cause failures but are not considered failures. Some structural or mechanical failures may be excluded from the criterion if it can be shown that such structural or mechanical parts were designed according to aviation industry best practices. *[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 a particular type.* *[4] This means a reduction by a factor of 10 of the likelihood of exiting the operational volume compared to the 'low' and 'medium' integrity containment.*
Criterion #2 (End of flight upon exit of the operational volume)	When the UA leaves the operational volume, the immediate termination of the flight should be initiated through a combination of procedures/processes and/or available technical means.	
Comments	*Such criteria may be satisfied by the operational procedures developed by the UAS operator that may rely (fully or partially, depending on the level of automation of the UAS) on technical means developed by the UAS designer and documented in the UAS flight manual.*	

Criterion #3 (Definition of the final ground risk buffer)	The UAS operator defines the size of the ground risk buffer. In principle, the ground risk buffer should at least adhere to the 1:1 principle[5]. Alternatively, as the 1:1 rule may not be suitable for some UA configurations (e.g. fixed-wing or parachute-equipped UA), the competent authority may require defining the ground risk buffer based on a ballistic methodology approach, a glide trajectory[6], representative flight tests and/or a combination of these. A smaller ground risk buffer value may be proven by the UAS operator for a rotary-wing UA using a ballistic methodology approach acceptable to the competent authority. If the UAS uses a parachute, the UAS operator should consider the effect of wind on the UAS when it is deployed.	In addition to 'low' robustness, the ground risk buffer should consider the following points: (a) **Probable**[7] single failures (including the projection of high-energy parts such as rotors and propellers) which would lead to an operation outside 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 considering UA performance.
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. For the evaluation of the size of the ground risk buffer based on the 1:1 principle, see Annex A Section A.5.2.4.* *[6] See Annex A Section A.5.2.4.*	*[7] 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	The UAS should be designed such that **no single failure**[8] of the UAS or of any external system supporting the operation could lead to operation **outside the ground risk buffer**. Software (SW) and airborne electronic hardware (AEH) whose development error(s) could **directly lead to operations outside the ground risk buffer** should be developed to an industry standard or methodology recognised as adequate by the competent authority.
Comments	*N/A*	[8] *Example methods for achieving this may include:* — *an independent flight termination system (FTS) that will initiate the end of the flight when the UA exits the operational volume; or* — *a secondary independent emergency flight control system that ends the flight in a controlled manner without exceeding the ground risk buffer; or* — *a tether that prevents the UA from exiting the ground risk buffer.*

Containment of untethered UA	**LEVEL of ASSURANCE**		
	Low	**Medium**	**High**
For all criteria	The applicant declares[1] that the required level of integrity has been achieved. The UAS designer: (a) for <u>criterion #1</u>, conducts a design and installation appraisal[2] including as a minimum:	The applicant has supporting evidence that the required level of integrity has been achieved. This is typically done by testing, analysis, simulation[2], inspection and design review. Among the supporting evidence: (a) for <u>criterion #1 and criterion #4</u>: same as criterion #1, 'low';	Same as 'medium'. The UAS operator should use a UAS for which EASA has verified the claimed integrity through a design verification report 'DVR'. In addition, the competent authority of the Member State or the entity that is designated by the competent authority

	— design and installation features (e.g. independence, separation or redundancy claims); — any relevant particular risk (e.g. hail, ice, snow, electromagnetic interference, etc.) associated with the UAS operation and how they are being addressed; (b) for criterion #2, tests the technical means to safely end the flight and includes the procedures in the UAS flight manual. The UAS operator: — for criterion #2, tests the adequacy of the emergency procedures to terminate the flight.	(b) for criterion #2: the adequacy of the emergency procedures to terminate the flight is proven through: — dedicated flight tests; or — simulation provided the simulation is proven valid for the intended purpose with positive results.	validates the claimed level of integrity for the non-design-related criteria.
Comments	*[1] Supporting evidence for this declaration may still be requested by the competent authority.* *[2] A simple, written justification from the UAS designer, including functional diagrams and 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.*	*[2] When simulation is used, the suitability of the targeted environment used in the simulation needs to be justified.* *The UAS operator may use a UAS for which the UAS designer has issued a statement of compliance with the MoC to Light-UAS.2511 (https://www.easa.europa.eu/en/document-library/product-certification-consultations/final-means-compliance-light-uas2511-moc-light) using the form attached to the MoC 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 statements based on such MoC with evidence available, or to*	*N/A*

		accept appropriate MoC proposed by the UAS designer. Otherwise, the competent authority may request the UAS operator to use a UAS for which EASA has verified the claimed integrity.	

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

Containment of tethered UA	**LEVEL of INTEGRITY**
	Low, Medium and High[1]
Criterion #1 (Technical design)	(a) The length of the line is adequate to contain the UA in the operational volume. (b) The strength of the line is compatible with the ultimate loads[2] expected during the operation. (c) The strength of attachment points is compatible with the ultimate loads[2] expected during the operation. (d) The tether cannot be cut by rotating propellers.
Comments	*UAS operators may purchase a UAS designed to be used with a tether or they may apply a tether. In this case, the UAS operator is required to comply with criterion #1.*
Criterion #2 (Procedures)	The UAS operator 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 provided 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 of tethered UA	**LEVEL of ASSURANCE**		
	Low	**Medium**	**High**
Criterion #1 (Technical design)	The UAS designer or the UAS operator declares[1] that the required level of integrity has been achieved.	The UAS designer or the UAS operator has supporting evidence (including the tether material specifications) to claim the required level of integrity has been 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 Member State 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)	The UAS operator declares to have adequate procedures.	(a) Procedures are validated against standards considered adequate by the competent authority and/or in accordance with 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 Member State or by an entity that is designated by the competent authority.

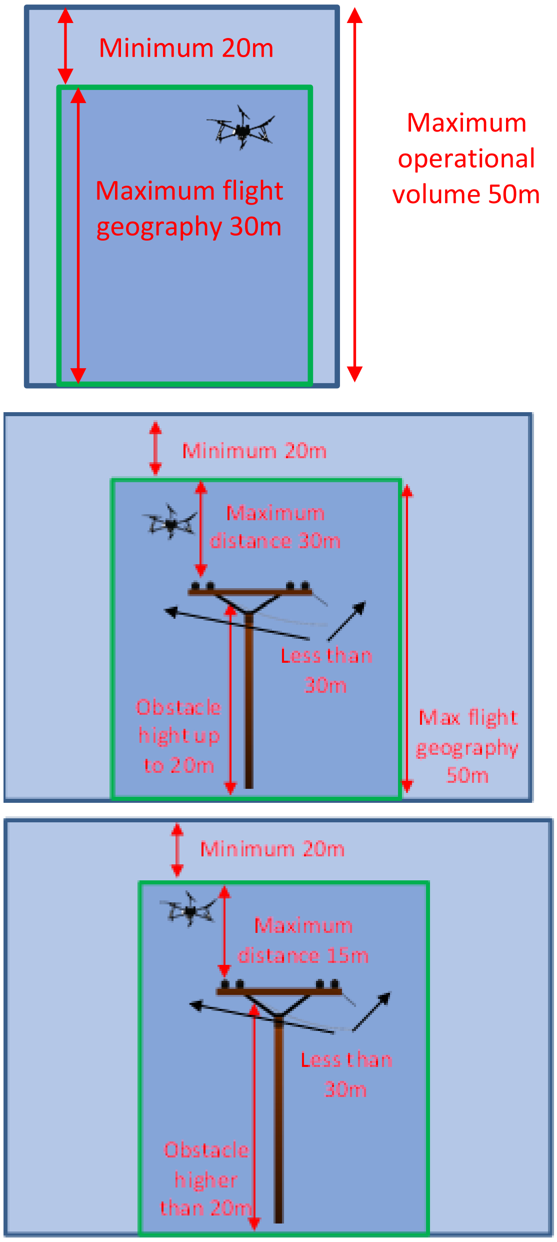
		— simulation provided the simulation is proven valid for the intended purpose with positive results.	
Comments	*[1] Procedures do not require validation against either a standard or a means of compliance considered adequate by the competent authority.*	*[1] National aviation authorities (NAAs) may define 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 Article 11

GLOSSARY OF TERMS

Term	Acronym	Definition
I.1. Abnormal situation		A 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 organisation will have its own acceptable risk level, which is derived from its legal and regulatory compliance responsibilities, its threat profile, and its business/organisational drivers and impacts.
I.3. Adequate		Whatever is necessary or sufficient for a specific requirement.
I.4. Adjacent airspace		The airspace adjacent to the operational volume. See Section S.2.2.6 of AMC1 Article 11.
I.5. Adjacent ground area		The ground area adjacent to the ground risk buffer. See also Section S.2.2.5 of this AMC (SORA Main Body).
I.6. Aerodrome		A defined area (including any buildings, installations and equipment), 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		The aerodrome environment is normally protected by the Member State through the creation of a geographical zone defined according to Article 15 of Implementing Regulation (EU) 2019/947. The aerodrome environment in the SORA context is generally defined as: (a) class A, B, C, D or E controlled airspace which touches the surface with an aerodrome and/or controlled airspace which does not touch the surface, but in connection to an aerodrome (normally depicted on aeronautical charts and sectionals); or (b) any TMZ in class A, B, C, D or E controlled airspace.
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. The ARC is assigned to airspace encounter categories (AECs) based on a qualitative assessment of collision risk of generic types of airspace.
I.10. Aircraft	a/c	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.11. 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.

Term	Acronym	Definition
I.12. Airspace encounter category	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 is grouped by operational altitude, airport environment, controlled airspace, uncontrolled 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 finds itself 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.13. Airspace observer	AO	Means a person who assists the remote pilot by performing unaided visual scanning of the airspace in which the unmanned aircraft is operating for any potential hazard in the air. (Article 2(25) of Implementing Regulation (EU) 2019/947)
I.14. 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.15. Applicant		An individual or an organisation that 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 Section S.2.5(b) of this AMC (SORA Main Body).
I.16. Assemblies of people		Means gatherings where persons are unable to move away due to the density of the people present. (Article 2(3) of Implementing Regulation (EU) 2019/947)
I.17. 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 before the approval is granted or after in auditing.

Term	Acronym	Definition
I.18. Atypical air environment		Airspace where the risk of collision between a UAS and manned aircraft is acceptably low. Examples are: (a) restricted airspace or segregated areas; (b) airspace where normally manned aircraft should not be present (e.g. at a height low enough or close to an obstacle, excluding those potential landing sites for manned aircraft, see examples below)[52];  (c) airspace not covered in airspace encounter categories (AECs) 1 through 11.
I.19. Authority		The organisation responsible within the State concerned with the certification of compliance with applicable requirements.

[52] Only in areas where applicable and accepted by the competent authority.

Term	Acronym	Definition
I.20. Authorisation		The permit granted to a UAS operator by a competent authority.
I.21. Automatic system		Any system in which the remote crew is supported by mechanised or computerised components executing predefined processes.
I.22. Autonomous UA		Means an operation during which an unmanned aircraft operates without the remote pilot being able to intervene. (Article 2(17) of Implementing Regulation (EU) 2019/947)
I.23. Barrier		A material object or set of objects that separates, demarcates or serves 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.24. Beyond visual line of sight operation	BVLOS	Means a type of UAS operation which is not conducted in VLOS. (Article 2(8) of Implementing Regulation (EU) 2019/947)
I.25. Beyond visual line of sight operation with airspace observers	BVLOS with AOs	A UAS operation whereby the remote pilot maintains 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 technological means. The remote pilot-in-command (RPIC) has direct control of the UAS at all times.
I.26. Catastrophic		Failure condition that could result in one or more fatalities.
I.27. Certification		The legal recognition based on an appropriate assessment that a product, part, service, organisation or person complies with the applicable requirements through the issuance of a certificate, licence, approval or other documents as required by national laws and procedures, attesting such compliance.
I.28. Civil aircraft		Aircraft other than public/State or military aircraft.
I.29. Collision avoidance		Averting physical contact between an aircraft and any other object or terrain.
I.30. Command and control link	C2 link	Means the data link between the UA and the CMU for the purpose of managing the flight. (Article 2(27) of Implementing Regulation (EU) 2019/947)
I.31. Commercial off-the-shelf	COTS	Components designed to be implemented into existing systems without extensive customisation and for which design data is not always available to the customer.
I.32. Competent authority		The authority responsible to assess the safety measures proposed by the UAS operator for a safety operation, following a specific operations risk assessment (SORA) and issuing the operational authorisation. See also Section S.2.5(e) of this AMC (SORA Main Body).
I.33. Compliance		Successful performance of all mandatory activities; agreement between the expected or specified result and the actual result.

Term	Acronym	Definition
I.34. Component		Any self-contained part, combination of parts, subassemblies or units, which perform a distinct function necessary to the operation of the system.
I.35. Configuration		The requirements, design and implementation that define a particular version of a system or system component.
I.36. Configuration control/management		The process of evaluating, approving or rejecting, and coordinating changes to configuration items after the formal establishment of their configuration identification.
I.37. Conformity		Aircraft or parts checked against design documents for correctness.
I.38. Contingency area		Means the projection of the contingency volume on the surface of the earth. (Article 2(31) of Implementing Regulation (EU) 2019/947)
I.39. Contingency procedures		Planned course of action designed by the organisation 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.40. Contingency volume		Means the volume of airspace outside the flight geography where contingency procedures described in point (6)(d) of Appendix 5 to the Annex are applied. (Article 2(30) of Implementing Regulation (EU) 2019/947) See also Section S.2.2.3 of this AMC (SORA Main Body).
I.41. Control and monitoring unit	CMU	Means the equipment to control and monitor unmanned aircraft remotely as defined in point (32) of Article 3 of Regulation (EU) 2018/1139. (Article 2(26) of Implementing Regulation (EU) 2019/947)
I.42. Controlled airspace		Airspace class A, B, C, D and E. Airspace of defined dimensions within which air traffic control service is provided in accordance with the airspace classification. Controlled airspace does not imply that separation services are provided at all times. Classes A, B, C, D and E are described in ICAO Annex 11, and in ICAO Annex 2 Section 6.
I.43. Controlled ground area		Means the ground area where the UAS is operated and within which the UAS operator can ensure that only involved persons are present. (Article 2(21) of Implementing Regulation (EU) 2019/947) Note: the concept of controlled ground area is applicable also for UAS operations over water surfaces.
I.44. Cooperative aircraft		Aircraft that have an electronic means of identification (i.e. a transponder) aboard and operating.
I.45. 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 to third parties and/or the environment involved.

Term	**Acronym**	**Definition**
I.46. Critical area		The ground area where persons would be expected to be impacted by the UA in the event of a loss of control of the operation or an unplanned landing.
I.47. 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.48. Critical systems		Systems required for the operation to perform one or more critical functions.
I.49. Criticality		The degree of impact a malfunction has on the operation of a system.
I.50. Danger area		A danger area is airspace of defined dimensions within which activities dangerous to the flight of aircraft may exist at specified times.
I.51. Data link		A term referring to all interconnections to, from and within the UAS. It includes control, flight status, communication and payload links.
I.52. Demonstration		A method of proof of performance by observation.
I.53. 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.
I.54. Emergency recovery capability		A UAS safety feature (e.g. return-to-home) that provides for the cessation of the UA operation in a manner that minimises the risk to persons on the ground, other airspace users and critical infrastructure.
I.55. 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 itself. See also Section S.2.3.2(d) of this AMC (SORA Main Body).
I.56. 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 Section S.2.3.2(e) of AMC1 Article 11.
I.57. 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.58. Equipment		A complete assembly operating either independently or within a system/subsystem that performs a specific function.

Term	Acronym	Definition
I.59. Failure		The loss of a function or the malfunction of a system or a part of it. It should be understood as an occurrence that affects the operation of a component, part or element such that it can no longer function as intended. Errors may cause failures but are not considered failures. Some structural or mechanical failures may be excluded from the criterion if it can be shown that these structural or mechanical parts were designed according to aviation industry best practices.
I.60. Failure mode		The way in which the failure of an item occurs.
I.61. Fixed-wing UA		It includes configurations such as aeroplanes, kites, gliders, etc.
I.62. Flight geography		Means the volume(s) of airspace defined spatially and temporally in which the UAS operator plans to conduct the operation under normal procedures described in point (6)(c) of Appendix 5 to the Annex. (Article 2(28) of Implementing Regulation (EU) 2019/947) See also Section S.2.2.2 of this AMC (SORA Main Body).
I.63. Flight termination system	FTS	Procedure or function which aims to immediately end the flight.
I.64. Fly-away		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.65. Functional test based	FTB	An approach to demonstrate compliance with some OSOs, as defined in Section 3 of Annex E to this AMC.
I.66. Geo-awareness		Means a function that, based on the data provided by Member States, detects a potential breach of airspace limitations and alerts the remote pilots so that they can take immediate and effective action to prevent that breach. (Article 2(15) of Implementing Regulation (EU) 2019/947)
I.67. Geo-caging		An automatic function that helps the remote pilot to maintain the UAS within the defined overall volume (a 'cage').
I.68. Geo-fencing		An automatic function for preventing the UA from entering a prescribed volume.
I.69. Ground risk buffer		An area over the surface of the earth, which surrounds the operational volume and that is specified in order to minimise the risk to third parties on the surface in the event of the unmanned aircraft leaving the operational volume. (Article 2(33) of Implementing Regulation (EU) 2019/947) See also Section S.2.2.4 of this AMC (SORA Main Body).
I.70. Handover		The act of passing command and control from one control and monitoring unit to another.
I.71. Hazard		A potentially unsafe condition resulting from failures, external events, errors, or a combination of these.

Term	Acronym	Definition
I.72. Height		The vertical distance of a level, a point or an object considered as a point, measured from a specified datum.
I.73. Human error		Human action with unintended consequences.
I.74. 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 to human performance.
I.75. 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.76. Initial air risk class	Initial ARC	Initial classification of the airspace where UAS operations are intended to be performed before risk mitigations are applied.
I.77. Intrinsic ground risk class	iGRC	Initial classification of the ground risk before ground mitigations are applied.
I.78. Intrinsic ground risk class footprint	iGRC footprint	The projection of the operational volume plus ground risk buffer on the surface of the earth.
I.79. Incident		An occurrence other than an accident that affects or could affect the safety of operations.
I.80. Industry standard		A published document established by consensus and approved by a recognised 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.81. Inspection		An examination of an item against a specific standard.
I.82. 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 equipment.
I.83. Integrity		Attribute of a system or an item indicating that it can be relied upon to work as expected.
I.84. Involved person		A person directly involved with the operation of the UAS or is 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 in the relevant emergency procedures and/or contingency plans.
I.85. Loss of control of the operation		A situation — whose outcome heavily relies on providence; or — which cannot be handled by a contingency procedure.

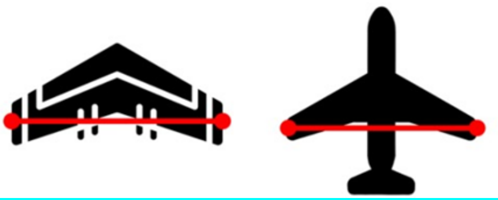
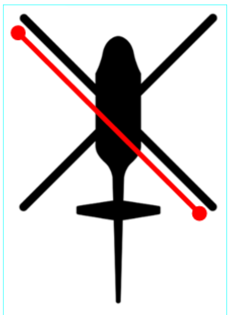
Term	**Acronym**	**Definition**
I.86. Lost C2 link (loss of data link)		The loss of the command-and-control link contact with the UA such that the remote pilot can no longer intervene in the UA's flight control.
I.87. Maintenance		The inspection, overhaul, repair, preservation and/or replacement of parts.
I.88. Malfunction		The occurrence of a condition whereby the UAS operation is outside specified limits.
I.89. Maximum take-off mass	MTOM	Means the maximum unmanned aircraft mass, including payload and fuel, as defined by the manufacturer or the builder, at which the unmanned aircraft can be operated. (Article 2(22) of Implementing Regulation (EU) 2019/947)
I.90. Mid-air collision	MAC	An accident where two aircraft come into contact with each other while both are in flight.
I.91. Minimum aviation system performance standard	MASPS	A MASPS specifies the characteristics that should be useful to UAS 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 into 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 the 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.92. Mitigation		A means to reduce the risk of a hazard.
I.93. Minimum operational performance specification	MOPS	A MOPS provides standards for specific equipment that are useful to UAS 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 the equipment characteristics and the 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 the proper understanding are provided as well as installed equipment tests and operational performance characteristics for equipment installations.
I.94. Multiple simultaneous UAS operations	MSO	UA operations where multiple UA are under a common (centralised) flight management and the individual UA 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 independently of each other under the common flight management.

Term		Acronym	Definition
I.95.	National aviation authority	NAA	Also referred to as 'civil aviation authority', is a government statutory authority in each Member State that issues the operational authorisation and conduct the oversight if the UAS operator.
I.96.	Night		'Night' means the hours between the end of evening civil twilight and the beginning of morning civil twilight as defined in Implementing Regulation (EU) No 923/2012. (Article 2(34) of Implementing Regulation (EU) 2019/947) *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.97.	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.98.	Operation out of control		An operation unintentionally being conducted outside the limits approved in the authorisation.
I.99.	Operational life		It is defined by the UAS designer as the maximum flight hours and/or cycles a UAS operator should use the UAS while continuously conforming with the maintenance design requirements.
I.100.	Operations manual	OM	A manual containing procedures, instructions and guidance for use by operational personnel in the execution of their duties. Annex A to this AMC illustrates an example for its content.
I.101.	Operational volume		Is the combination of the flight geography and the contingency volume. (Article 2(32) of Implementing Regulation (EU) 2019/947) See also Section S.2.2.1 of this AMC (SORA Main Body).
I.102.	Parachute		A device used or intended to be used to retard the fall of a body or object through the air.
I.103.	Population density		The number of people living per unit of an area (e.g. per square mile or square kilometre).
I.104.	Procedure		Standard, detailed steps that prescribe how to perform specific tasks.
I.105.	Process		A set of interrelated resources and activities, which transform inputs into outputs.
I.106.	Qualification		A process through which a State / competent authority / applicant ensures that a specific implementation satisfies the applicable requirements with an adequate level of confidence.
I.107.	Quantification		The act of assigning a numerical value to or measuring the probability that a specific event will occur.
I.108.	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.109. Remote crew member		A member of the crew that performs duties essential to the safety of flight and whose duties and responsibilities have been assigned to them by the UAS operator. It may include the remote pilot-in-command (RPIC), airspace observers (AOs) and UA observers, maintenance staff, launch and recovery system operators etc..
I.110. 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 UA flies automatically, by monitoring its course and remaining able to intervene and change the UA course at any time.
I.111. Risk		The combination of the frequency (probability) of an occurrence and its associated level of severity.
I.112. Risk analysis		The development of qualitative and/or quantitative estimate of risk based on evaluation and mathematical techniques.
I.113. Risk assessment		The process by which the results of a risk analysis are used to make decisions.
I.114. Risk estimation		The combination of the consequences and likelihood of the hazard.
I.115. 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 mid-air collision occurs. A relative risk measure, which compares the probability of an event in a non-mitigated scenario to the probability of the same event in a mitigated scenario.
I.116. Robustness		Means the property of mitigations resulting from combining the safety gain provided by the mitigations and the level of assurance and integrity that the safety gain has been achieved. (Article 2(5) of Implementing Regulation (EU) 2019/947)
I.117. Rotorcraft-helicopter UA		It includes all vertical-lift UA configurations having up to 2 rotors.
I.118. Rural air volume		In the context of air risk, it is the volume not defined as urban environment and is 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 on the ground or water surface 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 for 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.

Term	Acronym	Definition
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.
I.125. Separation		Maintaining a specific minimum distance between two or more aircraft or between aircraft and 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 it crashes into a building or a structure.
I.128. Specific operations risk assessment	SORA	A methodology to guide both the UAS operator and the competent authority in determining whether a UAS operation can be conducted in a safe manner.
I.129. 'Specific' category		A UAS operation category where a proportionate approach to the assessment of the risk will be taken by requiring the UAS operator to present a specific operations risk assessment (SORA) of the UAS operation before operational authorisation is granted by the competent authority.
I.130. Standard operational 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	STS	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 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 both the UAS operator and the competent authority.
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 risks by reducing local aircraft density or time of exposure of an individual UAS. Strategic mitigations tend to take the form of operational restrictions of time or space. Strategic mitigations do not fulfil the 14 CFR 91.113, SERA.3201, or ICAO Annex 2 Section 3.2 'see and avoid' requirement. (Examples of strategic mitigation: an operational restriction to fly between the hours of 10PM and 3AM; operational restriction to stay below 500 ft 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 interrelated items arranged to perform a specific function or specific functions.

Term	**Acronym**	**Definition**
I.134. System safety		System safety is a specialty within system engineering that supports programme risk management. It is the application of engineering and management principles, criteria and techniques to optimise safety. The goal of system safety is to optimise safety through the identification of safety-related risks, eliminating or controlling them through design and/or procedures, based on acceptable system safety precedence.
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 feedback system 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 requirements and collision avoidance layers of the 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 aspects of the system.
I.137. Third party		A party that derives no economic benefit and has no control over the risk associated with the UAS operation.
I.138. Threat		An occurrence that in the absence of appropriate threat barriers can potentially result in a 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	Airspace of defined dimensions in which the carriage and operation of pressure-altitude reporting transponders is mandatory.

Term	**Acronym**	**Definition**
I.141. UA characteristic dimension	UA CD	The width of the UA in the direction transversal to the direction of flight (refer to Annex F Edition 2.5, critical area). For example: — for fixed-wing UA, regardless of the number of planes, including hybrid configurations, the UA characteristic dimension is the wingspan;  — for rotorcraft UA (e.g. helicopters or gyroplanes), the UA characteristic dimension is the diameter of the main rotor;  — for VTOL-capable aircraft (VCA), such as multicopters, the UA characteristic dimension is defined by the maximum distance (i.e. the diagonal distance) between the blade tips. 
I.142. UAS flight manual		Sometimes also referred to as 'manufacturer's instructions', it is a manual developed by the designer of the UAS, 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.143. 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 to as 'U-space'.
I.144. UAS component design and production organisation		The organisation designing and producing a component to be installed on a UAS (e.g. a parachute). It is also responsible for carrying out the test, check compatibility and interface with the UAS models listed in the component instructions manual.

Term	Acronym	Definition
I.145. UAS component installer		The organisation responsible for installing a component (e.g. a parachute) on a UAS model listed in the component instructions 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 the organisation designated by them.
I.146. 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.147. UAS operator		Means any legal or natural person operating or intending to operate one or more UAS. (Article 2(2) of Implementing Regulation (EU) 2019/947) See also Section S.2.5(c) of this AMC.
I.148. Uncontrolled airspace		For the purpose of this assessment, uncontrolled airspace is that defined as class G airspace.
I.149. Uninvolved persons		Means persons who are not participating in the UAS operation or who are not aware of the instructions and safety precautions given by the UAS operator. (Article 2(18) of Implementing Regulation (EU) 2019/947)
I.150. Unmanned aircraft	UA	Means any aircraft operating or designed to operate autonomously or to be piloted remotely without a pilot on board. (Article 3(30) of Regulation (EU) 2018/1139)
I.151. Unmanned aircraft system	UAS	Means an unmanned aircraft, as defined in Article 3(30) of Regulation (EU) 2018/1139, and its control and monitoring unit. (Article 2(1) of Implementing Regulation (EU) 2019/947)
I.152. Urban air volume		In the context of air risk, it is the volume above a town or a city, starting from the 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.153. U-space		The UAS traffic management (UTM) concept defined in Europe through Implementing Regulation (EU) 2021/664.
I.154. Verified		A term used to describe controls / safety requirements that are objectively determined to have been met.
I.155. Very high-level airspace	VHL airspace	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 regulatory authorities as needed. UAS operating in VHL airspace may have to comply with operating rules, procedures and equipment not yet identified. VHL airspace is airspace where manned aircraft operations are very infrequent.

Term	Acronym	Definition
I.156. Very low-level airspace	VLL airspace	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 regulatory authorities as needed. UAS operating in VLL airspace may have to comply with operating rules, procedures and equipment not yet identified. VLL airspace is airspace where manned aircraft operations are very infrequent. VLL airspace excludes class A, B, C, D, E and F airspace and airport environments.
I.157. Visual line of sight operation	VLOS operation	Means a type of UAS operation in which the remote pilot is able to maintain continuous unaided visual contact with the unmanned aircraft, allowing the remote pilot to control the flight path of the UA in relation to other aircraft, people and obstacles for the purpose of avoiding collisions. (Article 2(7) of Implementing Regulation (EU) 2019/947)
I.158. VTOL-capable UA		It includes vertical-lift UA configurations with 3 or more rotors and fixed-wing aircraft capable of vertically taking off and landing. It includes multirotor UA.

AMC1bis Article 11 Rules for conducting an operational risk assessment

SPECIFIC OPERATIONS RISK ASSESSMENT (SORA) (*SOURCE:* JARUS SORA V2.0)

Edition: December 2020

[…]

AMC1 Article 12(2)(a) Authorising operations in the 'specific' category

GRANTING AN OPERATIONAL AUTHORISATION FOR UAS OPERATIONS CLASSIFIED IN A SAIL WHERE THE LEVEL OF ROBUSTENSS OF OSOS AND MITIGATIONS IS LOW

When the risk assessment defined in Article 11 classifies the level of robustness of the operational safety objectives and the mitigations as 'low', the competent authority may issue an operational authorisation based on the applicant's declaration of compliance with the related OSOs and mitigations.

The same applies in case the level of robustness is classified as 'medium' and the applicant has provided a declaration based on a means of compliance published by EASA.

For a VLOS UAS operation classified up to SAIL II according to AMC1 Article 11 (SORA), the competent authority may only validate the compliance matrix (i.e. Chapter A.4 of Annex A to AMC1 Article 11) provided by the UAS operator. The competent authority may authorise the operation without receiving evidence (e.g. the operations manual).

The applicant is responsible to comply with all the requirements and produce or obtain any required evidence (e.g. operations manual) and keep it updated during the time of validity of the operational authorisation.

AMC1 UAS.SPEC.030(2) Application for an operational authorisation — EASA Form 208

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 **Issue 2**
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 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 edition date __ ☐ PDRA # __-__ edition date ☐ other __________		
~~**2.5 Level of assurance and integrity**~~			
2.~~6~~4 Type of operation	☐ VLOS ☐ BVLOS		
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 What is the minimum RP:UA ratio allowed between the remote pilot (RP) and the UA that may be operated simultaneously?	RP:UA ___:____		
2.~~12~~8 Operations manual reference			
2.~~13~~9 Compliance ~~evidence~~ matrix file reference			
3. UAS data			
3.1 ~~Manufacturer~~Design organisation name		**3.2 Model name**	
3.3 Type of UAS	☐ ~~Aeroplane~~ Fixed-wing ☐ Rotorcraft-~~ – H~~helicopter ☐ Rotorcraft-gyroplane ☐ VTOL-capable aircraft (VCA) (including multirotors) ☐ Lighter than air / other	**3.4 Maximum UA characteristic dimensions**	_____ m

3.5 Take-off mass	______ kg	**3.6 Maximum operational speed**	______ m/s (______ kt)
3.7 Type of C2 link			
3.8 Size of the adjacent ground area	_____ km		
3.9 Is the UAS tethered during the operation?	☐ Yes ☐ No		
3.10 Type of propulsion system	☐ Electric ☐ Combustion ☐ Hybrid, specify type: ______________________ ☐ Other, please specify: ______________________		
3.~~7~~11 Serial number or, if applicable, UA registration mark			
3.~~8~~12 Type certificate (TC) or design verification report (DVR) number and issue date, if applicable			
3.~~9~~13 Number of the certificate of airworthiness (CofA), if applicable			
3.14~~0~~ Number of the noise certificate, if applicable			
3.15 E-conspicuity system	☐ Direct remote ID ☐ Network remote ID ☐ SRD-860 In ☐ SRD-860 Out ☐ ADS-B In ☐ ADS-B Out ☐ Other_________		
3.16 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, the UAS operator, declare that:**

- the UAS operation complies with any applicable Union and national regulations related to privacy, data protection, liability, insurance, security, and environmental protection;
- I have developed procedures to ensure that the intended UAS operation complies with the security requirements applicable to the area(s) of operation;
- I have developed measures to protect against unlawful interference and unauthorised access;
- I have developed procedures to ensure that all flights comply with Regulation (EU) 2016/679 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data;
- I have developed procedures for the remote pilot(s) to plan UAS operations in a manner that minimises nuisance, including noise- and other emissions-related nuisance, to people and animals;
- I have records of:
  - all relevant qualifications and training courses completed by the remote pilot(s) and other personnel in charge of duties essential to the UAS operation and by maintenance staff, for at least 3 years after those persons have ceased employment with the organisation or have changed their position within the organisation;
  - the maintenance activities carried out 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 designated remote pilots-in-command for each flight, and if applicable, for each phase of flight;
— an up-to-date list of maintenance staff employed to carry out maintenance activities;

— the insurance coverage, if applicable, will be in place at the expected date of start of the UAS operation.

Section 4 – Specific operations risk assessment (SORA)	
Step #1 — Documentation of the proposed operation	
Step #1.1 Description of proposed locations	• If location-specific: Give reference to the file: ______________________________ • If location-independent: (generic authorisation) Give reference to the file as example of a location: ______________________________
Step #1.2 Short description of the proposed operation	
Step #1.3 Dimensions of the operational volume and the adjacent volume (Rounded up to first decimal place)	Maximum height of the flight geography — H_{FGmax} ________ m Maximum 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 Width of the adjacent volume — S_{AV} ________ m
Step #2 — UAS intrinsic ground risk class (iGRC)	
Step #2.1 Type of operational areas or maximum population density on the ground (including flight geography, contingency volume and ground risk buffer)	☐ controlled ground area — people/km² ☐ sparsely populated area — ☐ up to 5 ☐ up to 50 ☐ up to 500

	☐ populated area ☐ up to 5 000 ☐ up to 50 000 ☐ more than 50 000 ☐ assemblies of people ☐ no limit
Step #2.2 Specify the intrinsic ground risk class (iGRC)	
Step #2.3 Remarks/Reasoning for Step #2 (optional)	

Step #3 — Final ground risk class (GRC) determination (optional)	
Step #3.1 Specify the ground risk mitigations applied and the level of robustness (if applicable)	**M1**(A) Strategic mitigation — sheltering ☐None ☐Low ☐Medium
	M1(B) Strategic mitigation — operational restrictions ☐None ☐Medium ☐High **M1**(C) Tactical mitigation — ground observation ☐None ☐Low
	M2 Effects of UA impact dynamics are reduced ☐None ☐Medium ☐High
Step #3.2 Specify the final ground risk class (GRC)	
Step #3.2 Remarks/Reasoning for Step #3 (optional)	
Step #4 — Initial air risk class (ARC)	
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 ☐CTR ☐CTA ☐FIZ
Step 4.2 Specify the initial air risk class (ARC) of the operational volume	☐ARC-a ☐ARC-b ☐ARC-c ☐ARC-d
Step #4.3 Remarks/Reasoning for choosing the ARC in Step #4	
Step #5 — Strategic air risk mitigations and final air risk class (ARC)	
Step #5.1 Specify the strategic mitigations of the air risk class, if applied	☐No ☐ VLOS ☐BVLOS with AOs ☐ Operational restrictions ☐ Common rules and structures
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 — Tactical mitigation performance requirements (TMPRs) and robustness level	
Step #6 Tactical mitigation performance requirements (TMPRs)	☐ No requirement (VLOS / BVLOS with AOs) ☐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 #7.1 Specific assurance and integrity level (SAIL)	☐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 Assembly of people within 1 km of the operational volume?	☐No ☐Yes
Step #8.2 Remarks/Reasoning for Step #8 (optional)	
Step #9 — Identification of operational safety objectives (OSOs)	
Step #9.1 Operational safety objectives	

~~4~~5. Remarks	
~~**5. 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**

EASA Form 208

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.

Section 1

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.~~

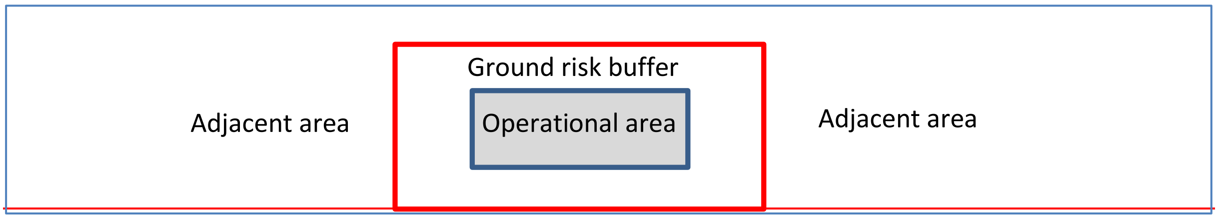
1.34 Contact details of the person responsible for the operation, in charge to answer possible operational questions raised by the competent authority.

~~2.1 Date on which the UAS operator expects to start the operation.~~

Section 2

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**~~

2.43 Select one of the three options. If the SORA is used, indicate the ~~version~~ edition date as defined in AMC1 Article 11. In case a PDRA is used, indicate the number and its ~~revision~~ edition date as defined in the applicable AMC to Article 11. 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 a PDRA is used, then 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.~~ If the UAS flight manual provided by the UAS designer indicates that it is designed with a level of automation that reduces the remote pilot's workload allowing one remote pilot (RP) to control multiple UA simultaneously, then specify the number of UA that one remote pilot is permitted to control (e.g. in case one RP is able to control simultaneously five UA, indicate RP:UA 1:5). This number should not exceed the limit defined in the UAS flight manual. Additionally, the UAS operator may decide to have a pool of remote pilots controlling multiple UA simultaneously. In this case, clear procedures should be developed to define who is the pilot-in-command, responsible during each phase of the flight (e.g. in case three RPs are permitted to control simultaneously ten UA, indicate RP:UA 3:10).

~~2.8 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.~~

~~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~~8 Indicate the OM's identification and revision number.~~ This document should be attached to the application.~~

2.~~13~~9 Indicate the compliance ~~evidence~~ matrix file identification and revision number~~.~~ (e.g. the compliance matrix defined in Chapter A.4 of Annex A to AMC1 Article 11 (SORA). This document should be attached to the application.

Section 3

This section may be replicated for all authorised UAS models to be used under this operational authorisation.

~~3.1 Name of the manufacturer of the UAS.~~

3.2 Model of the UAS as defined by the ~~manufacturer~~design organisation in the UAS flight manual.

3.3 ~~Select one of the five options.~~ Fixed-wing UA includes configurations such as aeroplanes, kites, gliders, etc.).

Rotorcraft-helicopter UA includes all vertical-lift configurations having up to 2 rotors.

Rotorcraft-gyroplane UA is a special configuration with unpowered rotor.

VTOL-capable aircraft (VCA) UA includes vertical-lift configurations with 3 or more rotors and fixed-wing UA capable of vertically taking off and landing.

Lighter-than-air configurations include configurations such as airships, hot-air balloons, etc.

3.4 Indicate the maximum dimensions of the UA in metres (refer to definition I.141 'UA characteristic dimension' in Annex I of AMC1 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), expressed in kg, at which the UA~~S~~ ~~operation~~ may be operated. All flights should ~~then~~ be conducted without ~~operated not~~ exceeding ~~that~~ the specified TOM. The TOM may be different from (however, not exceeding~~ higher than~~) the MTOM defined by the UAS ~~manufacturer~~design organisation in the UAS flight manual.

3.6 Maximum operational ~~cruise~~ airspeed, expressed in m/s and kt in parentheses, that the remote pilot will not exceed during the operation. This should always be lower than the maximum ~~as~~ defined in the ~~manufacturer's instructions~~ UAS flight manual.

3.7 Indicate the type of C2 link to be used during the operation (e.g. radio link, LTE/5G, satellite, etc.).

3.8 indicate the size in km to be considered for the adjacent ground area starting from the limits of the ground risk buffer, using the instructions defined in Section S.4.8.4 of AMC1 Article 11 (SORA).

3.~~7~~11 This field is mandatory if the UA is registered according to Article 14(7) of Implementing 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~~ design organisation 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 to them would require the competent authority's prior approval. For UAS operations classified up to SAIL IV, a change to the serial number does not require a prior approval from the competent authority.

3.~~8~~12 Include the EASA TC number, or the UAS design verification report (DVR) number issued by EASA, if applicable.

3.~~9~~13 If a UAS with an EASA TC is required by the competent authority, the UAS should have a certificate of airworthiness (CofA).

3.~~10~~14 If a UAS with an EASA TC is required by the competent authority, the UAS should have a noise certificate.

3.15 Multiple options are possible. Direct remote ID developed according to EN 4709-002.

~~3.11 Select one of the four options.~~

~~3.12 Select one of the two options.~~

In order to compile Section 4, please refer to AMC1 Article 11 (SORA).

Section 4

Step #1.1:

The identification of the location(s) should contain the full operational volume and ground risk buffer (the red line in Figure 1; refer to Annex A to AMC1 Article 11 for guidance and examples on the calculation of the operational volume and ground risk buffer). Depending on the initial ground and air risk classification determined using the SORA process and on the application of mitigations, the location(s) may be 'generic' or 'precise' (refer to GM2 UAS.SPEC.030(2)).

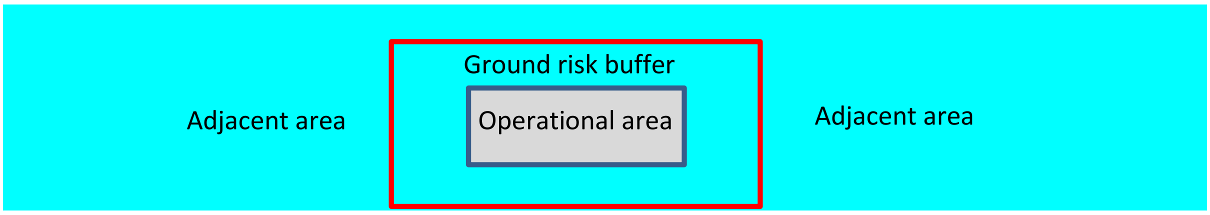


Figure 1 — Operational area and ground risk buffer

— Please, refer to GM2 UAS.SPEC.030(2) for guidance on the conditions to apply for 'generic' versus 'precise' locations.

— If location-specific: please, provide a list with the geo-coordinates for each location including the 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. An example of a geographical file (e.g. '.kmz' or '.kml') may be provided to show a typical operational volume, ground risk buffer and the air risk buffer (if available).

Step #1.2: Insert, for example, transport, inspection, filming, testing, etc.

Step #1.3: Please, provide a list with this information if location-specific with multiple locations.

Step #4.1: For information on the airspace classification, refer to Article 2 and to points SERA.6001 and SERA.6005 of Regulation (EU) No 923/2012.

Step #9.1: List the OSOs and the level of robustness you intend to comply with. The level of robustness should as a minimum reflect the one defined in Table 14 of Section S.4.9.3 of AMC1 Article 11 considering the SAIL listed in point 'Step #7.1' of this form.

Section 5 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) Application for an operational authoris~~z~~ation

OPERATIONS MANUAL~~ — TEMPLATE~~

For all operations classified in the 'specific' category, the UAS operator should develop an OM structured according to Chapter A.3 of Annex A of AMC1 Article 11.

The OM should be submitted to the competent authority for operations classified in SAIL III and higher. For operations classified in SAIL I or II, please refer to AMC1 Article 12(2)(a).

~~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).

AMC2 UAS.SPEC.030(3)(e) Application for an operational authorisation

OPERATIONAL PROCEDURES WITH 'MEDIUM' AND 'HIGH' LEVEL OF ROBUSTNESS

1. **Scope of this AMC**

1.1 This AMC addresses the criteria for the 'medium' and 'high' level of robustness of the operational procedures that are required under the following OSOs:

(a) OSO #08: *Technical issue with the UAS — Operational procedures are defined, validated and adhered to.;*

(b) OSO #11: *Deterioration of the external systems that support the UAS operations — Procedures are in place to handle the deterioration of the external systems that support the UAS operations;*

(c) OSO #14: *Human error — Operational procedures are defined, validated and adhered to*; and

(d) OSO #21: *Adverse operating conditions — Operational procedures are defined, validated and adhered to*.

These criteria may be used to also address the criteria for the 'medium' and 'high' levels of robustness of the operational procedures required in other sections of the SORA (e.g. under the mitigations means for the ground risk, which are defined in Annex B to AMC1 Article 11 or for the air risk defined in Annex D to Article 11.

2. **Criteria for the level of integrity**

2.1. Criterion #1: Procedure definition

2.1.1. Annex E to AMC1 Article 11 provides the minimum elements that the operational procedures need to appropriately cover for the intended UAS operations.

2.1.2. Chapter A.3 of Annex A to AMC1 Article 11 provides an example of an operations manual structure and a table referencing each OM chapter with the OSOs the requirements refer to. AMC1 UAS.SPEC.030(3)(e) on the OM template[53] for the

[53] EASA is working within JARUS to amend Annex A to the SORA. When this activity will be completed (planned for 2022/Q2) the title of Annex A will be changed to 'Operations manual' and it will describe how the UAS operator should develop an

operational authorisation of UAS operations in the 'specific' category and the corresponding guidance in GM1 UAS.SPEC.030(3)(e) should be followed to define the procedures, as they provide more details on the elements that are referred to in point 2.1.1.

2.2. Criterion #2: Procedure complexity

2.2.1. Based on the SORA criterion of 'procedure complexity' for a low level of integrity, procedures with a higher level of integrity should not be complex. This implies that the workload and/or the interactions with other entities (e.g. air traffic management (ATM), etc.) of remote pilots and/or other personnel in charge of duties essential to the UAS operation should be limited to a level that may not jeopardise their ability to adequately follow the procedures.

2.2.2. Procedures should be validated in accordance with point 3.5.

2.23. Criterion #23: Consideration of potential human error

Operational procedures should be developed to minimise human errors:

(a) each of the tasks and the complete sequence of the tasks of a procedure should be intuitive, unambiguous, and clearly defined;

(b) the tasks should be clearly assigned to the relevant roles and persons, ensuring a balanced workload (see point 2.2); and

(c) the procedures should adequately address fatigue and stress, considering, among other aspects, the following: duty times, regular breaks, rest periods, the applicable health and safety requirements in the operational environment, handover/takeover procedures, responsibilities, and workload.

2.3. Criterion #3: Emergency response plan (ERP)

For more information regarding the ERP procedure, the UAS operator should refer to AMC3 UAS.SPEC.030(3)(e).

3. Criteria for the level of assurance

3.1. The purpose of the validation process described in this AMC is to confirm whether the proposed operational procedures are complete and adequate to ensure the safe conduct of the intended UAS operations.

3.2. The validation process should include the following:

(a) a review of the completeness of the procedures to ensure that:

(1) all elements that are indicated in points 2.1.1 and 2.1.2 have been addressed; and

(2) all relevant references have been considered, including but not limited to:

(i) the applicable regulations;

(ii) the requirements from the competent authority and/or other relevant authorities or entities;

(iii) the local requirements and conditions;

operations manual with a content proportionate to SAIL of its operation. Annex A to the SORA will also replace AMC1 UAS.SPEC.030(3)(e) and GM1 UAS.SPEC.030(3)(e).

(iv) the available recommended practices for the intended type of UAS operations;

(v) the instructions from the UAS designer ~~manufacturer~~ and of any other UAS equipment designer ~~manufacturer~~, if applicable;

(vi) the instructions and requirements from externally provided services that support the UAS operations, if applicable;

(vii) the results from previous experience, including tests and/or simulations as those indicated in point (c) and (d); and

(viii) consensus-based voluntary industry standards;

(b) an expert judgement to assess the adequacy of the procedures based on:

(1) the objective(s) of each procedure;

(2) relevant key performance parameters/indicators and/or benchmarking of options, if applicable;

(3) an assessment of the procedures' complexity in accordance with point 2.2; and

(4) an assessment of the effect of human factors on procedures in accordance with point 2.~~3~~2;

(c) a proof of the adequacy of the procedures through tests or practical exercise for phases of the UAS operation other than the UA flight, which involve the UAS and/or any external system that supports the operation;

(d) a proof of the adequacy of the contingency and emergency procedures through:

(1) dedicated flight tests conducted in an area with reduced air and ground risk and/or representative subsystems tests; or

(2) simulation, provided it is proven valid for the intended purpose with positive results; or

(3) any other means acceptable to the competent authority that issues the authorisation;

(e) if the option in point (d)(3) is selected, a substantiation of the suitability of those means for proving the adequacy of the procedures;

(f) a record of proof of the adequacy of the procedures, including at least:

(1) the UAS operator's name and registration number;

(2) the date(s) and place(s) of tests or simulations;

(3) identification of the means used, e.g. for tests or simulations that use actual UASs: the type category, the name of the UAS designer ~~manufacturer~~, and the model and serial number of each UA used;

(4) a description of tests or simulations conducted, including their purpose, the expected results (including key performance parameters/indicators, where relevant), how they were conducted, the results obtained, and conclusions; and

(5) the signature of the person that is appointed by the UAS operator to conduct the tests or simulations;

(g) for UAS operations that require a 'high' level of assurance, the procedures and the dedicated flight tests, simulations, or other means acceptable to the competent authority, which are indicated in point 3.2, validated by the competent authority that issues the authorisation or by an entity that is recognised by that competent authority.

3.3. The following conditions apply to the dedicated flight tests that are indicated in point 3.2(d)(1):

(a) the configuration of the UAS hardware and software should be identified;

(b) the UAS operator should conduct the dedicated flight tests;

(c) if no simulations as the ones indicated in point 3.2(d)(2) are conducted, the dedicated flight tests should cover all the relevant aspects of the contingency and emergency procedures;

(d) for UAS operations that require a 'high' level of assurance, the dedicated flight tests that are performed to validate the procedures and checklists should cover the complete flight envelope or proven to be conservative;

(e) the UAS operator should conduct as many flight tests as agreed with the competent authority to prove the adequacy of the proposed procedures;

(f) the dedicated flight tests should be conducted in a safe environment (reducing the ground and air risks to the greatest extent possible), while ensuring the representativeness of the tests' results for the intended UAS operations; and

(g) the UAS operator should record the flight tests as part of the information to be recorded as per point UAS.SPEC.050(1)(g), e.g. in a logbook, as indicated in AMC1 UAS.SPEC.050(1)(g); such a record should include any potential issues identified.

3.4. ~~To ensure that the integrity criterion of point 2.2 is met, the complexity of the procedures should be validated.~~ The UAS operator should reduce the complexity of the procedures as much as possible.

3.4.1. ~~This validation should~~ The verification of the complexity of the procedures may include:

(a) an expert judgement, as indicated in point 3.3(b); and

(b) a proof of the adequacy of the procedures, as indicated in point 3.3(c) and (d).

3.4.2. The UAS operator ~~should~~ may adopt a method for the evaluation of the complexity of the procedures applied by the relevant personnel, i.e. the remote pilot and/or other personnel in charge of duties essential to the UAS operation. That method should be adequate for the evaluation of the workload that is required by the task(s) of each procedure.

For example, a suitable method for evaluating the workload of the remote pilot and/or other personnel in charge of duties essential to the UAS operation may be the 'Bedford Workload Scale', which was conceived as a qualitative and relatively simple methodology for rating the pilots' workload that is associated with the design of an aircraft's human–machine interface (HMI). However, this methodology is deemed to be adequately generic to be also applicable to the tasks associated with the operational procedures to be conducted by remote pilots and/or other personnel in charge of duties essential to the UAS operation.

Figure 1 depicts the Bedford Workload Scale adapted to operational procedures for UAS operations: 'pilot' is replaced by 'remote crew member' (i.e. the remote pilot or other personnel in charge of duties essential to the UAS operation), and 'pilot decision' is replaced by 'remote crew member performs a procedure task'. A procedure may include one or more tasks.

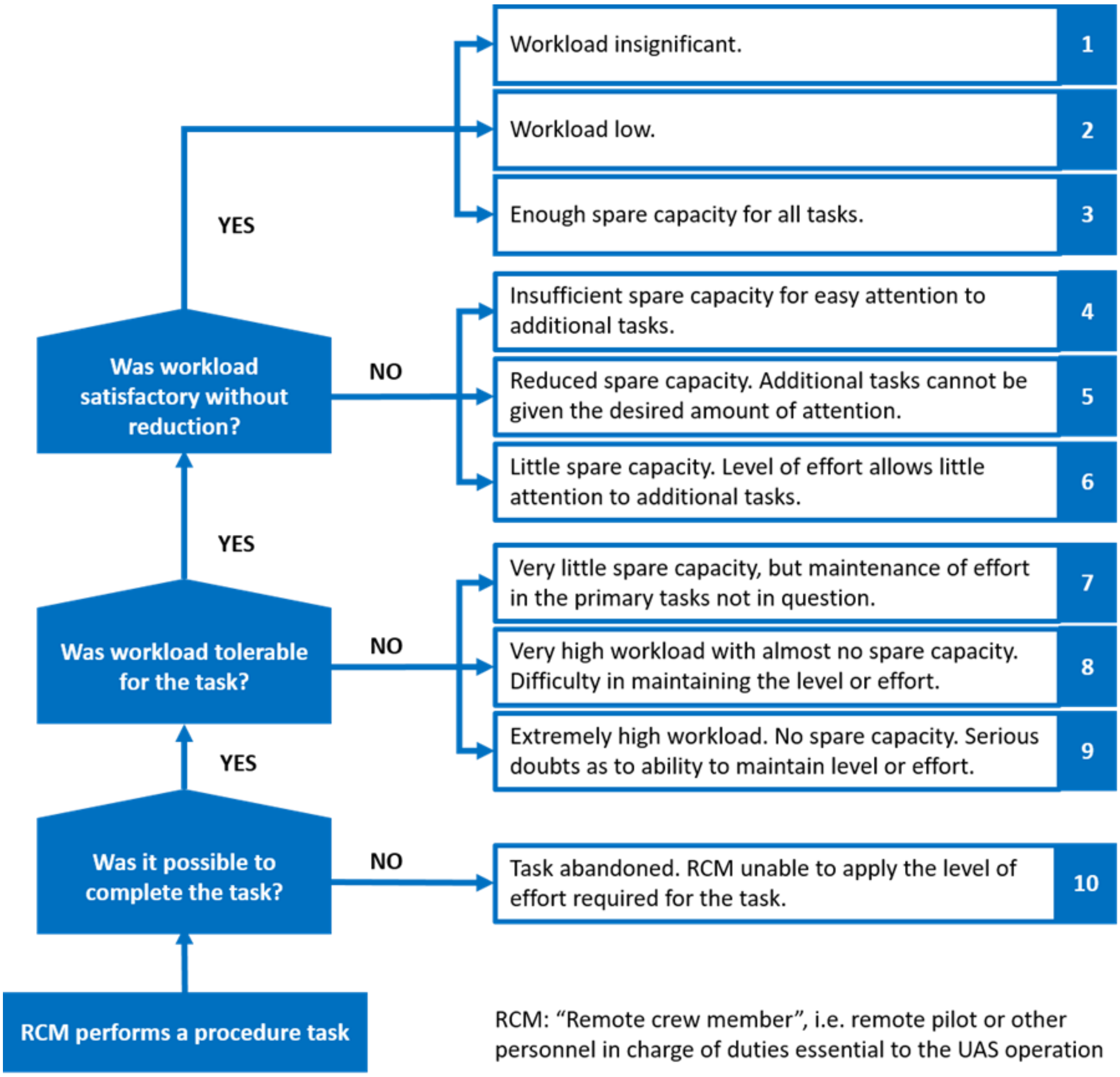


Figure 1 — Bedford Workload Scale adapted to operational procedures for UAS operations

AMC3 UAS.SPEC.030(3)(e) Application for an operational authorisation

EMERGENCY RESPONSE PLAN (ERP) WITH 'MEDIUM' AND 'HIGH' LEVEL OF ROBUSTNESS

1. Scope of this AMC

1.1 This AMC defines the content of an ERP as well as the methodology for its validation. It may be used to meet Criterion #41 (Procedures) of Mitigation M3 — *An ERP is in place, UAS operator validated and effective* of Annex B to AMC1 Article 11 for medium and high level of robustness. of OSO #8 (ERP) of Annex E to AMC1 Article 11.

1.2 The risk assessment, as required by Article 11 of the UAS Regulation, should address the safety risks that are associated with the loss of control of a UAS operation, which may result in:

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

(b) injuries to third parties in the air; or

(c) damage to critical infrastructure.

Note: As per point Section S.2.3.2 of B.4 of Annex B to AMC1 Article 11, the loss of control of a UAS operation corresponds to situations where the contingency emergency procedures would not have provided achieved the desired effect., the UAS operation is in an unrecoverable state, and:

the outcome of the situation relies highly on providence; or

the situation could not be handled via a contingency procedure; or

there is a grave and imminent danger of fatalities.

1.3. Therefore, in line with the risk assessment applied, the scope of this AMC is limited to addressing the response to emergency situations that are caused by the UAS operation, as well as the potential consequences that are indicated in point 1.2. However, the response to such emergency situations should not be limited to the potential risk/harm only to third parties but also to the UAS operator's personnel.

1.4. […]

2. Purpose of the ERP

[…]

3. Effectiveness of the ERP

[…]

4. Emergency situations, response activation, procedures, and checklists

[…]

5. Roles, responsibilities, and key points of contact

[…]

6. Emergency response means

[…]

7. ERP validation

7.1. [..]

7.2. […]

(f) is performed with the periodicity that is indicated in the ERP.

However, if the UAS operator is a one-person entity and does not manage external personnel in an emergency response, a tabletop exercise may not be appropriate as the participation of third parties is not required. In such case, the conditions of point 7.1 are deemed sufficient and proportionate to the level of simplicity of the operator and, in principle, of the UAS operations.

For UAS operators with a more complex structure as well as for complex UAS operations, the tabletop exercises may need to be complemented with partial emergency exercises and/or full-scale exercises, including the corresponding drills. If the level of robustness that is required or claimed for the ERP is high, such exercises and drills are needed.

7.3. If the level of robustness of the ERP is high:

(a) the ERP and its effectiveness with respect to limiting the number of people at risk should be validated by the competent authority itself or by an entity designated by the competent authority;

(b) the UAS operator should coordinate and agree on the ERP with all third parties that are identified in the plan; and

(c) the representativeness of the tabletop exercise is validated by the competent authority that issues the authorisation or by an entity that is designated by that competent authority.

7.43. After following the procedures that are described in the ERP in a real emergency situation, the UAS operator should conduct an analysis of the way the emergency was managed and verify the effectiveness of the ERP.

8. ERP training

[…]

8.4. The competent authority that issues the authorisation or an entity that is designated by that competent authority should verify the competencies of the relevant personnel if the level of assurance that is required or claimed for the ERP is high.

GM1 UAS.SPEC.030(3)(e) Application for an operational authorisation

OPERATIONS MANUAL — TEMPLATE

A non-exhaustive list of topics to be considered by the UAS operator when compiling some chapters of the OM is provided below:

'1.2 System for amendment and revision of the OM'

(a) A description of the system for indicating changes and of the methodology for recording effective pages and effectivity dates; and

(b) Details of the person(s) responsible for the revisions and their publication.

'2 Description of the UAS operator's organisation'

~~(a) The organisational structure and designated individuals. Description of the operator's organisational structure, including an organisational chart showing the different departments, if any (e.g. flight/ground operations, operational safety, maintenance, training, etc.) and the head of each department;~~

~~(b) Duties and responsibilities of the management personnel; and~~

~~(c) Duties and responsibilities of remote pilots and other members of the organisation involved in the operations (e.g. payload operator, ground assistant, maintenance technician, etc.).~~

~~'3.4 Competency, duties and responsibilities of personnel involved in the operations such as the remote pilot, UA observer, VO, supervisor, controller, operations manager etc.'~~

~~(a) Theoretical, practical (and medical) requirements for operating UAS in compliance with the applicable regulation;~~

~~(b) Training and check programme for the personnel in charge of the preparation and/or performance of the UAS operations, as well as for the VOs, when applicable;~~

~~(c) Training and refresher training records; and~~

~~(d) Precautions and guidelines involving the health of the personnel, including precautions pertaining to environmental conditions in the area of operation (policy on consumption of alcohol, narcotics and drugs, sleep aids and anti-depressants, medication and vaccination, fatigue, flight and duty period limitations, stress and rest, etc.).~~

~~'5.1 General procedures valid for all operations':~~

~~(a) Consideration of the following to minimise human errors:~~

~~(1) a clear distribution and assignment of tasks; and~~

~~(2) an internal checklist to check that staff are properly performing their assigned tasks.~~

~~(b) Consideration of the deterioration of external systems supporting the UAS operation; in order to assist in the identification of procedures related to the deterioration of external systems supporting the UAS operation, it is recommended to:~~

~~(1) identify the external systems supporting the operation;~~

~~(2) describe the deterioration modes of these external systems which would prevent the operator maintaining a safe operation of the UAS (e.g. complete loss of GNSS, drift of the GNSS, latency issues, etc.);~~

~~(3) describe the means put in place to detect the deterioration modes of the external systems; and~~

~~(4) describe the procedure(s) in place once a deterioration mode of one of the external systems is detected (e.g. activation of the emergency recovery capability, switch to manual control, etc.).~~

~~(c) Coordination between the remote pilot(s) and other personnel;~~

~~(d) Methods to exercise operational control; and~~

~~(e) Pre-flight preparation and checklists. These include, but are not limited to, the following points:~~

~~(1) The site of the operation:~~

(i) the assessment of the area of operation and the surrounding area, including, for example, the terrain and potential obstacles and obstructions for keeping a VLOS of the UA, potential overflight of uninvolved persons, potential overflight of critical infrastructure (a risk assessment of the critical infrastructure should be performed in cooperation with the responsible organisationfor the infrastructure, as they are most knowledgeable of the threats)

(ii) the assessment of the surrounding environment and airspace, including, for example, the proximity of restricted zones and potential activities by other airspace users;

(iii) when UA VOs are used, the assessment of the compliance between visibility and planned range, the potential terrain obstruction, and the potential gaps between the zones covered by each of the UA VOs; and

(iv) the class of airspace and other aircraft operations (local aerodromes or operating sites, restrictions, permissions).

(2) Environmental and weather conditions:

(i) environmental and weather conditions adequate to conduct the UAS operation; and

(ii) methods of obtaining weather forecasts.

(3) Coordination with third parties, if applicable (e.g. requests for additional permits from various agencies and the military when operating, for example, in environmentally protected areas, areas restricted to photographic flights, near critical infrastructure, in urban areas, emergency situations, etc.);

(4) the minimum number of crew members required to perform the operation, and their responsibilities;

(5) the required communication procedures between the personnel in charge of duties essential to the UAS operation, and with external parties when needed;

(6) compliance with any specific requirement from the relevant authorities in the intended area of operations, including those related to security, privacy, data and environmental protection, use of the RF spectrum; also considering cross-border operations (specific local requirements) when applicable;

(7) the required risk mitigations put in place to ensure the operation is safely conducted (e.g. a controlled ground area, securing the controlled ground area to avoid third parties entering the area during the operation, and ensuring coordination with the local authorities when needed, etc.); and

(8) procedures to verify that the UAS is in a condition to safely conduct the intended operation (e.g. update of geographical zones data for geo-awareness or geo-fencing systems; definition and upload of lost link contingency automatic procedures; battery status, loading and securing the payload;).

(f) Launch and recovery procedures;

(g) In-flight procedures (operating instructions for the UA (reference to or duplication of information from the manufacturer's manual); instructions on how to keep the UA within the flight geography, how to determine the best flight route; obstacles in the area, height; congested environments, keeping the UA in the planned volume);

(h) Post-flight procedures, including the inspections to verify the condition of the UAS;

(i) Procedures for the detection of potentially conflicting aircraft by the remote pilot and, when required by the UAS operator, UA VOs; and

(j) Dangerous goods (limitations on their nature, quantity and packaging; acceptance prior to loading, inspecting packages for any evidence of leakage or damage).

'5.2 Procedures peculiar to a single operation'

(a) Procedures to cope with the UA leaving the desired 'flight geography';

(b) Procedures to cope with the UA entering the 'containment' volume;

(c) Procedures to cope with uninvolved persons entering the controlled ground area, if applicable;

(d) Procedures to cope with adverse operating conditions (e.g. in case icing is encountered during the operation, if the operation is not approved for icing conditions);

(e) Procedures to cope with the deterioration of external systems supporting the operation. In order to help properly identify the procedures related to the deterioration of external systems supporting the UAS operation, it is recommended to:

(1) identify the external systems supporting the operation;

(2) describe the deterioration modes of these external systems which would prevent the operator maintaining a safe operation of the UAS (e.g. complete loss of GNSS, drift of the GNSS, latency issues, etc.);

(3) describe the means put in place to detect the deterioration modes of the external systems; and

(4) describe the procedure(s) in place once a deterioration mode of one of the external systems is detected (e.g. activation of the emergency recovery capability, switch to manual control, etc.).

(f) De-confliction scheme (i.e. the criteria that will be applied for the decision to avoid incoming traffic). In cases where the detection is performed by UA VOs, the phraseology to be used.

'6 Emergency procedures'

(a) Procedures to avoid or, at least minimise, harm to third parties in the air or on the ground. With regard to the air risk, an avoidance strategy to minimise the collision risk with another airspace user (in particular, an aircraft with people on board); and

(b) Procedures for the emergency recovery of the UA (e.g. landing immediately, termination of the flight with FTS or a controlled crash/splash, etc.).

'7. Emergency response plan (ERP)'

See AMC3 UAS.SPEC.030(3)(e).

AMC1 UAS.SPEC.040(1) Operational authorisation — EASA Form 209

OPERATIONAL AUTHORISATION TEMPLATE

The competent authority should produce the operational authorisation according to the following form:

	Operational authorisation for the 'specific' category **Issue 2**	NAA Logo

1. Authority that issues the authorisation	
1.1 ~~1~~ Issuing authority	
1.2 Point of contact **~~Name~~Office** **Telephone** **Email**	
2. UAS operator data	
2.1 UAS operator registration number	
2.2 UAS operator name	
2.3 Operational point of contact **Name** **Telephone** **Email**	
3. Authorised operation	
3.1 Authorised location(s) including the lower and upper limits of the operational volume	☐ Generic, lower limit __m (__ ft), upper limit __m (__ ft) ☐ Precise, specify coordinates ________________________, lower limit __m (__ ft), upper limit __m (__ ft)
~~**3.2 Extent of the adjacent area**~~	~~_____ km~~
3.~~3~~2 Risk assessment reference and revision	☐ SORA ~~version~~ edition date___ ☐ PDRA # __-__ edition date___

		☐ other __________
3.~~4~~3 Level of assurance and integrity		☐ SAIL I ☐ SAIL II ☐ SAIL III ☐ SAIL IV ☐ SAIL V ☐ SAIL VI ☐ Other_____________
3.4~~5~~ Type of operation		☐ VLOS ☐ BVLOS
3.5~~6~~ Transport of dangerous goods		☐ Yes ☐ No
3.6 Dropping material		☐ Yes ☐ No
3.7 Ground risk characterisation	**3.7.1 Operational area (maximum population density)**	☐ controlled ground area people/km² ☐ sparsely populated area ☐ up to 5 ☐ up to 50 ☐ up to 500 ☐ populated area ☐ up to 5 000 ☐ up to 50 000 ☐ more than 50 000 ☐ assemblies of people ☐ no limit
	3.7.2 Adjacent ground area (average population density)	people/km² ☐ sparsely populated area ☐ up to 50 ☐ up to 500 ☐ populated area ☐ up to 5 000 ☐ up to 50 000 ☐ assemblies of people ☐ no limit
	3.7.3 Adjacent ground area (outdoor assemblies of people allowed within 1 km of the operational volume)	☐ up to 40 000 people ☐ up to 400 000 people ☐ more than 400 000 people
3.8 Ground risk mitigations	**3.8.1 ~~Strategic mitigations~~ M1(A) — Sheltering**	☐ No ☐ ~~Yes, l~~Low ☐ ~~Yes, m~~Medium ☐ ~~Yes, high~~
	3.8.2~~. ERP~~ M1(B) — Operational restrictions	☐ No ☐ ~~Yes, low~~ ☐ ~~Yes, m~~Medium ☐ ~~Yes, h~~High
	3.8.3 M1(C) — Ground observation	☐ No ☐ Low
	3.8.4 M2 — Mitigation to reduce effect of ground impact	☐ No ☐ Medium ☐ High
3.9 Final ground risk class (GRC)		

~~3.9 Height limit of the operational volume~~		~~_____ m (______ ft)~~	
3.10 Residual air risk level ~~3.10.1~~ in the operational volume		☐ ARC-a ☐ ARC-b ☐ ARC-c ☐ ARC-d	
~~3.10.2 adjacent volume~~		~~☐ ARC-a ☐ ARC-b ☐ ARC-c ☐ ARC-d~~	
3.11 Air risk mitigations	3.11.1 Strategic mitigations	☐ No ☐ Yes If yes, please describe _________________	
	3.11.2 Tactical mitigation methods		
3.12 Achieved level of containment		☐ Low ☐ Medium ☐ High ☐ Tethered ~~☐ Basic ☐ Enhanced~~	
3.13 What is the minimum RP:UA ratio allowed between the remote pilot (RP) and the UA that may be operated simultaneously?		RP:UA ___:____	
3.14~~3~~ Remote pilot competency			
3.15~~4~~ Competency of staff, other than the remote pilot, essential for the safety of the operation			
3.16~~5~~ Type of events to be reported to the competent authority (in addition to those required by Regulation (EU) No 376/2014)			
3.17~~6~~ Insurance		☐ No ☐ Yes	
~~3.17 Operations manual references~~			
3.18 Compliance ~~evidence~~ matrix file reference			
3.19 Remarks / additional limitations			
4. Data of authorised UAS			
4.1 ~~Manufacturer~~ Design organisation name (optional)		4.2 Model name (optional)	
4.3 Type of UAS	☐ ~~Aeroplane~~ Fixed-wing ☐ Rotorcraft-helicopter ~~– Helicopter~~ ☐ Rotorcraft-gyroplane ☐ VTOL-capable UA (including multirotors)	4.4 Maximum UA characteristic dimensions	_____ m

	☐ Lighter than air/other		
4.5 Take-off mass (optional)	_____ kg	**4.6 Maximum operational speed**	_____ m/s (_____ kt)
4.7 Type of C2 link			
4.8 Size of the adjacent ground area		_____ km	
4.9~~7~~ Additional technical requirements			
4.10~~8~~ Serial number or, if applicable, UA registration mark (optional)			
4.11~~9~~ Number of type certificate (TC) or design verification report (DVR), number and issue date ~~if required~~ (optional)			
4.12~~0~~ Number of the certificate of airworthiness (CofA)~~, if required~~ (optional)			
4.13~~1~~ Number of the noise certificate~~, if required~~ (optional)			
4.14 E-conspicuity system		☐ Direct remote ID ☐ Network remote ID ☐ SRD-860 in ☐ SRD-860 out ☐ ADS-B In ☐ ADS-B Out ☐ Other _________	
~~**4.12 Mitigation to reduce effect of ground impact**~~		~~☐ No ☐ Yes, low ☐ Yes, medium ☐ Yes, high~~ ~~Required to reduce the ground risk ☐ No ☐ Yes,~~	
~~**4.13 Technical requirements for containment**~~		~~☐ Basic ☐ Enhanced~~	

5. Remarks

6. Operational authorisation

[insert 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 Implementing Regulation (EU) 2019/947, and with any applicable Union and national regulations related to privacy, data protection, liability, insurance, security, and environmental protection.

Any flight outside **[insert Member State name]** must comply with all the requirements defined in this operational authorisation and is subject to validation by the competent authority of the Member State where the operation is intended to be performed, in accordance with Article 13 of Implementing Regulation (EU) 2019/947. The conditions

specified in this operational authorisation shall be supplemented, where necessary, by proof of compliance with the local conditions published by the Member State where the operation is intended to be performed and the implementation of mitigations to address risks specific to the airspace, terrain, population and climatic conditions of the flight area.			
6.1 Operational authorisation number			
6.2 Valid from	DD/MM/YYYY	**6.3~~2~~ Expiry date**	DD/MM/YYYY
Date DD/MM/YYYY		**Signature and stamp**	

EASA Form 209

<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's office responsible for the file.

2.1 UAS operator's registration number in accordance with Article 14 of the UAS Regulation.

2.2 UAS operator's name, as registered in the UAS operator's registration database. This is an optional field as the information may be retrieved from the UAS operator's registration.

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. It should include the maximum flight altitude, expressed in metres and feet in parentheses, of the approved operational volume 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).

The identification of the location(s) should contain the full operational volume and ground risk buffer (the red line in Figure ~~2~~1). Depending on the initial ground and air risk classification determined using the SORA process and on the application of mitigations~~ measures~~, the location(s) may be 'generic' or 'precise' (refer to GM2 UAS.SPEC.030(2)). When the UAS operation is conducted in a Member State other than the State of registration, the competent authority of the Member State of registration should specify the location(s) only after receiving confirmation from the State of operation, according to Article 13 of the UAS Regulation.

In case of 'precise' locations, the information may be provided in a separate file listing all authorised locations using a file format to display geographic data (e.g. kml, Json, etc.~~.~~).

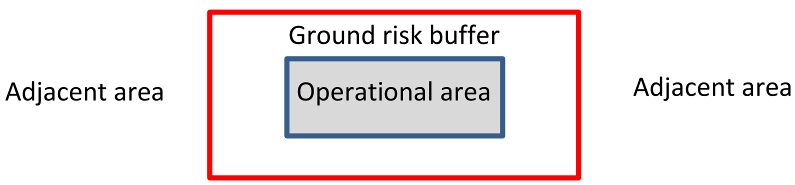


Figure ~~2~~1 — Operational area and ground risk buffer

~~3.2 Provide the maximum distance in km to be considered for the adjacent area, starting from the limits of the ground risk buffer.~~

3.2~~3~~ Select one of the three options. If the SORA is used, indicate the edition date as defined in AMC1 Article 11. In case a PDRA is used, indicate the number and its edition date as defined in the applicable AMC to Article 11. 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.

3.3~~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 If a qualitative measurement of the population density is used, then select one of the qualitative descriptors, otherwise check one of the descriptors linked to the maximum population density allowed.

~~3.8.1 Select one of the four options. In case the risk assessment is based on the SORA, 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 M3 mitigation.~~

3.9 ~~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).~~ If the SORA has been used, indicate the final risk class achieved after the application of the ground mitigations. If another risk assessment methodology has been used, indicate the equivalent information.

~~3.10 Select one of the four options.~~

~~3.11.1 Select one of the two options.~~

3.11.2 Describe the air risk tactical mitigation methods to be applied by the UAS operator (e.g. employ airspace observer(s) or UA observer(s), etc.).

~~3.12 Select one of the two options.~~

3.13 If the UAS flight manual provided by the UAS designer indicates that it is designed with a level of automation that reduces the remote pilot's workload allowing one remote pilot (RP) to control multiple UA simultaneously, then specify the number of UA that one remote pilot is permitted to control (e.g. in case one RP is able to control simultaneously five UA, indicate 'RP:UA 1:5'). This number should not exceed the limit defined in the UAS flight manual. Additionally, the UAS operator may decide to have a pool of remote pilots controlling multiple UA simultaneously. In this case, clear procedures should be developed to define who is the pilot-in-command, responsible during each phase of flight (e.g. in case three RPs are permitted to control simultaneously ten UA, indicate 'RP:UA 3:10').

3.1~~3~~4 Specify the competency or the type of the remote pilot certificate, if required~~; otherwise, indicate 'Declared'~~.

3.1~~4~~5 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'~~.

3.1~~5~~6 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 two options.~~

~~3.17 Indicate the OM's identification and revision number.~~

3.18 Indicate the compliance ~~evidence~~ matrix file identification and revision number (e.g. the compliance matrix defined in Chapter A4 of Annex A to AMC1 Article 11 (SORA).

3.19 ~~Additional limitations defined by~~ Free-text field where the competent authority may provide any additional relevant information.

Section 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)~~ This section may be replicated for all authorised UAS models to be used under this operational authorisation.

4.1 Name of the organisation designing the UAS. This field is optional.

4.2 Model of the UAS as defined by the design organisation in the UAS flight manual. This field is optional.

4.3 ~~Select one of the five options.~~ Fixed-wing UA includes configurations such as aeroplanes, kites, gliders, etc.

Rotorcraft-helicopter UA includes all vertical-lift configurations having up to 2 rotors.

Rotorcraft-gyroplane UA is a special configuration with unpowered rotor.

VTOL-capable aircraft (VCA), including rotorcraft, includes vertical-lift configurations with 3 or more rotors and fixed-wing UA capable of vertically taking 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 'UA characteristic dimension' in Annex I to AMC1 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), expressed in kg, at which the UA~~S~~ ~~operation~~ may be operated. All flights should ~~then~~ be conducted without ~~operated not~~ exceeding ~~that~~ the specified TOM. The TOM may be different from (however, not exceeding~~ higher than~~) the MTOM defined by the UAS ~~manufacturer~~design organisation in the UAS flight manual. This field is optional.

4.6 Maximum operational ~~cruise~~ airspeed, expressed in m/s and kt in parentheses, that the UA will not exceed during the operation. This should always be lower than the maximum speed defined in the UAS flight manual ~~manufacturer's instructions~~.

4.7 Indicate the type of C2 link to be used during the operation (e.g. radio link, LTE/5G, satellite, etc.).

4.8 Provide the size in km to be considered for the adjacent ground area, starting from the limits of the ground risk buffer using the instructions defined in Section S.4.8.4 of AMC1 Article 11 (SORA).

4.~~7~~9 List any additional technical requirements established by the competent authority.

4.~~8~~10 This field is mandatory in case the UA is registered according to Article 14(7) of Implementing 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~~ design organisation 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 to them would require a prior approval from the competent authority. For UAS operations classified up to SAIL IV, a change to the serial number does not require prior approval from the competent authority.

4.11 Include the EASA TC number, or the UAS design verification report (DVR) number issued by EASA, ~~as~~if required by the competent authority.

~~4.9 Include the EASA TC number, or the UAS design verification report number issued by EASA, as required by the competent authority.~~

4.1~~0~~2 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.

4.1~~1~~3 If a UAS with an EASA TC is required, the UAS should have a noise certificate.

~~4.12 Select one of the four 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.~~

4.14 Multiple options are possible.

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 in section 6 should provide the link to the national database where the operational authorisation is stored.