

ED-336

GUIDELINES FOR SAIL II APPLICATION OF SORA

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CHAPTER 1

INTRODUCTION

The Specific Operations Risk Assessment (SORA) methodology stands as a robust framework for evaluating the risk associated with Unmanned Aircraft Systems (UAS) operations within the Specific category, as delineated by the “JARUS Guidelines on Specific Operations Risk Assessment” (Ref. [1] - SORA (Ed. 2.0) and Ref. [2] – SORA (Ed. 2.5)). Its acceptance as an Acceptable Means of Compliance (AMC) to Article 11 of the European Regulation (EU) 2019/947, coupled with its increasing adoption by aviation authorities worldwide (e.g., Australia, Canada, etc.), underscores its pivotal role in ensuring safety and regulatory compliance in UAS operations.

Built upon a proportionate approach, SORA mandates that the robustness of an operation—comprising the operator's proficiency, training standards, and UAS capabilities—be commensurate with the assessed level of risk. Within this framework, operations are classified into different risk levels, ranging from SAIL I to SAIL VI, each demanding tailored safety measures and regulatory adherence.

For medium to high-risk operations (SAIL III to SAIL VI), stringent requirements are imposed upon operators and designers/manufacturers, necessitating a demonstrable level of organizational maturity and adherence to rigorous standards. Conversely, for low-risk operations (SAIL I and SAIL II), safety is predominantly ensured during the planning phase and through the implementation of adequate operational procedures.

The primary goal of this document is to assist applicants in enhancing the quality of their submissions to NAAs, thereby streamlining the UAS authorization process and alleviating the burden on regulatory divisions.

1.1 SCOPE

This document is tailored for operations categorized up to SAIL II within the SORA process or any equivalent definition adopted by respective Civil Aviation Authorities (CAAs) that have adopted or modified the SORA methodology.

The Specific Assurance and Integrity Level (SAIL) serves as a pivotal metric, delineating both the risk level and the requisite level of robustness for an operation, encompassing factors such as operator proficiency, training standards, and system reliability. Notably, each increment in SAIL signifies a tenfold increase in both risk and operational requirements.

For applicants new to the SORA methodology or operating within the limitations of SAIL II, it is advisable to default to this level when assessing and mitigating ground and air risks. This proactive approach allows applicants to align their operational scope with achievable SAIL levels early in the process, thereby optimizing resource allocation and expediting the authorization process for both the applicant and CAAs.

1.2 SORA METHODOLOGY OVERVIEW

The “JARUS Guidelines on Specific Operations Risk Assessment” (Ref. [1] - SORA (Ed. 2.0) and Ref. [2] – SORA (Ed. 2.5)) serve as a foundational methodology for assessing the risk inherent in UAS operations conducted under the specific category. These guidelines facilitate the evaluation of the intended concept of operation, leading to the categorization of operations into six distinct Specific Assurance and Integrity Levels (SAIL). Each SAIL level is accompanied by recommended operational safety objectives, ensuring a comprehensive approach to risk management.

This document is tailored to address SAIL levels up to SAIL II, reflecting the common operational scope encountered within the UAS industry. SAIL levels are determined based on various criteria, such as operational complexity, environmental factors, and the level of robustness in operator proficiency and system reliability. By adhering to the guidelines outlined herein, operators can effectively mitigate risks associated with their operations while striving to achieve the prescribed safety objectives for their respective SAIL category.

CHAPTER 2

REFERENCES

2.1 APPLICABLE DOCUMENTS

TABLE 2-1: APPLICABLE DOCUMENTS

Ref.:	Originator	Document Number and Revision:	Title
[Ref 0]	EASA	EAR for UAS . Revision from July 2024.	Easy Access Rules for Unmanned Aircraft Systems
[Ref 1]	JARUS	SORA Main Body (Ed. 2.0)	JARUS Guidelines on Specific Operations Risk Assessment (SORA 2.0)
[Ref 2]	JARUS	SORA Main Body (Ed. 2.5)	JARUS Guidelines on Specific Operations Risk Assessment (SORA 2.5)
[Ref 3]	JARUS	SORA – Annex A (Ed. 2.5)	Jarus Guidelines on SORA. Annex A – Guidelines on collecting and presenting system and operation information for a specific UAS operation.
[Ref 4]	JARUS	SORA – Annex B (Ed. 2.5)	Jarus Guidelines on SORA. Annex B – Integrity and assurance levels for the mitigations used to reduce the intrinsic Ground Risk Class.
[Ref 5]	JARUS	SORA – Annex C (Ed 1.0)	Jarus Guidelines on SORA. Annex C – Strategic Mitigation Collision Risk Assessment.
[Ref 6]	JARUS	SORA – Annex D (Ed 1.0)	Jarus Guidelines on SORA. Annex D – Tactical Mitigation Collision Risk Assessment.
[Ref 7]	JARUS	SORA – Annex E (Ed 2.5)	Jarus Guidelines on SORA. Annex E – Integrity and assurance levels for the Operational Safety Objectives (OSO).
[Ref 8]	JARUS	SORA - Annex F (Ed. 2.5)	Jarus Guidelines on SORA. Annex F – Theoretical Basis for Ground Risk Classification and Mitigation.
[Ref 9]	JARUS	SORA - Annex I (Ed. 2.5)	Jarus Guidelines on SORA. Annex I – Glossary of terms.
[Ref 10]	AESA	Material guía evaluación del riesgo operacional. Ed.02.	Guía evaluación de riesgo operacional (Art. 11 Reglamento de Ejecución (UE) 2019/947 de la Comisión, de 24 de mayo de 2019).
[Ref 11]	EASA	Critical area - EASA	Tool for the calculation of critical area of Unmanned Aircrafts. EASA. https://www.easa.europa.eu/en/domains/drones-air-mobility/operating-drone/critical-area-assessment-tool-caat
[Ref 12]	NASA	Terminal velocity.	https://www.grc.nasa.gov/www/k-12/VirtualAero/BottleRocket/airplane/termv.html
[Ref 13]	FOCA	FOCA-UAS-GM-Part 1 ISS 01 / REV 02. 01/11/2023	How to apply for an Operational authorisation based on a Specific Operational Risk Assessment (SORA)

Ref.:	Originator	Document Number and Revision:	Title
[Ref 14]		Indoor time – C. Schweizer	Indoor time-microenvironment-activity patterns in seven regions of Europe. Journal of Exposure Science & Environmental Epidemiology. April 2007. C. Schweizer, R. Edwards, L. Bayer-Oglesby, W. J. Gauderman.
[Ref 15]	EASA	MOC Light-UAS.2511-01. Issue 1. 05/05/2022.	Means of Compliance with Light-UAS.2511 Containment.
[Ref 16]	EASA	MOC Light-UAS.2512-01. Issue 1. 06/07/2023.	Means of Compliance with Light-UAS.2512 / Means of compliance with SORA M2 (medium robustness). “M2 MoC”.
[Ref 17]	EASA	OM for the operation in SAIL II of unmanned aircraft systems (UAS)	Operations manual / OM for the operation in SAIL II of unmanned aircraft systems (UAS). EASA.
[Ref 18]	AESA	UAS-OPR-P01-DT01 Edition 3. 06/06/2023.	Guía sobre el contenido del Manual de Operaciones (UAS.SPEC.030 (3) (e) de la parte B del anexo al Reglamento de Ejecución (UE) 2019/947, de 24 de mayo de 2029)
[Ref 19]	FOCA	FOCA-UAS-GM-OM ISS 01 / REV 01. 01/04/2023	Guidance to elaborate an Operations Manual.
[Ref 20]	AESA	UAS-OPS-DT01-II Edition 7. 13/07/2023	Anexo II. Catálogo de atenuaciones Estratégicas y tácticas para la operación de UAS en espacio aéreo controlado y FIZ.
[Ref 21]	EASA	PDRA-S02 V1.1 / January 2022	Characteristics as per Table 2 of EASA EAR [1]
[Ref 22]	EASA	PDRA-G01 V1.2 / January 2022	Characteristics as per Table 2 of EASA EAR [1]
[Ref 23]	EASA	PDRA-G02 V1.1 / January 2022	Characteristics as per Table 2 of EASA EAR [1]
[Ref 24]	EASA	PDRA-G03 V1.0 / January 2022	Characteristics as per Table 2 of EASA EAR [1]
[Ref 25]	JARUS	PDRA-05	As published by JARUS
[Ref 26]	FOCA	FOCA-UAS-GM-Air Risk Issue 01 / Rev 01. 29/06/2023	Guidance to Step #4 - Determination of the Initial Air Risk Class (ARC).
[Ref 27]	AESA	UAS-OPR-P01-DT04-Ed.05	Material orientativo relativo a la justificación de los objetivos de seguridad SAIL II. AESA.
[Ref 28]	AESA	UAS-OPR-P01-DT06-Ed.03	Anexo para la justificación de los objetivos de seguridad SAIL I y SAIL II.
[Ref 29]	FOCA	FOCA-UAS-GM-OSO8 Issue 01 / Rev 01. 29/06/2023	GM OSO 8/11/14/21 Operational Procedures.
[Ref 30]	EUROCAE	ED-301	Guidelines for the Use of Multi-GNSS Solutions for UAS Specific Category – Low Risk Operations SAIL I and II

Ref.:	Originator	Document Number and Revision:	Title
[Ref 31]	EASA	Guidelines for UAS operations in the open and specific category Issue no.: 2 04/10/2024	Guidelines for UAS operations in the open and specific category – Ref to Regulation (EU) 2019/947 Issue no.: 2

2.2 ACRONYMS

ADS-B	Automatic Dependent Surveillance-Broadcast
AESA	Agencia Estatal de Seguridad Aérea (Spanish Agency of Aviation Safety)
AGL	Above Ground Level
AMC	Acceptable Means of Compliance
AMSL	Above Mean Sea Level
ARC	Air Risk Class
ATC	Air Traffic Control
BVLOS	Beyond Visual Line Of Sight
ConOps	Concept of Operations
C2	Command and Control
CAA	Civil Aviation Authority
DAA	Detect And Avoid
EASA	European Union Aviation Safety Agency
ERP	Emergency Response Plan
EU	European Union
EVLOS	Extended Visual Line Of Sight
FAA	Federal Aviation Authority (United States of America)
FOCA	Federal Office of Civil Aviation (Switzerland)
GM	Guidance Material
GRC	Ground Risk Class
HIRF	High Intensity Radiated Field
JARUS	Joint Authorities for Rulemaking on Unmanned Systems
kP	Planetary K-index
LBA	Lufthart Bundesamt (Germany)
MOC	Means of Compliance
NAA	National Aviation Authority
PDRA	Predefined Risk Assessment
SAIL	Specific Assurance and Integrity Level
SORA	Specific Operations Risk Assessment
SRM	Safety and Risk Management
TCAS	Traffic Collision Avoidance System

TLOS	Target Level of Safety
TMPR	Tactical Mitigations Performance Requirements
TMZ	Transponder Mandatory Zone
UA	Unmanned Aircraft
UAS	Unmanned Aircraft System
UTM	Unmanned Aircraft Systems Traffic Management
VLOS	Visual Line Of Sight

CHAPTER 3

SORA STEP #1 – DOCUMENTATION OF THE PROPOSED OPERATION(S)

The objective of SORA Step #1 is to describe the proposed operations, which entails detailing contextual information on the proposed operation: where, when, with what drone, and how the operator is going to perform the operation. By providing this information, applicants can ensure clarity and transparency, thus facilitating the evaluation and approval process. [Ref 3] – SORA – Annex A (Ed. 2.5) may be used as a reference on the minimum information required.

3.1 OBJECTIVE OF THE OPERATION

Define the objective of the operation (e.g. audiovisual, photogrammetry, transport, industrial inspections, etc.).

3.2 AIRCRAFT

Define the aircraft being used in the operation.

- Model;
- Make;
- Configuration (e.g. fixed-wing, multicopter, helicopter, hybrid VTOL, balloon, etc.);
- Maximum Takeoff Mass (in kg);
- Speed (in m/s, km/h or kts);
- Typical Kinetic Energy (in J or kJ);
- Maximum characteristic dimension (in m);
- Communications (number of links and technologies used);
- Safety means (including containment, ground risk mitigations, conspicuity, etc.);
- If known, achievable SAIL of the aircraft;
- If known, achievable level of containment;
- Any other relevant information.

3.3 TYPE OF OPERATION

Define if the operation is in Visual Line Of Sight (VLOS) or Beyond Visual Line Of Sight (BVLOS).

NOTE: *Operations may have segments with different types of operations (e.g. take-off and landing in VLOS, cruise in BVLOS).*

3.4 ALTITUDES

Define the altitudes relevant for the operation, in m or ft, such as:

- Take-off;
- Landing (if different than take-off);
- Cruise;
- Upper limit of the flight geography;
- Lower limit of the flight geography (if applicable);
- Upper limit of the contingency volume;
- Lower limit of the contingency volume (if applicable).

NOTE: *Applicants may choose to define altitudes with reference to ground (take-off) or mean sea level. It is recommended to use AGL in operations where terrain level is roughly constant, and AMSL in other scenarios. Applicants should specify whether altitude references are AGL or AMSL.*

3.5 SCHEDULES

Provide any relevant information on the flight/operational schedules and any other temporary restriction, such as:

- Daytime and/or nighttime;
- Business hours and/or days, holidays, etc.

3.6 LOCATIONS

Describe (e.g. address, name of building, area, etc.) and provide coordinates for every relevant location (as a minimum, take-off and landing).

NOTE: *Applications may be generic (i.e. not be subject to precise locations). In this case, applicants should mention it.*

3.7 POPULATION DENSITY

Describe the areas (or types of areas) overflown in terms of population density (quantitative) and/or qualitative assessment, as per [Ref 2] – SORA (Ed. 2.5), Table 3 – Correspondence between quantitative and qualitative assessment of the iGRC.

NOTE: *If the operation, or part of it, takes place over a controlled ground area, it should be explicitly mentioned.*

3.8 GROUND RISK MITIGATIONS

Summarise ground risk mitigations used in the operation or part of it (SORA STEP #3 – FINAL GROUND RISK CLASS (GRC) DETERMINATION), such as:

- M1 – Strategic mitigations:
 - Sheltering;
 - Operational restrictions;
 - Ground observation.
- M2 – Effects of UA impact dynamics are reduced:
 - Parachute recovery system;
 - Frangibility.
- M3 – An Emergency Response Plan (ERP) is in place, operator validated and effective (only in SORA 2.0, [Ref 1]).

3.9 AIRSPACE

Characterise the airspace structures relevant for the operation, as per [Ref 5] – SORA – Annex C (ED 1.0):

- Operations in airport/heliport environment in:
 - Class B, C or D airspace;
 - Class F or G.
- Operations above 150 m (500 ft) AGL but below flight level 600 in:
 - Mode-S Veil or transponder mandatory zone (TMZ);
 - Controlled airspace;
 - Uncontrolled airspace over urban area;
 - Uncontrolled airspace over a rural area.
- Operations below 150 m (500 ft):
 - Mode-S Veil or transponder mandatory zone (TMZ);
 - Controlled airspace;
 - Uncontrolled airspace over urban area;
 - Uncontrolled airspace over a rural area.
- Operations above flight level 600;
- Operations in atypical or segregated airspace.

NOTE: *Operations may have segments with different airspace considerations.*

3.10 STRATEGIC AIR RISK MITIGATIONS

Summarise strategic (SORA STEP #5 – APPLICATION OF STRATEGIC MITIGATIONS TO DETERMINE RESIDUAL ARC (OPTIONAL)) and tactical (

SORA STEP #6 – TACTICAL MITIGATION PERFORMANCE REQUIREMENT (TMPR) AND ROBUSTNESS LEVELS) air risk mitigations used in the operation (or part of it), such as:

- Strategic mitigation by operational restrictions:
 - Geographical boundaries;
 - Time limitations;
 - Time of exposure.
- Strategic mitigation by common structures and rules;
- TMPR using VLOS;
- TMPR using BVLOS.

3.11 GEOGRAPHIC ZONES

Provide any relevant information on geographic zones, such as:

- Special use airspace (prohibited, restricted and/or dangerous);
- Environmental protected areas;
- Any other zone with particular restrictions for UAS.

3.12 ENVIRONMENTAL RESTRICTIONS

Define environmental limit conditions.

- Wind limits (steady and gust, as applicable);
- Precipitations (rain, snow, fog, etc.);
- Temperature limits;
- Icing conditions;
- Electric storms;
- High Intensity Radiated Fields (HIRF);
- kP index;
- Visibility conditions;
- Any other relevant restriction.

3.13 MINIMUM REMOTE CREW

Define minimum remote crew (roles and number) required for the operation, such as:

- Pilot In Command;
- Safety pilot
- Airspace visual observer;
- Ground personnel.

3.14 LEVEL OF PARTICIPATION OF THE REMOTE CREW

Define the level of automation of the operation, such as:

- Manual;
- Automatic;
- Autonomous.

NOTE: *Different conditions may apply for nominal, contingency and/or emergency events.*

Additionally, define the main tasks conducted by the remote crew, according to their roles, such as:

- Direct manual control;
- Monitoring;