EGNOS Guidelines for low-risk UAS operations

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Executive summary

As the UAS (Unmanned Aircraft Systems) domain evolves and more complex operations are expected to be performed, airspaces will become increasingly congested, and such complex operations will inherently pose higher risks to both people and properties. In this evolving context, accuracy and integrity of the UAS position will become critical for maintaining safety and efficiency of the operations. GNSS (Global Navigation Satellite System) technology, enhanced by SBAS (Satellite-Based Augmentation System) such as EGNOS (European Geostationary Navigation Overlay Service), will play a key role by providing more precise positioning data.

This document contains guidelines for the use of EGNOS in support to non-safety critical UAS low-risk operations to improve the navigation performance in terms of accuracy and reliability with respect to GPS, and Galileo in the future. It therefore provides an overview of GNSS, EGNOS, and how the range of EGNOS services, particularly the EGNOS Open Service and the EGNOS Data Access Service, and tools can potentially support non-safety critical UAS operations, which shall be equipped with EGNOS-capable receivers and be operated within EGNOS coverage areas.

Besides that, it is proved in the form of guidelines and recommendations how EGNOS services and their tools not only improve navigation performance, but ease compliance with current regulatory framework governing UAS operations. Section 6 contains an overview table summarising the evidence needed to meet regulation requirements and the EGNOS services and tools that may ease gathering such tailored evidence.

Although part of the regulatory framework covered in these guidelines is applicable to low-risk UAS operations within the Specific Category only (SAIL I and II), such as the SORA (Specific Operations Risk Assessment) methodology, included as Acceptable Means of Compliance within EASA Regulation, this document may prove useful to UAS operations classified within the Open Category.

The combination of EGNOS OS and EDAS solutions prove to be an advantage for UAS positioning and navigation in open category and low-risk operations in the specific category. Nevertheless, it should be highlighted that safety critical operations UAS operations entailing a higher risk, as those in the Specific Category ranked with a SAIL higher than II and in the Certified Category, may require a more stringent service than the provided by EDAS and EGNOS OS. Consequently, the provision of an appropriate E-GNSS service based on EGNOS and tailored to UAS operations akin to the current EGNOS SoL Service for manned aviation would be highly valuable.

The target audience of this document is mainly UAS operators in a position to plan a UAS flight, particularly one posing low-risk, and need to gather the proper evidence needed to meet the requirements established in the current regulation. It also comprises other airspace users, National Competent Authorities (NCAs) and, future services providers willing to support the performance of low-risk UAS operations (i.e. CIS, USSP or others).

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1 Introduction

1.1 Background

The current UAS (Unmanned Aircraft Systems) domain is characterized by relatively non-congested airspaces, with operations generally posing a low risk to human safety due to limited traffic and controlled environments. However, as the sector grows, the airspace is expected to become increasingly congested, with more complex operations that will inherently pose higher risks to both people and properties. In this evolving context, accuracy and integrity of the UAS position will become critical for maintaining safety and efficiency of the operations. GNSS (Global Navigation Satellite System) technology, enhanced by SBAS (Satellite-Based Augmentation System), will play a key role by providing more precise positioning data. This improved accuracy and integrity will be vital for collision avoidance, precise navigation, and overall operational safety, serving as an important asset in managing the growing complexity and risk in UAS airspace.

The European Geostationary Navigation Overlay Service (EGNOS) is Europe's regional SBAS. It is used to improve the performance of GNSS, such as GPS, and Galileo in the future. EGNOS was mainly deployed to provide safety of life navigation services to aviation, maritime and land-based users. However, in the recent years, ESSP (European Satellite Service Provider) and EUSPA (European Agency for the Space Program) has been collaborating so as to bring GNSS navigation, particularly Galileo an EGNOS, closer to the UAS domain as well. This document hence focuses on the use of EGNOS as navigation means in low-risk UAS operations, which are performed in non-safety critical applications and do not pose risk to human lives.

Apart from the ongoing progress on EGNOS implementation in manned aviation, mainly focused on LPV procedures, in relation to the civil drone domain, there are a number of additional areas where SBAS-based operations can be implemented and EGNOS is expected to be a key enabler (EGNOS fits for purpose), particularly for the compliance of the current regulatory framework, and possibly from the expected evolution of the UAS rulemaking considering the increasing demand for more challenging UAS operations.

1.2 Purpose

The purpose of this document is to provide clear guidelines for UAS operators in a position to plan UAS flights supported by GNSS navigation with the aim to promote the use of EGNOS in support to non-safety critical low-risk UAS operations.

As per current European regulations, UAS flights get classified according to their features and the risk they pose (low, medium or high). These guidelines are therefore intended to UAS operators planning UAS flights posing low risk to the environment, **which are classified within the Open and Specific (SAIL I and II) Category**, as it will be further explained in the document.

This document therefore aims to guide the operator in the process to comply with current European regulation and make them knowledgeable about the various services offered by EGNOS, which can enhance navigation reliability and safety for UAS operations and prove useful to ease compliance of applicable regulation.

1.3 Scope

These guidelines aim to provide a comprehensive framework for non-safety low-risk UAS operations utilizing GNSS and EGNOS as the primary means of navigation, with the purpose to ease compliance with regulations affecting such operations taking advantage of EGNOS Services, with a specific focus on the requirements for low-risk UAS in the Specific Category that rely on GNSS navigation, which are established in the SORA (Specific Operations Risk Assessment) methodology, included as Acceptable Means of Compliance within EASA Regulation.

The document firstly offers a general regulatory context, outlining the European rules governing such operations, while also presenting an overview of GNSS, EGNOS (European Geostationary Navigation Overlay Service), and the range of EGNOS services that can potentially support UAS operations. **Although part of the regulatory framework covered in these guidelines is applicable to UAS operations within the Specific Category only, such as the SORA Methodology, the following sections regarding low-risk UAS operations in the Specific Category (SAIL I and II) may prove useful to UAS operations classified within the Open Category.**

Following this foundational overview, the document includes specific guidelines on how low-risk UAS operations could particularly benefit from EGNOS support, explaining how EGNOS services can facilitate compliance with current UAS regulations applying to such low-risk UAS operations, enhancing safety and operational reliability. By clarifying these key elements, the document ensures that UAS operators performing low-risk UAS operations meet all applicable requirements to navigate the evolving regulatory and technological landscape.

Additionally, these guidelines offer practical tips to help applicants navigate the SORA methodology ensuring compliance with the necessary safety and operational standards when using GNSS as navigation means.

- Section 2 shows a brief scheme of the regulatory framework applying to UAS operations.
- Section 3 explains GNSS and EGNOS concepts, the different services provided and their relevance for low-risk UAS operations.
- Section 4 provides an overview on how to use EGNOS in UAS operations and what needs to be done to be provided with EGNOS in low-risk UAS operations.
- Section 5 provides guidelines and advice on the requirements that low-risk UAS operations using GNSS navigation and the means that EGNOS itself offers to ease compliance.

2 European Regulatory Framework scheme for UAS

This section provides a brief comprehensive scheme outlining the European regulatory framework governing UAS operations in Europe.

Figure 2-1 shows a simplified scheme how European regulation is organised outlining the regulatory framework governing UAS operations in Europe, in relation with the purpose and scope of this document:

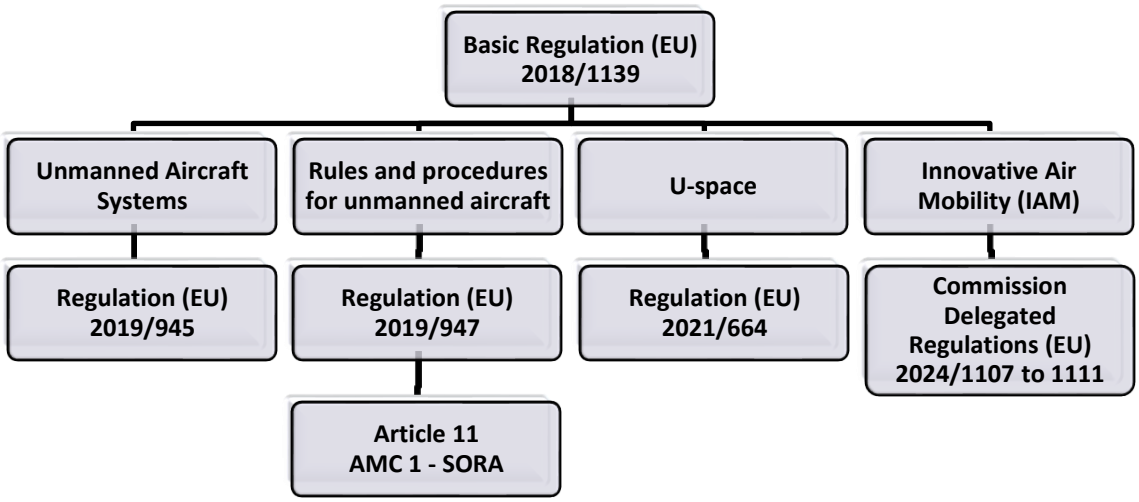


Figure 2-1. European UAS Regulatory Framework

- **Basic Regulation (EU) 2018/1139 – Basic Regulation**
  - Common rules in the field of civil aviation.
  - New rules for UAS (principles and essential requirements)
- **Regulation (EU) 2019/945 – Unmanned Aircraft Systems**
  - Requirements for the design and manufacture of UAS intended to be operated under the rules and conditions defined in Regulation (EU) 2019/947.
- **Regulation (EU) 2019/947 – Rules and procedures for unmanned aircraft**
  - As per Regulation (EU) 2019/947, when planning a UAS operation, it gets classifies into one of the following three categories according to its features:
    - OPEN CATEGORY – UAS operations that shall not be subject to any prior operational authorisation, nor to an operational declaration by the UAS operator before the operation takes place.
    - SPECIFIC CATEGORY – UAS operations that shall require an operational authorisation issued by the competent authority or an authorisation in the framework of model aircraft clubs and associations, or, under circumstances defined in the regulation, a declaration to be made by a UAS operator.

      Acceptable Means of Compliance (AMC1) to Article 11 in Regulation (EU) 2019/947 states that Specific Operations Risk Assessment (SORA) Methodology v2.0 (Specific Category) by JARUS (Joint Authorities for Rulemaking on Unmanned Systems) establishes a sufficient level of confidence that a specific operation can be conducted safely. Edition

2.5 of SORA Methodology has been published by JARUS in May 2024 although not included as AMC to EASA regulation yet (expected along 2025).

When applying to a competent authority for an operational authorisation, the operator shall perform a risk assessment in accordance with Article 11. When categorized within the Specific, UAS operations get identified with a number from I to VI called Specific Assurance and Integrity Levels (SAIL) related to the risk such operation poses. In this context, requirements affecting a UAS operation will depend on its classification; Low risk (SAIL I & II), Medium risk (SAIL III & IV) and High risk (SAIL V & VI).

- CERTIFY CATEGORY – UAS operations that shall require the certification of the UAS pursuant to Delegated Regulation (EU) 2019/945 and the certification of the operator and, where applicable, the licensing of the remote pilot. The Certify Category is sub-divided into three types of operations: Type #1, Type #2 or Type #3.

- **Regulation (EU) 2021/664 – U-space**
  - This Regulation lays down rules and procedures for the safe operations of UAS in the U-space airspace, for the safe integration of UAS into the aviation system and for the provision of U-space services.

- **Commission Delegated Regulations (EU) 2024/1107 to 1111 – Innovative Air Mobility (IAM)**
  - **Commission Delegated Regulations (EU) 2024/1107** - Continuing airworthiness of certified unmanned aircraft systems and their components.
  - **Commission Delegated Regulations (EU) 2024/1108** - Initial airworthiness of UAS subject to certification and Regulation 2019/945.
  - **Commission Delegated Regulations (EU) 2024/1109** - Competent authority requirements and administrative procedures for the certification, oversight and enforcement of the continuing airworthiness of certified unmanned aircraft systems.
  - **Commission Delegated Regulations (EU) 2024/1110** - Initial airworthiness of unmanned aircraft systems subject to certification and Regulation 2019/947
  - **Commission Delegated Regulations (EU) 2024/1111** - Establishment of requirements for the operation of manned aircraft with a vertical take-off and landing capability

Once provided this brief regulatory framework, the following sections present an overview of GNSS, EGNOS and the range of EGNOS services that can potentially support non-safety critical UAS operations posing low risk to human life and property. The document includes specific guidelines on how low-risk UAS operations could particularly benefit from EGNOS support and how EGNOS services can facilitate compliance with regulations contained in this section applying to non-safety critical low-risk UAS operations, enhancing safety and operational reliability.

When using GNSS as navigation means externally provided by a service supporting UAS operations classified within the Specific Category, the SORA methodology, developed by JARUS and included in the regulatory framework, defines the requirements identified within the

'Operational Safety Objective (OSO) #13 - External services supporting UAS operations are adequate to the operation' that the UAS operator shall comply.

Although the SORA Methodology is identified as Acceptable Means of Compliance (AMC1) to Article 11 in Regulation (EU) 2019/947 applicable to UAS operations within the Specific Category only, **the following sections regarding low-risk UAS operations in the Specific Category (SAIL I and II) may prove useful to UAS operations classified within the Open Category.**

3 EGNOS for low-risk UAS operations

What is EGNOS?

EGNOS – European Geostationary Navigation Overlay Service – is Europe's regional FREE of charge SBAS used to improve the performance of GNSS, such as GPS, and Galileo in the future.

What is GNSS?

GNSS – Global Navigation Satellite System – means any satellite constellation that provides global positioning, navigation, and timing services. Using signals from space, each of these systems transmits ranging and timing data to GNSS-enabled receivers to determine their location.

Worldwide currently available GNSS: Galileo (EU), GPS (USA), GLONASS (Russia), BeiDou (China).

GNSS signals travel from space down to Earth and pass through the ionosphere. Signals may become delayed and distorted. If left uncorrected, this delay can significantly alter the accuracy of the measurements, resulting in positioning errors. Augmentation systems help resolve GNSS positioning errors improving – "augmenting" - the navigation system's performances via aircraft (ABAS), ground (GBAS) or satellite-based systems (SBAS), such as EGNOS.

What is SBAS?

SBAS – satellite-based augmentation system – improves the accuracy and reliability of GNSS positioning by correcting signal measurement errors and by providing integrity information. These systems correct GNSS measurements taken by accurately located reference stations deployed across a country, region or continent.

EGNOS is the European SBAS. Other worldwide currently available SBAS:

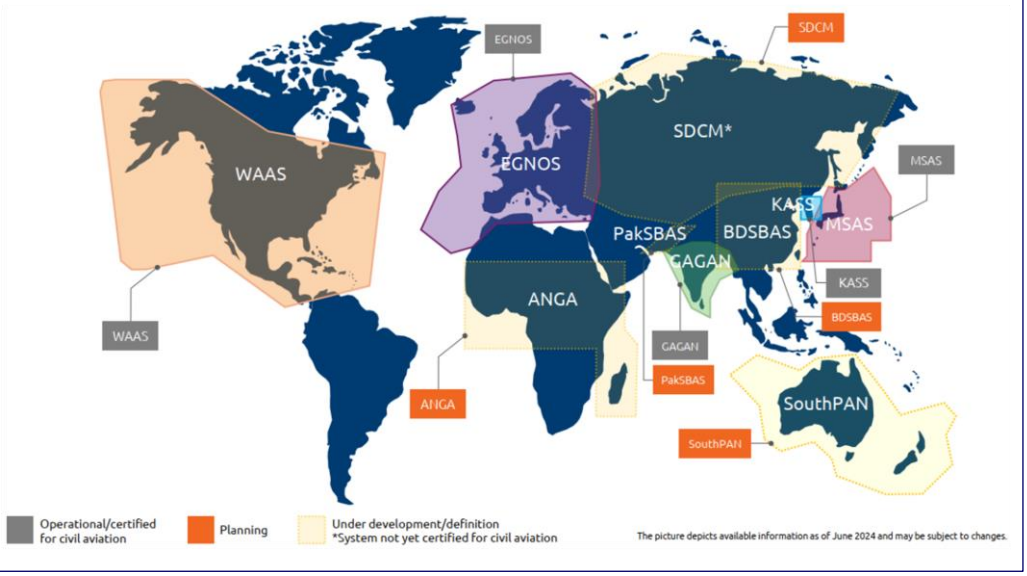


Figure 3-1. What is EGNOS, GNSS and SBAS?

EGNOS provides corrections and integrity information to GPS signals over a broad area centred over Europe and it is fully interoperable with other existing SBAS systems. EGNOS provides several services to aviation, maritime and land-based users. Figure 3-2 provides a brief overview of the EGNOS services offered to users within the aviation domain.

EGNOS SERVICES in the aviation and UAS domains:

OS Open Service

Service for applications where human life is not at stake, such as personal navigation, goods tracking and precision farming. EGNOS OS service is freely accessible without any direct charge or specific authorisation. It improves GNSS positioning accuracy and is already used by UAS with SBAS-capable receiver.

SoL Safety of Life Service

Service for applications where human lives could be endangered if the performance is degraded below specific accuracy limits and no alert notice is given. SoL Service mainly supports manned aviation (LPV procedures) providing accuracy correction and integrity information without any direct charge.

Requirements for integrity in UAS operations currently under discussion at European level.

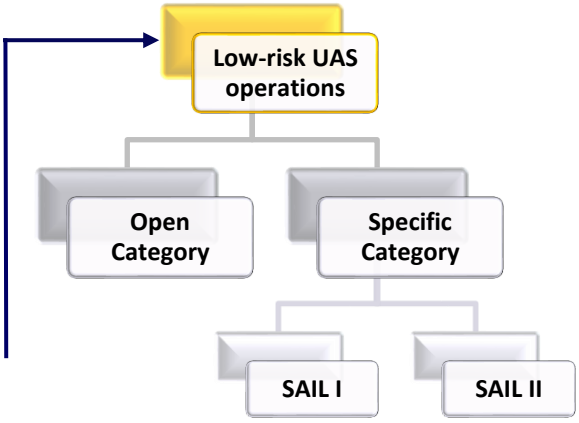
EDAS EGNOS Data Access Service

EGNOS terrestrial data service which offers EGNOS data in real time and historical data to authorised users. The service provides the single point of access for the data collected and generated by the EGNOS ground infrastructure. The EGNOS corrections are broadcast via Internet avoiding any GEO satellite shadow, having more availability and stability.

Figure 3-2. EGNOS Services for users in the aviation domain

EGNOS IN LOW-RISK UAS OPERATIONS

As stated in previous sections, these guidelines are oriented to support low-risk UAS operations, covering both operations in the Open Category and in the lower risk levels of the Specific Category (SAIL I and II). Consequently, it is oriented to UAS operations as those performed in **non-safety critical scenarios.**



The use of EGNOS services to UAS operations for non-safety critical operations is currently considered for **EGNOS OS and EGNOS EDAS.** Both of them improve the performance of the PVT solution onboard the UAS' SBAS-capable receiver and can be openly used by UAS operators in non-safety critical scenarios, where integrity information is not essential.

OS Open Service

EGNOS OS corrections to the GPS solution can be used in remote identification, providing information about its position. Using EGNOS, the reported position is in line with the EGNOS OS committed performance.

EDAS EGNOS Data Access Service

The use of **EGNOS EDAS** in drones highly improves the positioning and navigation for UAS in the open category and specific low risk operations. EDAS service can be used to improve GPS solution using a Mobile Communication to retrieve corrections in real time from a close EDAS reference station.

The use of EGNOS services in UAS flights currently improves the navigation performance in terms of accuracy and reliability with respect to GPS, and Galileo in the future. There are a vast of non-safety critical operations which may take benefits of EGNOS OS and EDAS services, in non-populated environments: Agriculture, railway, control of sea borders, Search and Rescue, delivery, etc.

The combination of EDAS and EGNOS OS solutions prove to be an advantage for UAS positioning and navigation only for open category and low-risk operations in the specific category. Nevertheless, safety critical operations UAS operations entailing a higher risk, as those in the Specific Category ranked with a SAIL higher than II and in the Certified Category, may require a more stringent service than EDAS and EGNOS OS. The provision of an appropriate E-GNSS service based on EGNOS and tailored to UAS operations akin to the current EGNOS SoL Service for manned aviation would be highly valuable to support the variety of UAS operations.

A White Paper on EGNOS for UAS operations is available at the EGNOS User Support Portal, which reviews the EGNOS services and their current and future applications in unmanned aviation, with special focus on the current performance of the EGNOS OS and EDAS in UAS operations.

Figure 3-3. Low-risk UAS operations scheme and EGNOS provision

4 How to use EGNOS in low-risk UAS operations

4.1 Technical requirements

4.1.1 EGNOS Open Service

The EGNOS Open Service is the one currently used in UAS operations for positioning information. In order to benefit from the improved accuracy that EGNOS OS provides, the user needs to take into account the following:

GNSS receiver

The onboard GNSS receiver must be SBAS-capable as described in the EGNOS OS Service Definition Document (SDD). Some GNSS receivers currently available on the market are able to receive and process EGNOS signals and can be used to support numerous non-safety critical applications. The operator needs to make sure that the GNSS receiver used for the UAS navigation is capable to apply EGNOS corrections, by looking at the receiver datasheet and verifying its SBAS capability.

1.3 Performance

Parameter	Specification
Receiver type	72-channel u-blox M8 engine GPS L1C/A, SBAS L1C/A, QZSS L1C/A, QZSS L1 SAIF, GLONASS L1OF, BeiDou B1I, Galileo E1B/C

Figure 4-1. SBAS specifications U-blix M8

EGNOS configuration

Receivers should be properly configured to use EGNOS corrections. SBAS corrections should be activated and EGNOS properly configured. The EGNOS User Support website provides free guidance material on how to configure SBAS receivers.

Practical training material was created by EUSPA, ESSP and GSC on how to set up and activate EGNOS in UAS.
Users can check the **video training** with the following **QR code:**

EGNOS configuration video training

EGNOS OS performance

EGNOS OS Service is provided with at least the minimum committed performance described in the SDD. Real-time performance is shown in the OS real-time performance dedicated tool, where two solutions are plotted when using the SBAS corrections or GPS only.

The mentioned published White Paper includes information on real EGNOS performance in UAS operations.

EGNOS OS availability

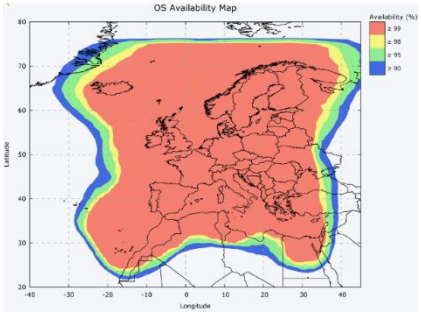


Figure 4-2. EGNOS OS availability

UAS must operate within the EGNOS OS compliance area, where the user is able to calculate its position with at least the EGNOS OS minimum accuracy committed is available 99% of the time, as specified in the EGNOS OS SDD (Section 6) and shown in Figure 4-2, ensuring line of sight between the GNSS antenna and at least one of the EGNOS geostationary satellites.

4.1.2 EGNOS EDAS Service

EDAS provides ground-based access to EGNOS data. The EGNOS Data Access Service (further "EDAS") comprises the provision of data collected, generated and delivered by the EGNOS infrastructure. In order to benefit from the improved performance that EGNOS EDAS provides, the user needs to ensure that the following requirements are met:

EDAS access

EDAS is accessible to EU users (within EU Member States, Norway, Switzerland and Iceland) upon registration and to non-EU users upon registration and potential authorisation by the EGNOS Service Provider. Access is provided through the connection to a dedicated Internet domain (egnos-edas.eu). EDAS is free of charge and can only be used for non-safety critical purposes, i.e. purposes that have no impact on the safety of human life.
Further information about registration and account generation can be found in the dedicated website.

EDAS configuration

Published mentioned White Paper provides information on how to configure EDAS.

EDAS performance

EDAS data is provided with the specific committed performance and subject to the service limitations described in the EDAS Service Definition Document (SDD) (Section 6)

Minimum performance characteristics are described in the SDD. However, real-time performance of the service is shown in a EDAS real-time dedicated tool.

As for EGNOS OS, published White Paper includes information on real EGNOS performance in UAS operations.

EDAS coverage

The EDAS DGNSS Coverage Map shows the available positioning solutions based on EDAS in the area and the EGNOS stations that are available in the current location.

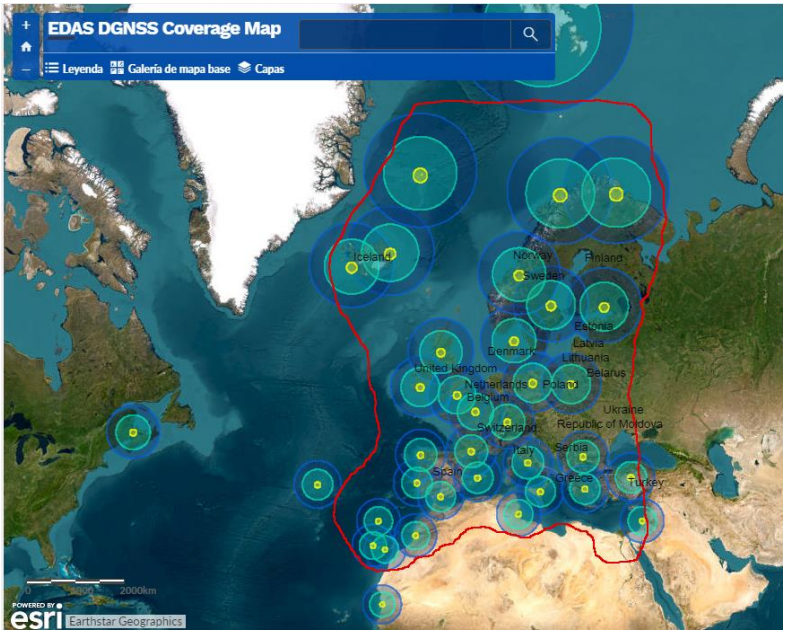


Figure 4-3. EDAS DGNSS Coverage Map

4.2 Useful documentation and tools

EGNOS User Support

EGNOS delivers useful documentation for UAS operations through the EGNOS User Support website.

Within this useful documentation in the EGNOS User Support website can be found:

- EGNOS OS SDD.
- EDAS SDD.
- Guidance material on EGNOS performance in UAS operations or how to configure EGNOS in UAS receivers, among others.

EGNOS OS and EDAS SDDs identify in Section 2.2 **Terms and Conditions of use of EGNOS OS and EDAS** services, **including** liability, that is **the service commitments and user responsibilities**. **A contract or Service Level Agreement (SLA) is not required** to be signed by operators/users and the Service Provider for the provision of EGNOS OS and EDAS.

Another available tools to be mentioned so as to plan UAS missions are:

- EGNOS Configuration Forecast which shows the planned status of the operational EGNOS assets and GPS constellation at least for one week in advance.
- EGNOS maps, which shows all areas within the Digital Elevation Model over Europe where there is no visibility of one or both EGNOS operational geostationary satellites.
- EGNOS city visibility maps, which shows information for non-operational purposes on the EGNOS GEO satellites visibility.

Finally, in addition to EGNOS OS and EDAS dedicated tools, **EGNOS already offers tools to manned aviation that are expected to be tailored for UAS users in a potential EGNOS Service for UAS** (ESU) for safety-critical applications in the future:

- EGNOS SoL Performance Forecasting and Monitoring Tool
- EGNOS SoL Historical Performance Information Tool.
- EGNOS NOTAMs.

EGNOS Helpdesk

The EGNOS helpdesk provides users with information related to the EGNOS system, its performance and applications.

For further information related to the EGNOS, the EGNOS Helpdesk is available 24/7 via email (**helpdesk@egnos.gsc-europa.eu)**, phone (**+34 911 236 555)**, or website.

EGNOS training material

As part of its training materials, EUSPA, in collaboration with ESSP and GSC, has developed a practical video training for drone operators, demonstrating how to set up and activate EGNOS in drones.

EGNOS configuration video training

5 How to comply with applicable regulation when using EGNOS

This section provides an overview and guidelines on how to comply with the applicable regulation when using EGNOS, and GNSS, as navigation means to support UAS operations.

Commission Implementing Regulation (EU) 2019/947 establishes the rules and procedures for the operation of unmanned aircraft. For that matter, Regulation (EU) 2019/947 classifies UAS operations, as mentioned in Section 2 into one of three categories according to its features: Open, Specific and Certified. When classified within **Specific Category**, Regulation establishes that a **risk assessment shall be performed in accordance with Article 11** - Rules for conducting an operational risk assessment. According to Regulation (EU) 2019/947 an operational risk assessment shall:

- describe the characteristics of the UAS operation;
- propose adequate operational safety objectives;
- identify the risks of the operation on the ground and in the air;
- identify a range of possible risk mitigating measures;
- determine the necessary level of robustness of the selected mitigating measures in such a way that the operation can be conducted safely.

The assessment shall propose a target level of safety, which shall be equivalent to the safety level in manned aviation, in view of the specific characteristics of UAS operation.

For this purpose, **EASA identifies Specific Operations Risk Assessment (SORA) methodology (v2.0) as Acceptable Means of Compliance (AMC1)** to Article 11 in Regulation (EU) 2019/947 on how to perform a risk assessment and the requirements to meet when, among others features, a UAS operation is supported by GNSS, and EGNOS, as navigation means. SORA v2.5 package has been published by JARUS in May 2024, but it is not in force yet in European regulation (expected along 2025).

The SORA methodology is the JARUS Working Group – Safety Risk Management (WG-SRM) consensus vision on how to safely evaluate a UAS operation. It defines the requirements to establish a sufficient level of confidence that a specific operation can be conducted safely.

What is SORA?

SORA provides a methodology to guide both the applicant, generally the UAS operator, and the competent authority in determining whether an operation can be conducted in a safe manner. The SORA is a guide that allows an operator to identify the risk, and the required tailored evidence and assurances needed for a UAS operation within the Specific Category to be acceptably safe following Operational Safety Objectives (OSOs).

What is an Operational Safety Objective (OSO)?

SORA v2.0 methodology identifies 24 OSOs related to UAS operation but in SORA v2.5 OSOs are reduced to 17. In both versions, UAS operations supported by GNSS, and EGNOS, as navigation means shall comply with **OSO #13 - External services supporting UAS operations are adequate to the operation**.

These OSOs identify a level of robustness that shall be met to ensure the safety of the operation.

What is the level of robustness?

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

SORA methodology identifies three levels of robustness: Low, medium and high. A level of robustness is associated to a corresponding Specific Assurance and Integrity Levels (SAIL) and varies in the different OSOs.

What is the SAIL?

The Specific Assurance and Integrity Level (SAIL), scaled from I to VI, is assigned to a UAS operation within the Specific Category based on the Ground Risk Class (GRC) and Air Risk Class (ARC) determined through the SORA methodology for the intended operation. **Low-risk UAS operations are identified with SAIL I and II**, medium-risk with SAIL III and IV and high-risk with V and VI.

The SAIL maps the maximum allowable loss of control rate that ensures that an operation meets a Target Level of Safety (TLOS), defined for people and aircraft uninvolved in the operation. The SAIL is used to identify and demonstrate varying levels of ability to maintain control of the operation to meet the TLOS.

Given this basic knowledge of the SORA methodology, it is hereunder explained where and how the present case, low-risk UAS operations externally supported by EGNOS as navigation means, is affected by SORA methodology and the requirements concerning the use of GNSS navigation provided by an external service.

EASA currently identifies v2.0 of SORA methodology within AMC1 Article 11 Rules for conducting an operational risk assessment of Regulation (EU) 2019/947. SORA v2.5 package was published by JARUS in May 2024, but it is not in force yet in European regulation. For this matter, it is worth mentioning that:

- These guidelines are based in current applicable regulations, i.e. SORA v2.0.
- Modifications in SORA v2.5 that may be eventually included in regulations governing UAS operations have been identified. These modifications would be addressed in an eventual new version of these guidelines.

Within OSOs included in SORA methodology, UAS operations supported by GNSS, and EGNOS, as navigation means shall, as above-mentioned, comply with **OSO #13 - External services supporting UAS operations are adequate to the operation**.

SORA OSO #13

OSO #13 – 'External services supporting UAS operations are adequate to the operation' concerns about the deterioration of external systems supporting UAS operations and stablishes, in the form of level of integrity and assurance, the evidence and assurances needed by UAS operations supported by services externally provided, so it is assured that they are adequate to the operation.

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, by a service provider other than the UAS operator.

SORA v2.5 methodology includes within Annex E 'Navigation Service Provider (e.g., Global navigation satellite system)' as external service. Additionally, EASA in Regulation (EU) 2019/947 also identifies services that support navigation, e.g. GNSS services, as external services.

These tailored evidence and assurances derive from a certain required level of robustness linked to the risk that the operation poses, which is identified by the SAIL.

The **first step would be therefore to determine the SAIL according to the associated GRC and ARC** of the UAS intended operation contained in an operational volume. Details of the definition of all these parameters and their expected values for **low-risk UAS operations, since they are identified with SAILs I and II,** are provided below.

Operational Volume, GRC and ARC

As defined in Regulation 2019/947, for a given UAS operation within the Specific category, it shall be first defined:

- The Operational volume in which the UAS operation is contained. It includes the Flight Geography and the Contingency Volume. Regulation (EU) 2019/947 in Article 11 requires for the risk assessment performance a description of the operational environment and geographical area for the intended operation, in particular overflown population, orography, types of airspace, airspace volume where the operation will take place and which airspace volume is kept as necessary risk buffers, including the operational requirements for geographical zones.

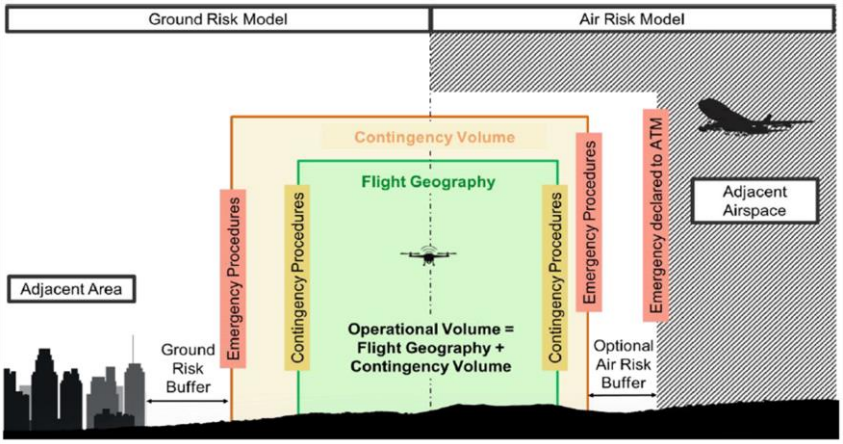


Figure 5-1. Graphical representation of the Operational Volume (Regulation 2019/947)

Luftfahrt-Bundesamt (LBA) and the Irish Aviation Authority (IAA) published in 2024 two similar guidance documents with the purpose to provide some guidelines on accurately calculating, defining and presenting these volumes, and ground risk buffer as well.

- Ground Risk Class (GRC), which is defined by the unmanned aircraft (UA) characteristics and the population density placed at-risk by the operation.
- Air Risk Class (ARC), which is defined by the airspace characteristics in which the operation is going to be performed (atypical airspace, altitude, controlled or uncontrolled airspace, airport or non-airport scenario, urban or rural environment).
- Mitigation measures, which are applied so as to reduce both the GRC and ARC.

The Final GRC (0-7) and the residual ARC (a to d class) are therefore defined after the application of such mitigation measures and determine the SAIL and the following steps in SORA methodology.

SAIL identification

Given a defined UAS operation and its associated Final GRC and Residual ARC, the operation's posed risk is identified by the SAIL, which is determined by the following table:

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	Category C operation			

Figure 5-2. SAIL identification (Regulation 2019/947)

Low-risk operations in the Specific Category linked to **SAIL I and II** shall pose a **Final GRC equal to or lower than 3, and Residual ARC of a or b** within the Operational volume, in which is contained the intended UAS operation.

Level of robustness

According to SORA methodology, the following table links the SAIL with the level of robustness in the OSO #13 case.

OSO number (in line with Annex E)		SAIL					
		I	II	III	IV	V	VI
OSO#13	External services supporting UAS operations are adequate for the operation	L	L	M	H	H	H

Figure 5-3. Level of robustness by SAIL in OSO #13 (Regulation 2019/947)

SAILs I & II UAS operations must meet a low level of robustness for OSO#13.

Level of integrity and assurance

According to SORA methodology, the following matrix links the level of Assurance and Integrity to the level of Robustness.

	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

Figure 5-4. Robustness, Integrity and Assurance matrix (Regulation 2019/947)

Low level of Robustness requires low level of Assurance and/or low level of Integrity.

SORA requires **low level of robustness, and low level of integrity and/or low level of assurance** for external services supporting **low risk (SAIL I & II) operations.**

In regard to what stated in Regulation 2019/947 in relation to OSO #13 - External services supporting UAS operations are adequate to the operation, hereafter are gathered the requirements associated to Low Level of Integrity and Low Level of Assurance.

DETERIORATION OF EXTERNAL SYSTEMS SUPPORTING UAS OPERATIONS BEYOND THE CONTROL OF THE UAS		Level of integrity		
		Low	Medium	High
OSO #13 External services supporting UAS operations are adequate for the operation	Criteria	The applicant ensures that the level of performance for any externally provided service necessary for the safety of the flight is adequate for the intended operation. If the externally provided service requires communication between the UAS operator and the service provider, the applicant ensures there is effective communication to support the service provision. Roles and responsibilities between the applicant and the external service provider are defined.		
	Comments	*N/A*	*N/A*	*Requirements for contracting services with the service provider may be derived from ICAO Standards and Recommended Practices (SARPs) that are currently under development.*

Figure 5-5. Level of integrity for external services supporting low-risk UAS operations in the Specific Category identified in OSO #13 (Regulation 2019/947)

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

Figure 5-6. Level of assurance for external services supporting low-risk UAS operations in the Specific Category identified in OSO #13 (Regulation 2019/947)

As previously explained, SORA v2.5 package has been published by JARUS in May 2024, but it is not in force yet in European regulation. Next figures highlight the changes included in SORA v2.5 with regards to SORA v2.0 in relation to the OSO #13:

DETERIORATION OF EXTERNAL SERVICES SUPPORTING UAS OPERATION		LEVEL of INTEGRITY		
		Low (SAIL I & II)	Medium (SAIL III)	High (SAIL IV to VI)
OSO #13 External services supporting UAS operations are adequate to the operation	Criterion	The applicant ensures that the level of performance for any externally provided **service critical for the safety of the flight**[1] is adequate for the intended operation. If the externally provided service requires communication between the Operator and the Service Provider, the applicant ensures there is effective communication to support the service provisions. Roles and responsibilities between the applicant 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 Service Provider may be derived from ICAO Standards and Recommended Practices - SARPS (currently under development).*

Figure 5-7. Level of integrity for external services supporting low-risk UAS operations in the Specific Category identified in OSO #13 (SORA v2.5)

DETERIORATION OF EXTERNAL SERVICES SUPPORTING UAS OPERATION		LEVEL of ASSURANCE		
		Low (SAIL I & II)	Medium (SAIL III)	High (SAIL IV to VI)
OSO #13 External services supporting UAS operations are adequate to the operation	Criterion	The applicant declares[1] that the requested level of performance for any externally provided service necessary for the safety of the flight is achieved.	The applicant has supporting evidence that the required level of performance for any externally provided service required for the safety of the flight can be achieved for the full duration of the mission.	Same as Medium. In addition: • The evidence of the externally provided service performance is achieved through demonstrations. • A competent third party validates the claimed level of integrity.
			This may take the form of an SLA or any official commitment that prevails between a Service Provider and the applicant on relevant aspects of the service (including quality, availability, responsibilities). The applicant has means to monitor externally provided services that affect flight-critical systems and take appropriate actions if real-time performance could lead to the loss of control of the operation.	
	Comments	[1] *Supporting evidence for this declaration may still be requested by the competent authority.* *Supporting evidence may take the form of a Service-Level Agreement (SLA) or any official commitment that prevails between a Service Provider and the applicant on relevant aspects of the service (including quality, availability, responsibilities).* *As an example, if an applicant uses an external surveillance service they should have evidence available supporting the claim that the service meets performance requirements in Annex D.*	*N/A*	*N/A*

Figure 5-8. Level of assurance for external services supporting low-risk UAS operations in the Specific Category identified in OSO #13 (SORA v2.5)

As per **SORA v2.5's** clarification that a "service critical for the safety of the flight" means a service whose loss would directly lead to a loss of control of the operation as identified per OSO #05, it is being discussed at European level the criticality of GNSS loss in UAS operations. Additionally, in the level of Assurance it is clarified that **supporting evidence for this declaration may be still requested by the competent authority**. This was not requested by SORA v2.0.

In order to ease compliance with the applicable OSO #13 within the SORA methodology related to the use of GNSS and EGNOS as navigation means in UAS operations, **recommendations and guidelines** are hereunder provided with the aim of guiding and supporting UAS operators with the gathering of the tailored evidence and assurances needed to meet the requirements in OSO #13 to ensure the safety of an operation supported by EGNSS and classified with SAIL I and II. **Section 6 contains an overview table** summarising the proposed evidence to meet regulation requirements and the EGNOS services and tools that may ease gathering such tailored evidence.

EUROCAE's document ED-301 – 'Guidelines for the use of multi-GNSS solutions for UAS Specific Category – Low-risk operations SAIL I & II' may be use as supporting source as well together with these guidelines. While ED-301 document is intended to facilitate fulfilment of SORA's OSO #13 to low-risk UAS operations in the Specific Category (SAIL I and II), these present guidelines are however aimed at making readers knowledgeable about how the services provided by EGNOS can improve navigation for non-safety critical low-risk UAS operations, as well as how the currently available and expected EGNOS tools can help operators meet the requirements necessary for operations using EGNSS as a means of navigation, such as the OSO #13 of SORA methodology.

OSO #13 - Low level of Integrity

Integrity – Criterion 1: ***"The applicant ensures that the level of performance for any externally provided service critical for the safety of the flight is adequate for the intended operation".***

- UAS operator shall ensure of having the adequate level of performance of GNSS for the intended operation.

Level of performance could be ensured by referring to the conditions of use of such services in the corresponding Service Definition Document (SDD), such as **EGNOS OS and EDAS SDDs** (see Section 4.1), which in section 6 include EGNOS level of performance and coverage areas, high-level information on the minimum performance characteristics (worst performance commitment).

The UAS operator should make sure that the GNSS receiver used for the UAS navigation is SBAS-capable. UAS operators can find guidance material in the EGNOS User Support website and training material in EUSPA's website.

EGNOS User Support portal provides information about the real-time status of EGNOS OS and EDAS services (see Section 4.1). UAS operator may use these before the intended operation to check whether it could be flown with adequate navigation performances.
The UAS operation must ensure line of sight between the GNSS antenna and at least one of the EGNOS geostationary satellites (see Section 4.1.1). EGNOS offers, as well, coverage and visibility maps in its User Support portal (see Section 4.2).

UAS operators may as well ensure the adequate level of performance by **making some forecast to predict eventual availability of the EGNOS Services**, before the intended operation. Currently, the EGNOS Configuration Forecast shows the planned status of the operational EGNOS assets (GEO satellites and RIMS) and GPS constellation at least for one week in advance.
In the future, a potential EGNOS Service for UAS may provide tailored EGNOS performance forecasting and real-time status of EGNOS, akin to those currently provided to manned aviation, but tailored to the UAS operations.

Integrity - Criterion 2: ***"If the externally provided service requires communication between the Operator and the Service Provider, the applicant ensures there is effective communication to support the service provisions."***

- To meet this criterion, the applicant would need to refer to the SDDs to Section 3.2.2 include the reference on how to contact the EGNOS service provider.

The EGNOS Helpdesk is the 24/7 direct point of contact for any question related with the EGNOS system, its performance and applications.

OSO #13 - Low level of Integrity

Integrity - Criterion 3: ***"Roles and responsibilities between the applicant and the external Service Provider are defined."***

- As included in the current Regulation 2019/947, compliance with this requirement may be ensured by referring to the conditions of use of such services in the corresponding Service Definition Document (SDD).

Roles and responsibilities between the operator and the external service provider could be demonstrated with the appropriate EGNOS SDDs, which in Section 2.2 to describe the Terms and Conditions of Use of EGNOS OS and EDAS, including liability (need to be updated to include information tailored to UAS operations)

EGNOS OS and EDAS do not require a contract to be signed by the operator/user and the Service Provider.

OSO #13 - Low level of Assurance

Assurance – Criterion 1: ***"The applicant declares 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 should make sure that the level of performance is considered enough for the particular operation. The applicant needs to state that the GNSS service determined in Integrity – Criterion 1 is achieved during the operation in a normal situation. A self-declaration may therefore suffice for that purpose.

Compliance with the level of performance could be ensured by referring to the conditions of use of such services in the corresponding SDD.

EGNOS tools and maps described in the 'Level of Integrity' part may ease gathering the supporting evidence that the GNSS service is provided within the performance levels committed in the SDD. Additionally, it is recommended to include some **operational procedures within the Operations Manual to check both EGNOS real-time status information (tools and maps) and EGNOS forecast information, before the intended operation.**

SORA v2.5 clarifies that a supporting evidence may be still requested by the competent authority, not only a declaration without evidence being necessarily available as stated in current Regulation 2019/947.

The applicant should therefore make a written self-declaration available, declaring that the level of performance is considered enough for the particular operation, referring to EGNOS sources provided above.

6 Conclusions

The European Geostationary Navigation Overlay Service (EGNOS) is Europe's regional satellite-based augmentation system (SBAS). It is used to improve the performance of global navigation satellite systems (GNSSs), such as GPS, and Galileo in the future. EGNOS was mainly deployed to provide safety of life navigation services to aviation, maritime and land-based users.

However, in the recent years, ESSP (as EGNOS Service Provider) and EUSPA (as the European Agency for the Space Program) has been collaborating so as to bring GNSS navigation, particularly EGNOS, closer to the UAS domain as well. This document hence focuses on the use of EGNOS as navigation means in non-safety critical low-risk UAS operations, which are performed in non-safety critical applications and do not pose risk to human lives.

The assessment performed in this document allowed the following sound conclusions:

- The use of EGNOS in UAS flights improves the navigation performance in terms of accuracy and reliability with respect to GPS, and Galileo in the future. There are a vast of non-safety critical UAS operations which may take benefits of EGNOS OS and EDAS services, in non-populated environments: Agriculture, railway, Search and Rescue, etc.
- EGNOS services to UAS operations for non-safety critical operations are currently EGNOS OS and EGNOS EDAS. The combination of EDAS and EGNOS OS solutions have proved to be an advantage for UAS positioning and navigation, in Open Category and low-risk operations in the Specific Category.
- For UAS operators to be supported by EGNOS, UAS operations should primarily meet the following conditions:
  - To be performed using an SBAS-capable receiver, which should be properly configured to use EGNOS corrections. The EGNOS User Support website provides free guidance and training material on how to configure SBAS receivers for different applications.
  - To be operated within EGNOS coverage areas, which are defined, as well as the minimum committed performances, in the EGNOS OS and EDAS SDDs.

  EGNOS configuration video training

  - To demonstrate compliance with applicable requirements in front of the competent authority to perform the expected UAS operation. The use of EGNOS in UAS operations not only enhances the positioning but EGNOS services (e.g., EGNOS User Support Portal and EGNOS Helpdesk) provide support to UAS flights planning and eases compliance with current and expected regulation, particularly what stated in OSO #13 as included as AMC to Regulation (EU) 2019/947 on performing a risk assessment.

    SORA v2.5 package has been already published by JARUS, although it is not in force yet in European regulation. For this matter, it is worth mentioning that:

    - These guidelines are based in current applicable regulations, i.e. SORA v2.0 package.
    - Modifications in SORA v2.5 that may be eventually affect regulations governing UAS operations are identified in these guidelines. Were that to happen, these modifications would be address in an eventual new version of these guidelines.

		SORA OSO #13 (Regulation 2019/947)	Proposed EGNOS compliance for Regulation 2019/947 - OSO#13	SORA v2.5 OSO #13	Proposed EGNOS compliance for SORA v2.5
Low LEVEL of INTEGRITY	Criterion 1	***The applicant ensures that the level of performance for any externally provided service critical for the safety of the flight is adequate for the intended operation.***	• **Evidence:** **EGNOS OS** and **EDAS SDD** (Section 6 - level of performance and coverage areas). SBAS-capable receiver on board (guidance material and training material with video) • **Operational procedures (before the operation):** Check EGNOS real-time status information (tools and maps) on EGNOS User Support Portal. Check EGNOS forecast information to predict eventual availability.	***Clarification included:*** ***"Service critical for the safety of the flight" means a service whose loss would directly lead to a loss of control of the operation as identified per OSO #05, where 'Navigation Service Provider (e.g., Global navigation satellite system)' is included as example of external service.***	Same evidence as proposed EGNOS compliance for Regulation 2019/947
	Criterion 2	***If the externally provided service requires communication between the Operator and the Service Provider, the applicant ensures there is effective communication to support the service provisions.***	• **Evidence:** **EGNOS OS** and **EDAS SDD** (Section 3.2.2. - how to contact the EGNOS service provider). The EGNOS Helpdesk (available 24/7)		
	Criterion 3	***Roles and responsibilities between the applicant and the external Service Provider are defined.***	• **Evidence:** **EGNOS OS** and **EDAS SDD** (Section 2.2 - the terms and conditions of use of EGNOS OS & EDAS respectively, including liability). **Not SLA/contract is required for the use of EGNOS OS and EDAS.**		
Low LEVEL of [illegible]	Criterion 1	***The applicant declares 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).***	• **Evidence (only if necessarily available):** **EGNOS OS** and **EDAS SDD** (with reference to above mentioned sections). **Operations manual** (see Level of Integrity – Criterion 1).	***Clarification included:*** ***Supporting evidence for this declaration may still be requested by the competent authority.***	• **Evidence:** **EGNOS OS** and **EDAS SDD** (above mentioned sections). **Operations manual** (see Level of Integrity – Criterion 1).

Table 6-1. EGNOS for compliance with JARUS SORA

The combination of EGNOS OS and EDAS solutions prove to be an advantage for UAS positioning and navigation in open category and low-risk operations in the specific category. Nevertheless, it should be highlighted that safety critical operations UAS operations entailing a higher risk, as those in the Specific Category ranked with a SAIL higher than II and in the Certified Category, may require a more stringent service than the provided by EDAS and EGNOS OS.

Consequently, the provision of an appropriate E-GNSS service based on EGNOS and tailored to UAS operations akin to the current EGNOS SoL Service for manned aviation would be highly valuable.

Annex A: Reference documents

RD	Title
RD 1.	Basic Regulation (EU) 2018/1139 of 4 July 2018 on common rules in the field of civil aviation and establishing a European Union Aviation Safety Agency, and amending Regulations (EC) No 2111/2005, (EC) No 1008/2008, (EU) No 996/2010, (EU) No 376/2014 and Directives 2014/30/EU and 2014/53/EU of the European Parliament and of the Council, and repealing Regulations (EC) No 552/2004 and (EC) No 216/2008 of the European Parliament and of the Council and Council Regulation (EEC) No 3922/91.
RD 2.	COMMISSION DELEGATED REGULATION (EU) 2019/945 of 12 March 2019 on unmanned aircraft systems and on third-country operators of unmanned aircraft systems.
RD 3.	COMMISSION IMPLEMENTING REGULATION (EU) 2019/947 of 24 May 2019 on the rules and procedures for the operation of unmanned aircraft.
RD 4.	COMMISSION IMPLEMENTING REGULATION (EU) 2021/664 of 22 April 2021 on a regulatory framework for the U-space.
RD 5.	COMMISSION DELEGATED REGULATION (EU) 2024/1107 of 13 March 2024 supplementing Regulation (EU) 2018/1139 of the European Parliament and of the Council by laying down detailed rules for the continuing airworthiness of certified unmanned aircraft systems and their components, and on the approval of organisations and personnel involved in these tasks.
RD 6.	COMMISSION DELEGATED REGULATION (EU) 2024/1108 of 13 March 2024 amending Regulation (EU) No 748/2012 as regards the initial airworthiness of unmanned aircraft systems subject to certification and Delegated Regulation (EU) 2019/945 as regards unmanned aircraft systems and third-country operators of unmanned aircraft systems
RD 7.	COMMISSION IMPLEMENTING REGULATION (EU) 2024/1109 of 10 April 2024 laying down rules for the application of Regulation (EU) 2018/1139 of the European Parliament and of the Council as regards competent authority requirements and administrative procedures for the certification, oversight and enforcement of the continuing airworthiness of certified unmanned aircraft systems, and amending Implementing Regulation (EU) 2023/203.
RD 8.	COMMISSION IMPLEMENTING REGULATION (EU) 2024/1110 of 10 April 2024 amending Regulation (EU) No 748/2012 as regards the initial airworthiness of unmanned aircraft systems subject to certification and Implementing Regulation (EU) 2019/947 as regards the rules and procedures for the operation of unmanned aircraft.
RD 9.	COMMISSION IMPLEMENTING REGULATION (EU) 2024/1111 of 10 April 2024 amending Regulation (EU) No 1178/2011, Implementing Regulation (EU) No 923/2012, Regulation (EU) No 965/2012 and Implementing Regulation (EU) 2017/373, as regards the establishment of requirements for the operation of manned aircraft with a vertical take-off and landing capability.
RD 10.	EASA Easy Access Rules for Unmanned Aircraft Systems (July 2024)

RD	Title
RD 11.	EGNOS Open Service (OS) – Service Definition Document Issue 2.3
RD 12.	EGNOS Data Access Service (EDAS) - Service Definition Document Issue 2.3
RD 13.	NEO-M8 U-blox M8 concurrent GNSS modules - Datasheet
RD 14.	EGNOS Safety of Life Service (SoL) - Service Definition Document Issue 3.5
RD 15.	JARUS guidelines on Specific Operations Risk Assessment v2.0 package
RD 16.	JARUS guidelines on SORA Annex E Integrity and assurance levels for the Operation Safety Objectives (OSO) v2.0 package
RD 17.	JARUS guidelines on Specific Operations Risk Assessment v2.5 package
RD 18.	JARUS guidelines on SORA Annex E Integrity and assurance levels for the Operation Safety Objectives (OSO) v2.5 package
RD 19.	EUROCAE ED-301 - Guidelines for the Use of Multi-GNSS Solutions for UAS Specific Category - Low Risk Operations SAIL I and II (August 2022)
RD 20.	EGNOS White Paper “EGNOS performance in UAS operations” (V01-00 September 2024)
RD 21.	Luftfahrt-Bundesamt (LBA) Guidance for Dimensioning of Flight Geography, Contingency Volume and Ground Risk Buffer.
RD 22.	Irish Aviation Authority (IAA) Guidance for Dimensioning of Flight Geography, Contingency Volume and Ground Risk Buffer.

Table A-1: Reference documents

Annex B: Acronyms and abbreviations

Acronym	Definition
ABAS	Aircraft Based Augmentation System
AMC	Acceptable Means of Compliance
ARC	Air Risk Class
CIS	Common Information Service
DGNSS	Differential GNSS
EASA	European Aviation Safety Agency
EDAS	EGNOS Data Access Service
EGNOS	European Geostationary Navigation Overlay Service
EGNSS	European Global Navigation Satellite System
EMA	EGNOS Multimodal Adoption Plan
ESSP	European Satellite Services Provider
EUSPA	EU Agency for the Space Programme
EU	European Union
GBAS	Ground Based Augmentation System
GEO	Geostationary
GLONASS	Global'naya Navigatsionnaya Sputnikovaya Sistema
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GRC	Ground Risk Class
GSC	GNSS Service Center
IAA	Irish Aviation Authority
IAM	Innovative Air Mobility
JARUS	Joint Authorities for Rulemaking on Unmanned Systems
LBA	Luftfahrt-Bundesamt
LPV	Localizer Performance with Vertical guidance
NCA	National Competent Authority
OS	Open Service
OSO	Operational Safety Objective
SAIL	Specific Assurance and Integrity Levels
SBAS	Satellite-Based Augmentation System

Acronym	Definition
SDD	Service Definition Document
SLA	Service Level Agreement
SoL	Safety of Life
SORA	Specific Operations Risk Assessment
TLOS	Target Level of Safety
UAS	Unmanned Aerial Systems
USSP	U-Space Service Provider

Table B-1: Acronyms and abbreviations