European Union Aviation Safety Agency

Opinion No 05/2019

Standard scenarios for UAS operations in the 'specific' category

RMT.0729

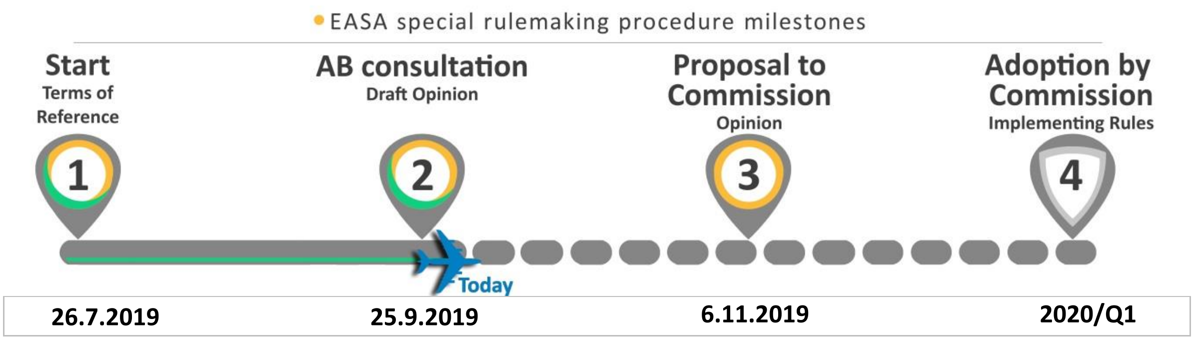
EXECUTIVE SUMMARY

The objective of this Opinion is to provide cost-efficient rules for low-risk unmanned aircraft systems (UAS) operations in the 'specific' category.

This Opinion proposes the addition of two standard scenarios (STSs) in Appendix 1 to the Annex to Commission Implementing Regulation (EU) 2019/947, defining the conditions when UAS operators can start an operation after having submitted a declaration to the competent authority. Moreover, the Opinion proposes the introduction of two new Parts in the Annex to Commission Delegated Regulation (EU) 2019/945, including the technical requirements that UAS need to meet in order to be operated in the STSs, and establishing two new UAS classes — classes C5 and C6. The conditions to conduct the STSs are based on the in-service experience of some Member States (MSs) and they have been validated through the application of the specific operations risk assessment (SORA).

The proposed changes are expected to increase the cost-effectiveness for UAS operators, manufacturers and competent authorities, and to improve the harmonisation of UAS operations in the MSs.

Action area:	Regular updates		
Affected rules:	Commission Implementing Regulation (EU) 2019/947 on the rules and procedures for the operation of unmanned aircraft Commission Delegated Regulation (EU) 2019/945 on unmanned aircraft systems and on third-country operators of unmanned aircraft systems		
Affected stakeholders:	Operators (private and commercial); competent authorities; flight crews; remote pilots; maintenance staff; design and production organisations; other airspace users (manned aircraft); providers of air traffic management/air navigation services (ATM/ANS) and other ATM network functions; air traffic services (ATS) personnel; aerodrome operators; general public; model aircraft associations; EASA (on a case-by-case basis)		
Driver:	Efficiency/proportionality	**Rulemaking group:**	No
Impact assessment:	None	**Rulemaking Procedure:**	Accelerated



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1. About this Opinion

1.1. How this Opinion was developed

The European Union Aviation Safety Agency (EASA) developed this Opinion in line with Regulation (EU) 2018/1139[1] (the 'Basic Regulation') and the Rulemaking Procedure[2].

This rulemaking activity is included in the European Plan for Aviation Safety (EPAS) 2019-2023 under rulemaking task (RMT).0729. The scope and timescales of the task were defined in the related ToR[3].

The text of this Opinion has been developed by EASA with the support of a group of experts made up of members of selected national aviation authorities (NAAs), with experience at the national level in UAS operations to be covered by these STSs. These experts were also members of the Joint Authorities for Rulemaking on Unmanned Systems (JARUS) team that developed the methodology for SORA. This Opinion underwent consultation with the Advisory Bodies in accordance with Article 16 'Special rulemaking procedure: accelerated procedure' of MB Decision No 18-2015. EASA took the decision to follow the procedure laid down in said Article as this regulatory proposal affects a limited group of stakeholders. Prior to the consultation with the Advisory Bodies, EASA performed a focused consultation on this regulatory proposal with all the interested parties, including UAS manufacturers, NAAs, UAS and manned aircraft operators, providers of ATM/ANS and other ATM network functions, and aerodrome operators on 1 July 2019.

The major milestones of this rulemaking activity are presented on the title page.

1.2. The next steps

The Opinion contains the proposed amendments to Commission Implementing Regulation (EU) 2019/947[4] and Commission Delegated Regulation (EU) 2019/945[5] (from now on referred to as the 'IA' and 'DA' respectively). It is submitted to the European Commission, which will use it as a technical basis in order to prepare EU regulations.

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[1] Regulation (EU) 2018/1139 of the European Parliament and of the Council 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 (OJ L 212, 22.8.2018, p. 1) (https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1535612134845&uri=CELEX:32018R1139).

[2] EASA is bound to follow a structured rulemaking process as required by Article 115(1) of Regulation (EU) 2018/1139. Such a process has been adopted by the EASA Management Board (MB) and is referred to as the 'Rulemaking Procedure'. See MB Decision No 18-2015 of 15 December 2015 replacing Decision 01/2012 concerning the procedure to be applied by EASA for the issuing of opinions, certification specifications and guidance material (http://www.easa.europa.eu/the-agency/management-board/decisions/easa-mb-decision-18-2015-rulemaking-procedure).

[3] https://www.easa.europa.eu/sites/default/files/dfu/ToR%20RMT.0729%20Issue%201%20.pdf

[4] Commission Implementing Regulation (EU) 2019/947 of 24 May 2019 on the rules and procedures for the operation of unmanned aircraft (OJ L 152, 11.6.2019, p. 45) (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32019R0947).

[5] 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/?qid=1570531993621&uri=CELEX:32019R0945).

2. In summary — why and what

2.1. Why we need to change the rules — issue/rationale

With EASA Opinion No 01-2018 on the introduction of a regulatory framework for operations of unmanned aircraft systems in the 'open' and 'specific' categories, EASA presented the concept of STSs for UAS operations in the 'specific' category that are characterised by a low risk. Those UAS operations can be conducted based on a declaration submitted by the UAS operator to the NAA. The approach proposed in the EASA Opinion was to define in the Regulation the process to allow such types of UAS operations, and then include it in a Decision issued by EASA, including the acceptable means of compliance (AMC), and the detailed description of the mitigation measures to be put in place. During the discussion within the EASA Committee, leading to the approval of the regulation, it was decided to also include in the text of the Regulation the above-mentioned mitigation measures. Since a final version of an STS was not yet available at that time, it was decided to approve the IA with a provision for an Appendix 1 to be filled in as soon as the first STS was proposed by EASA. As a transitional measure, Article 23(2) was introduced to allow MSs to accept declarations based on national STSs until the IA is amended to include the first EU STS.

In order to identify the UAS operations to be covered by the STS, EASA carried out a survey among all MSs to identify the UAS operations which are allowed, according to national regulations, based on a declaration submitted by the UAS operator. Two types of UAS operations were then identified, and they led to the development of two STSs — STS-01 and STS-02. These two STSs were developed based on the experience gained in some MSs[6] and in addition, a risk assessment, based on SORA (see AMC1 to Article 11[7] of the IA), was carried out to validate the approach.

Since it was decided to also impose for STSs the use of UAS with particular CE class marks, an amendment to the DA was also necessary, to define the requirements for the two new UAS CE classes — C5 and C6 — to be used with STS-01 and STS-02 respectively.

Lastly, some improvements to the IA and the DA were introduced as described in Sections 2.3.5 and 2.3.6.

2.2. What we want to achieve — objectives

The overall objectives of the EASA system are defined in Article 1 of the Basic Regulation. This proposal will contribute to the achievement of the overall objectives by addressing the issues outlined in Section 2.1.

The specific objective of this proposal is, therefore, to:

— ensure that (emerging) safety issues are addressed;

— incorporate improvements that result from relevant developments in new technologies and from the application of the IA and the DA; and

— develop STSs for those UAS operations in the 'specific' category that are considered mature enough, based on a declaration by the UAS operator.

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[6] Especially in France, Spain, Denmark and Finland.

[7] https://www.easa.europa.eu/document-library/agency-decisions/ed-decision-2019021r

2.3. How we want to achieve it — overview of the proposals

According to point UAS.SPEC.020 of the IA, STSs will be developed only for UAS operations in the 'specific' category with a low risk (i.e. with a specific assurance and integrity level (SAIL), as defined in SORA, not greater than 2). For these UAS operations, UAS operators will be allowed to start the operation as soon as they have submitted a declaration to the NAA of registration and have received the receipt of confirmation and completeness. Since the NAA is not required to make any additional checks before the start of the operation (the UAS operator will, however, be included in the oversight programme of the NAA), it was decided to define the requirements for these UAS operations in a prescriptive way. Therefore, they have been developed with a structure and a level of detail similar to those listed in the 'open' category.

The two STSs included in this Opinion have been derived from the in-service experience gained in some MSs where large numbers of UAS operations have been conducted and many flight hours have been accomplished (in the order of tens of thousands[8]) without any accidents being recorded. In some of these MSs, such UAS operations are subject to an operational declaration (as defined by the national regulations) or are even conducted without the need for a declaration. The two STSs are related to the following UAS operations:

— STS-01: visual line of sight (VLOS) operations at a maximum height of 120 m, at a ground speed of less than 5 m/s in the case of untethered UA, over controlled ground areas that can be in populated (e.g. urban) environments, using UAS with maximum take-off masses (MTOMs) of up to 25 kg; and

— STS-02: beyond visual line of sight (BVLOS) operations with the UA at not more than 2 km from the remote pilot, if visual observers (VOs) are used, at a maximum height of 120 m, over controlled ground areas in sparsely populated environments, using UA with MTOMs of up to 25 kg.

The requirements proposed in the STSs have been developed to ensure that the resulting level of risk of UAS operations is consistent with the declarative regime defined in Article 5(5) and point UAS.SPEC.020 of the IA.

The template of the declaration to be submitted by UAS operators is proposed in Appendix 2 to the the Annex to the IA.

2.3.1. Description of STS-01

STS-01 may be considered as an extension of the UAS operations in the 'open' subcategory A2[9], since it allows UAS operations in VLOS, in urban environments, below 120 m, with a UA having an MTOM of less than 25 kg. Therefore, several of the requirements defined in STS-01 are similar to those for the 'open' subcategory A2.

2.3.1.1 Maximum flight height under normal operations

The UAS operator is required to define the volume within which the UAS can operate, called the 'flight geography'. The maximum vertical limit that the UAS operator can define for the flight geography for

[8] For instance, in France, the number of flight hours in 2018 for operations in national scenario S-3 (equivalent to STS-01) was 94 577.

[9] VLOS operations at a maximum height of 120 m, in an urban environment, using a UAS with an MTOM of up to 4 kg.

UAS operations under STS-01 is 120 m (from the closest point on the surface of the earth). From an air risk point of view, STS-01 is considered equivalent to subcategories A2 and A3 of the 'open' category; therefore, the operational limitations and the technical requirements imposed on the UAS are consistent (e.g. VLOS and a maximum height of 120 m, except when overflying an artificial obstacle).

This limitation is a little more conservative than the in-service experience of some MSs where UAS operations similar to STS-01 are allowed up to a height of 150 m (500 ft). In STS-01, a 30 m margin above the maximum height has been considered for use in abnormal situations.

As in the 'open' category, the possibility to operate the UA close to or above an artificial obstacle taller than 105 m (e.g. for building or infrastructure inspections) under the same conditions was kept.

2.3.1.2 Ground risk: controlled ground area

UAS operations in a populated environment, with a UA with an MTOM of up to 25 kg, may expose the overflown people to risk. Since the intrinsic ground risk needs to be kept low, a requirement to conduct such UAS operations over a controlled ground area is established.

As defined in Article 2(21) of the IA, a controlled ground area is 'the ground area where the UAS is operated and within which the UAS operator can ensure that only involved persons are present'. The UAS operator is required to define the limit of the controlled ground area and to control the access of people to it. The controlled ground area comprises the flight geography area, the contingency area and the ground risk buffer as depicted in Figure 1. For additional information on the contingency area and ground risk buffer, please refer to Section 2.3.5.

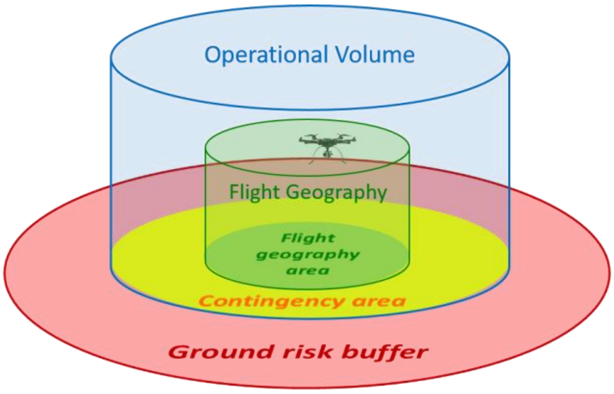

Figure 1: Notional depiction of the areas to be covered by the controlled ground area

Before conducting UAS operations under STS-01, UAS operators must ensure that the controlled ground area is in place, effective and compliant with the minimum distance defined in the proposed point UAS.STS-01.020(3) of the IA. For this purpose, the UAS operator must at least:

— be familiar with the intended area of operations and with all the factors that may affect the operation, especially in terms of safety, security, privacy and environmental protection;

— measure properly the required distances for effective implementation of the areas encompassed in the controlled ground area, identifying where necessary, the elements that can assist the remote pilot in rapidly and visually estimating the distance from the UA;

— secure the perimeter of the controlled ground area in the most effective way to prevent uninvolved people from entering the area[10]; and

— coordinate with the appropriate authority[11], when required.

Also, in order to protect any persons present in the controlled ground area, a requirement is established to have those persons informed of the risks of the operation, briefed, and, if applicable, trained on the safety precautions and measures established by the UAS operator for their protection. Besides that, these persons must have explicitly agreed to participate in the operation in the manner established by the UAS operator. The UAS operator should take all precautionary measures needed to ensure safety considering the level of risk (i.e. consider the need for personal protective equipment, acoustic alarms, shelters, etc.).

Since keeping the UAS at a safe distance from uninvolved people is considered a critical safety aspect, the requirement has been expressed with a higher degree of prescriptiveness, and minimum values are established. To determine those values, the following aspects were considered:

— for the ground risk buffer, 'low' robustness is considered sufficient in UAS operations with a low intrinsic ground risk. In this case, SORA indicates the 1:1 rule[12] to select the minimum horizontal distance. However, the 1:1 rule may lead to a buffer size such that the size of the controlled ground area might be impractical — in most cases, in a populated environment[13]. Therefore, the decision was made to propose more suitable values considering the following elements:

    — to better ensure that the UA flight can be terminated without exceeding the ground risk buffer, UAS operations under this STS are limited to:

        — any configuration except fixed-wing UA. With this limitation, UAS operations at low speed can be better ensured, and the likelihood of the UA gliding a distance great enough for it to fall outside the controlled ground area is minimised;

        — the ground speed in normal operation is limited to 5 m/s (which must be set in the UAS, see paragraph 2.3.1.9) so that the controllability of the UA is increased.

    — there is more in-service experience with UA with MTOMs of less than 10 kg, so two sizes of ground risk buffer have been identified, taking a more conservative approach for heavier UA;

    — for UA with MTOMs of up to 10 kg, in-service experience from MSs[14] has been considered. In particular, the main reference is French scenario S-3, where a safety area is calculated assuming a ballistic fall once the flight termination system is triggered, and therefore, the size of that area is dependent on the flight height and speed[15] of the UA.

[10] Means may be fencing off the area, installing signs, using operations staff or law enforcement agents to interdict the area, or others.

[11] For instance, municipality, law enforcement, etc.

[12] Example: If the UA is planned to operate at a height of 20 m, the ground risk buffer should at least be 20 m.

[13] For instance, in a city, that size could mean securing an area too wide to be allowed by the municipality due to the consequent disruption, and also complex for the operator to implement.

[14] For example, France (where S-3 is limited to 8 kg) and Italy.

[15] Ground speed, but wind must be considered by the UAS operator when establishing the areas.

This approach was preferred to a fixed distance, as prescribed in other MSs, which allows less flexibility and might be too conservative for UAS operations at low-flight heights;

- for UA with MTOMs above 10 kg, in-service experience is also considered, but since this experience is more limited, a more conservative approach is followed. In this case, the values considered were half of those derived from the 1:1 rule, except that a minimum of 20 m is considered in the case of a height of up to 30 m (thus, the values for UA above 10 kg are at least double those for the ones below 10 kg); and
- for tethered UA, the size of the controlled ground area considers a radius equal to the tether length plus 5 m, and centred on the point where the tether is fixed over the surface of the earth. This is derived from in-service experience, in particular from tethered UAS operations in France, where this margin of 5 m was considered sufficient to account for the potential projection of debris in a crash subsequent to a flight termination.

— For the contingency area, it was considered that this area was primarily conceived to cope with abnormal situations that could take the UA outside the flight geography (e.g. wind gusts), where by performing appropriate contingency procedures, the UA can be brought back to a normal situation. In addition, in the case of a flyaway of the UA, it is expected that the flight termination system will be activated while the UA is still in the contingency area. This is the reason why a minimum distance of 10 m was considered necessary for the contingency area. Considering the ground speed limitation of 5 m/s, the remote pilot would have 2 seconds to react, which is consistent with the in-service experience of the MSs.

2.3.1.3 Remote pilot competency

In order to ensure an adequate level of competency for remote pilots, the following approach was followed. Since STS-01 covers UAS operations with a low intrinsic risk, similar to the level for 'open' subcategory A2, a similar approach to the one used for that subcategory is followed for remote pilot competency.

For the theoretical knowledge part, similarly to the requirements for 'open' subcategory A2, the student remote pilot will be granted a certificate issued by a competent authority or by an entity recognised by a competent authority of a MS after:

- having passed the online theoretical knowledge examination as required for 'open' subcategories A1 and A3; and
- having passed a classroom theoretical knowledge examination provided by the competent authority or by the entity recognised by the competent authority. Compared with the one defined for 'open' subcategory A2, more subjects and topics need to be covered, and two options are possible:
  - if student remote pilots do not hold a certificate of remote pilot competency required for 'open' subcategory A2, the subjects to be covered by the examination are those listed in the proposed Attachment A to STS-01; or
  - if student remote pilots hold a certificate of remote pilot competency for 'open' subcategory A2, they are only required to pass the examination on the reduced number of subjects indicated in point 1(b) of the proposed Attachment A to STS-01.

With this modular approach, credit can be taken from the knowledge already acquired by student remote pilots when they have already completed the training for the 'open' category.

For the practical skill part, the self-training and assessment by the student remote pilot allowed in 'open' subcategory A2 is not deemed sufficient. The particular operational provisions and limitations of STS-01 to ensure that UAS operations remain at low risk are more critical than in 'open' subcategory A2 and, therefore, a higher level of robustness is required for the practical skill training and assessment.

Consequently, an external party is required to provide the practical skill training and assessment. This approach is consistent with the current experience in most MSs. However, discussions within the expert group indicated that the preference on the type of external party providing the training could vary significantly across the EU, ranging from being a UAS operator (excluding self-training and assessment) to entities recognised by the competent authority. Consequently, it was decided to propose both options.

UAS operators that intend to provide practical skill training and assessment to remote pilots (including their own pilots) must comply with a specific set of requirements, defined in the proposed Appendix 3 the Annex to the to the IA, and declare their compliance using the form in the proposed Appendix 4 the Annex to the to the IA.

Unlike the theoretical knowledge part, practical skills are peculiar to the specific scenario. Consequently, each accreditation of completion of the practical training and assessment issued by the UAS operator or the entity recognised by the competent authority will be for one STS.

The main areas related to the practical skill to be covered are included in the proposed Attachment A to STS-01.

There is no requirement for a final practical assessment, just a continuous evaluation. The personnel responsible for the practical skill training and assessment will follow the remote student and keep records. The assessor will let the student know when the practical skill assessment is completed. At the end of the process, the UAS operator shall produce an assessment report, and an attestation of completion will be issued.

The verification for the NAA that UAS operators are meeting the requirements of the regulation will be ensured during the oversight.

In addition, according to point UAS.SPEC.050(1)(d) of the IA, the UAS operator needs to ensure that the remote pilot has the necessary skills required to safely conduct the particular UAS operations, through the training and familiarisation with the UAS and with the procedures defined by the UAS operator.

2.3.1.4 Operations manual

In most MSs where UAS operations that would fall under the scope of STS-01 are being conducted, UAS operators are required to develop an operations manual (OM). This is further supported by SORA.

Therefore, a decision was made for STS-01 to require the UAS operator to compile its procedures in an OM, which shall contain at least all the elements defined in the proposed Appendix 5.

The operational volume and ground risk buffer for the intended operations, including the controlled ground area, are some of the elements to be defined in the OM, together with the procedures for normal, contingency and emergency conditions.

To ensure the adequacy of the contingency and emergency procedures, these should be evaluated by the UAS operator through either dedicated flight tests or simulations (provided that the representativeness of the simulation means is appropriate for the intended purpose). This is based on the current practices established in some MSs[16]. Furthermore, this approach is consistent with the 'medium' level of integrity required by SORA for operations with a risk corresponding to STS-01.

As required in points (1)(d) and (1)(e) of point UAS.SPEC.050 of the IA, UAS operators must ensure that remote pilots, the personnel in charge of duties essential to the UAS operation, including any staff member authorised to perform maintenance activities, are trained and assessed in accordance with the procedures, which for STS-01 are included in the OM.

2.3.1.5 Contingency and emergency procedures

The UAS operator is required to develop contingency and emergency procedures, to be described in the OM, and the remote pilot is required to put them in place immediately in the following situations:

— contingency procedures: in abnormal situations, which includes situations that can lead to the UA exceeding the limits of the flight geography; and

— emergency procedures: in emergency situations, which includes situations that can lead to the UA exceeding the limits of the operational volume. Remote pilots are expected to react immediately, performing the relevant emergency procedures as soon as they have an indication of those situations. Furthermore, when the emergency situation is perceived as likely to lead to the UA being outside the operational volume, remote pilots are required to trigger the flight termination system (FTS[17]) at least 10 m before the unmanned aircraft reaches the limits of the operational volume.

2.3.1.6 Emergency response plan

An emergency response plan (ERP) is considered an important element to ensure that the UAS operator's personnel participating in an operation are aware of what to do in case of an emergency in order to avoid an escalation of the effects.

In the discussions within the JARUS group, it was concluded that, even for UAS operations with the lowest risk in the 'specific' category, this plan should be required. Furthermore, in SORA, there is a penalty when this plan is not available or does not achieve a sufficient level of integrity.

Consequently, a requirement was established including the criteria provided by SORA for a 'medium' level of integrity, which is consistent with the level required for operational procedures.

Further guidance is provided in the AMC to the IA.

[16] For instance, in Spain, Royal Decree 1036/2017 (national regulation for civil UAS operations) Article. 27 (1)(b) requires UAS operators to conduct, prior to UAS operations, 'the necessary test flights to prove that the intended operation can be performed safely'.

[17] For additional information, please refer to 2.3.1.9.

2.3.1.7 Externally provided services

UAS operators must ensure that externally provided services, which are necessary for the safety of UAS operations (e.g. external C2 services, GNSS services, U-Space services, etc.), reach a level of performance that is adequate for the operation. In order to ensure this, UAS operators must consider:

— the information provided by the UAS manufacturers[18];

— specific requirements that might be applicable in the intended area of operation[19];

— how performance might be affected by the environmental conditions[20]; and

— what level of performance can be provided and adequately supported by the external service provider.

It is also important to ensure that adequate service is provided, and the allocation of roles and responsibilities between the operator and the external service provider(s) needs to be defined, if applicable[21].

2.3.1.8 Level of human involvement

There is currently no experience with autonomous UAS operations (without remote pilot intervention); thus, this kind of UAS operations is not allowed under STS-01. Therefore, it is always required to identify a remote pilot responsible for the flight.

Furthermore, the remote pilot must have the ability to maintain control of the UA, except in the case of a lost command and control link[22].

In addition, in order to avoid a level of complexity that might lead to a higher level of risk for STS-01, the following operational limitations were included:

— operate only one UA at a time;

— do not operate from a moving vehicle; and

— do not hand over the command of the UA to an other remote pilot station. This means that for each flight, the pilot in command should be always the same and the control cannot be transferred to another control unit during flight.

2.3.1.9 Technical requirements in STS-01

It is proposed that UAS to be operated under STS-01 should bear a C5 class mark. Such UAS will have to comply with the technical requirements included in the proposed Part 16 of the Annex to the DA.

The technical requirements of class C5 UAS are listed starting from those defined for class C3 with some exclusions and some additions. This approach was chosen to avoid unnecessary repetitions. A

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18 For example, the minimum signal strength of GNSS satellites from which signals must be received to conduct a safe operation under a specific flight mode.

19 For example, a certain U-space service with a certain level of performance might be required to operate in a certain area.

20 For example, electromagnetic fields, meteorological conditions, obstacles, etc.

21 Typically, this is part of a service level agreement (SLA), but for some services, this may not be necessary, e.g. an open GNSS service (free of charge) does not require any SLA between the UAS operator and the GNSS service provider and therefore there is no need to define those roles and responsibilities.

22 For other failures, the remote pilot must be able to perform contingency or emergency procedures (depending on the nature and potential effects of the failure(s)). In case of a loss of the C2 link, there is a requirement for the UAS to include a predictable method to recover the link or terminate the flight — see Section 2.3.1.9)

UAS manufacturer may in any case develop a class C5 UAS starting from a class C3 or C2 UAS. The technical requirements defined for class C3 UAS that were excluded are:

— the maximum height limitation, since the provision of height information to the remote pilot (see below) is considered sufficient, taking into account in-service experience with similar operations in some MSs and the fact that a higher competency is required for remote pilots operating under this STS compared with the 'open' category; and

— geo-awareness: the need to require a geo-awareness function was extensively discussed, and it was decided to keep this technical requirement as optional. UAS operators shall only operate UAS equipped with a geo-awareness function when they intend to operate in a geographical zone where the MSs mandate it. In any case, if the manufacturer decides to equip the UAS with a geo-awareness system, this needs to comply with the same requirements as those for a class C3 UAS.

The following additional technical requirements were added:

— the characteristic dimensions[23] of the UA are limited to 3 m, in accordance with the limit established in point UAS.SPEC.020(1)(a)(i) of the IA. The MTOM is limited to 25 kg since most MSs do not have relevant experience with UA with a higher mass in UAS operations under the scope of STS-01. In addition, the UA is limited to rotorcraft or tethered aircraft other than fixed-wing aircraft, as explained in Section 2.3.1.2. The MTOM threshold, combined with the UA configuration and the maximum characteristic dimension, ensures that the expected kinetic energy is consistent with a low ground risk classification (see Section 2.3.1.2);

— a requirement is established for the UA, unless tethered, to be equipped with a reliable and predictable means for the remote pilot to terminate the flight of the UA (FTS). The FTS needs to allow the remote pilot to:

  — prevent the UA from exiting the controlled ground area. Thus, the FTS should force the descent of the UA and prevent it from continuing its horizontal trajectory (e.g. by cutting the propulsion power); and

  — avoid a single failure in the UA disabling the activation of the FTS. Therefore, the activation system is required to be independent from the on-board automatic flight control and guidance system of the UA.

  Experience with this type of UAS operations[24] has shown that human factors may play a role in reducing the effectiveness of the FTS. In particular, there is a risk that the remote pilot does not activate the FTS in time, fearing the damage and the potential destruction of the UA. To mitigate this risk, a requirement to reduce the effect of the UA impact dynamics (e.g. a parachute, autorotation, etc.) has been added;

— provide information on the speed and flight height of the UA. This is based on the current in-service experience and considering the need to assist the remote pilot in keeping the UA within the planned flight geography;

[23] For example, main rotor diameter in a helicopter or gyroplane, distance between opposite rotors in a multi-rotor, longitude of body in an airship, etc.

[24] Mainly French scenario S-3.

— provide information on the signal strength of the command and control link, and receive an alert from the UAS when it is likely that the signal is going to be lost, and another alert when the signal is lost;

— a selectable low-speed mode to reduce the ground speed to no more than 5 m/s to ensure that the remote pilot can keep the UA within the controlled ground area (as described in Section 2.3.1.2); and

— the user's manual for a class C5 UAS shall contain all the information required in the user's manual for a class C3 UAS; in addition, it shall contain a description of the means to terminate the flight.

The possibility to develop an accessories kit that may convert a class C3 UAS into a class C5 UAS was also included. Consistently with the requirements imposed on UAS class C5, only rotorcraft UAS marked class C3 can qualify to be equipped with such an accessories kit. In addition, the class C3 UAS, in order to qualify for the installation of the accessories kit, needs to be equipped with a suitable interface. In this way, manufacturers, even if different from the one designing and producing the class C3 UAS, may put on the market the accessories kit. However, they are responsible for verifying that the UAS equipped with the accessories kit complies with all the requirements listed for class C3 UAS and the requirements for class C5 UAS, with the exclusion of the information on the height, since a class C3 UAS already includes a height limitation system. In addition, manufacturers of the accessories kit shall put it on the market as a single kit in order to have a clear split of responsibilities between the manufacturer of the class C3 UAS (responsible for the original class C3 functionalities) and the manufacturer of the accessories kit (responsible for the additional functionalities and for the verification that the accessories kit does not alter the original class C3 functionalities). Manufacturers shall make sure that the UAS operator does not need any special skill to install the kit on the UAS (the instructions shall be included in the user's manual). Moreover, each element of the accessories kit shall be identified to ensure a complete and correct installation by a UAS operator (e.g. each element should be identified with a number and should show also the total number of the elements composing the accessories kit). Lastly, the class C5 mark should be affixed on the accessory so that the UAS displays both the C3 and C5 class marks. Manufacturers of the UAS may mark their product with a C3 and C5 class label if it complies with all the requirements defined in Parts 4 and 16 of the Annex to the DA. An accessory to transform a class C2 UAS into a class C5 UAS is not proposed since the limitations defined for the A2 open subcategory are less restrictive than those defined for STS-01.

2.3.2. Description of STS-02

STS-02 refers to a UAS operation with an increased intrinsic risk compared with STS-01 because it allows BVLOS operations. The launch and recovery of the UAS is, in any case, required to be performed in VLOS. The main mitigation means is provided by VOs who assist the remote pilot in scanning the airspace for the presence of other airspace users.

2.3.2.1 Maximum flight height

It is proposed that the UAS operations covered by STS-02 should have the same height limitation as for STS-01. Therefore, the considerations included in Section 2.3.1.1 apply.

2.3.2.2 Ground risk: controlled ground area

STS-02, in comparison with STS-01, has an increased ground risk due to the larger area that the UA can cover. Therefore, the combination of the following main limitations is established to lower the intrinsic ground risk, based on the current experience in some MSs[25]:

— operations shall be conducted over a controlled ground area, and

— that controlled ground area shall be entirely located in a sparsely populated area.

It should be noted that when a controlled ground area is in place, SORA does not distinguish, in the intrinsic ground risk classification, between UAS operations being conducted in a populated environment and those over sparsely populated areas, or between VLOS and BVLOS. However, SORA assumes that such a controlled ground area is established, without any further considerations (it is up to the UAS operator to ensure it is in place and effective). Furthermore, it is clear that the difficulty in ensuring control over an area (being able to detect and react to the intrusion of people who are not involved) increases from operations in VLOS to those in BVLOS. This can be compensated for by the population of the environment (with a lower likelihood of intrusion in the case of sparsely populated areas).

Therefore, requiring UAS operations under STS-02 to be conducted over sparsely populated areas reduces the likelihood of intrusion into the controlled ground areas, making it easier to ensure control. In addition, to further ensure this control over the area, and considering also the still relatively limited experience with larger ranges in BVLOS operations, the distance between the UA and the remote pilot is limited.

As illustrated in Figure 2, remote pilots may fly at a distance that exceeds the VLOS[26] range. Without the assistance of a VO in BVLOS, the range can be up to a range of 1 km, when the UA flies a pre-programmed flight, allowing them to scan the airspace themselves. When VOs are employed, the range of the operation can be extended up to 2 km.

[25] For example, in France and Spain, UAS operations allowed in BVLOS under declaration are required to be conducted in sparsely populated areas. In addition, S-3 (BVLOS scenario under declaration) in France requires establishing a safety area, equivalent to a controlled ground area.

[26] The VLOS range may vary depending on the characteristics of the UA (size and colour) and on the weather conditions, up to a distance such that the remote pilot can clearly distinguish the UA in the sky.

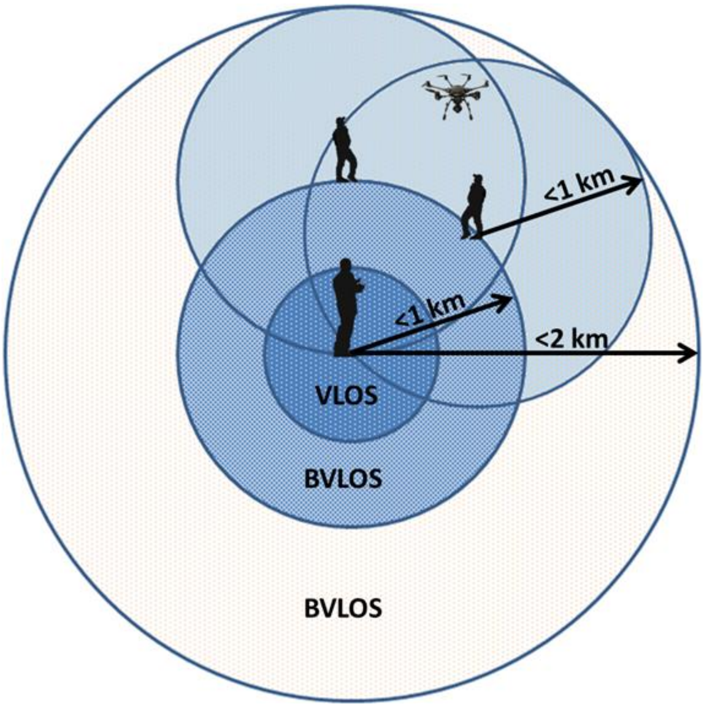

Figure 2: Range of STS-02

When more experience has been gained, this STS may be amended to alleviate this limitation.

Unlike STS-01, operations under STS-02 have the possibility to be conducted over wider areas, using a wider range of UAS (not limited to rotorcraft, if untethered) and without a restrictive speed limitation. Therefore, establishing minimum distances for the ground risk buffer as in STS-01 was not deemed reasonable. Besides, the criterion in SORA to use the 1:1 rule as a minimum was not deemed satisfactory either, as it might be too conservative in some cases, and fall short in other cases. It was considered more appropriate to require the UAS manufacturer to provide information, in the user's manual, on the maximum distance that the UA is likely to travel once the means to terminate the flight has been activated. This will be the information that the UAS operator needs to use to determine the minimum size for the ground risk buffer.

The launch (e.g. take-off) and the recovery (e.g. landing) are also required to be performed in VLOS. That is in order to mitigate the ground risk, especially for people involved in the UAS operation. This requirement also facilitates visually detecting during the launch any potential failure or unexpected performance that might have worse consequences if not detected during this phase.

2.3.2.3 Air risk: mitigations for BVLOS

To mitigate the increased air risk posed by BVLOS operations, the following requirements are established:

— an amendment to point UAS.SPEC.020(1)(b) of the IA, which defines the airspace where operations covered by STS may take place, is proposed to highlight the need to ensure a low probability of encounter with manned aircraft (see further explanation under the risk assessment in Appendix 2);

— a minimum visibility of 5 km is proposed to ensure the detection of any potential hazard in the air. This was proposed by JARUS in the frame of the SORA development and is also established in the regulations covering UAS operations in some states[27]. It is up to the UAS operator to establish how to obtain the most suitable information to comply with this requirement. Guidance material (GM) will be provided indicating that operators may use meteorological reports to obtain visibility data.

— someone is always required to scan the airspace to detect any potential hazards in the air. If no VO is used, then the scanning must be conducted by the remote pilot. From experience in some states[28], having the UA at not more than 1 km from the remote pilot (in combination with the 120 m height limitation) is considered a suitable distance to see the surrounding airspace and react promptly if required. However, if the remote pilot is required to perform the airspace scanning, the management of the flight must be such that it does not require too much attention. For this reason, the requirement to have a pre-programmed trajectory for the UA is established when operating without VOs. However, the remote pilot must always have the ability to intervene in order to manoeuvre the UA (e.g. for collision avoidance).

— If VOs are used, the UAS operator is required to ensure that:

    — the VOs are positioned so that they can provide adequate coverage of the operational volume and the surrounding airspace with the minimum flight visibility indicated, and there are no potential terrain obstructions;

    — the distance between any VO and the remote pilot is not more than 1 km, to ensure better control of VOs and their communication with the remote pilot;

    — robust and effective communication means are available for the communication between the remote pilot and the VOs;

    — if means are used by the VOs to determine the position of the UA, those means are functioning and effective; and

    — the VOs have been briefed on the intended path of the UA and the associated timing.

It should be noted that a definition of a VO is proposed in Article 2 of the IA. The responsibilities of VOs are proposed in point UAS.STS-02-050 of the IA as follows:

— to perform unaided visual scanning of the airspace in which the UA is operating for any potential hazards in the air;

— to maintain awareness of the position of the UA through direct visual observation or through assistance provided by electronic means (e.g. a display providing the geographical position of the UA); and

— to alert the remote pilot in case a hazard is detected, and assist in avoiding or minimising the potential negative effects.

VOs need to know where the UA is flying but they do not need to have the UA at sight because the objective is to scan the airspace where the UA is flying to detect potential conflict with another aircraft.

[27] For instance, in the USA, Part 107 establishes for VLOS operations a visibility of at least 3 statute miles (~ 5 km).

[28] For instance, the closest scenario in France to STS-02 is S-2 (under declaration) in which a maximum distance of 1 km is established between the UA and the remote pilot.

Besides. regarding the STS-01, the ground risk derived from the potential collision with another UA, bird, etc is minimised by the UA being operated over a controlled ground area (where no uninvolved people are present). The distance of 1 Km stems from the experience with current operations (in particular from French scenario S-2).
The distance of the UA from the remote pilot is proposed to be limited to not more than 2 km if VOs are used. In this way, the area to be covered by VOs is also limited, reducing their number and/or workload and, and therefore reducing the complexity and related risk of the operation.

To further ensure that the ground and air risks remain low, a technical requirement is established to ensure that the flight of the UA is contained in the flight geography through a function allowing the programming of the flight volume and preventing the UA from exceeding it. This requirement, also known as geo-caging, stems from in-service experience with current operations in BVLOS[29]. It should be noted that the geo-caging requirement has a different purpose compared to the geo-awareness requirement. The former ensures that the UA will stay within the flight geography defined by the UAS operator, while the latter provides an alert to the remote pilot when it is approaching a protected UAS geographical zone.

2.3.2.4 Remote pilot competency

For STS-02, the same theoretical knowledge training and assessment as for STS-01 is established, resulting in a common certificate issued by the competent authority or an entity recognised by that authority, after the remote pilot student has passed the online test and classroom examination at that authority or entity.

The same scheme for the practical skill training and assessment is also proposed, but in this case, there are some differences in the elements to be covered: STS-02 includes the elements defined for STS-01 plus additional topics related to BVLOS and the use of VOs, as indicated in point 2 of Attachment A to STS-02.

2.3.2.5 Operations manual

It is proposed that the UAS operations covered by STS-02 should have the same requirements for the OM as those for the UAS operations covered by STS-01. Therefore, the considerations presented in Section 2.3.1.4 apply. However, the UAS operator is required to take into consideration the peculiar elements of the operation, including but not limited to the communication requirements between all personnel in charge of duties essential to the UAS operation.

2.3.2.6 Contingency and emergency procedures

The same considerations as in Section 2.3.1.5 are valid for STS-02 except that for STS-02, as the area is wider and less populated, no specific value is defined for when the remote pilot should put in place the emergency procedures. The UAS operator is required to define it on a case-by-case basis.

2.3.2.7 Emergency response plan

It is proposed that the UAS operations covered by STS-02 should have the same requirements for the ERP as those for the UAS operations covered by STS-01. Therefore, the considerations in Section 2.3.1.6 apply.

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[29] In particular, in France the declarative French scenario S-2 (BVLOS up to 1 km) includes the requirement to equip the UA with a system to ‘prevent in real time the aircraft to exceed the horizontal limits of a programmable flight volume’.

2.3.2.8 Externally provided services

It is proposed that the UAS operations covered by STS-02 should have the same requirements for the externally provided services as those for the UAS operations covered by STS-01. Therefore, the considerations in Section 2.3.1.7 apply.

2.3.2.9 Level of human involvement

It is proposed that the UAS operations covered by STS-02 should have the same requirements for the level of human intervention as those for the UAS operations covered by STS-01. Therefore, the considerations in Section 2.3.1.8 apply.

2.3.2.10 Technical requirements in STS-02

It is proposed that UAS to be operated under STS-02 should bear a C6 CE class mark. This can be affixed once it is demonstrated that the UAS complies with the technical requirements included in the proposed Part 17 of the Annex to the DA.

As for the technical requirements of class C5 UAS, also for class C6 UAS, the technical requirements are listed starting from those defined for class C3 UAS, with some exclusions and some additions. Also in this case, a UAS manufacturer may develop a class C6 UAS starting form a class C3 or C2 UAS. The technical requirements defined for class C3 UAS that were excluded for class C5 UAS, are the same as those listed in Section 2.3.1.9, while the additional requirements are:

— as for class C3, the UA characteristic dimension[30] is proposed to be limited to 3 m, and the MTOM to 25 kg. To ensure that the expected kinetic energy is consistent with a low ground risk classification (see Section 2.3.1.2), for C6 class UAS, the maximum ground speed is proposed to be limited to 50 m/s;

— a geo-caging function is proposed, as explained in Section 2.3.2.3, in order to ensure the containment of the UA within the flight geography;

— an FTS is proposed as for class C5, with the exception that in the case of a class C6 UAS, considering the environment of the operation, the human factors aspect is less important in the effectiveness of the means to terminate the flight. Therefore, the requirement on the means to reduce the effect of the UA impact dynamics (e.g. a parachute) is not proposed;

— provide information on the speed and flight height of the UA as proposed for class C5; however, since STS-02 covers BVLOS operations, for class C6, it is proposed to also provide the geographical position of the UA. It should be noted that, even if STS-02 covers BVLOS operations, as the range is still relatively short (maximum 2 km distance from the remote pilot), the use of the take-off point as the reference for the height information is still considered valid, as shown by the in-service experience;

— as explained in Section 2.3.2.3, a means to programme the UA flight trajectory is proposed;

— as for class C5 UAS, provide information on the signal strength of the command and control link and receive an alert from the UAS when it is likely that the signal is going to be lost, and another alert when the signal is lost;

[30] For example, the main rotor diameter in a helicopter or gyroplane, distance between opposite rotors in a multi-rotor, longitude of body in an airship, etc.

— in addition to the information required in the user's manual for class C3, it is also proposed to add for class C6:

  — a description of the FTS;

  — a description of the function that limits UA access to certain airspace areas or volumes, which includes the 'geo-caging' function; and

  — the distance most likely to be travelled by the UA after the activation of the means to terminate the flight, to be considered by the UAS operator when defining the ground risk buffer (see Section 2.3.2.2).

For C6 class, it was decided not to propose the possibility to develop an accessory transforming a class C3 UAS into class C6 UAS. Some requirements mandated for the C6 class highly depend on the software of the flight control system (e.g. the geo-caging) and only the original manufacturer of the UAS will be able to develop it.

2.3.3. Verification of compliance of the technical requirements

The verification of compliance of the UAS with the technical requirements will be ensured via the CE mark process, using the same approach defined for UAS operated in the 'open' category. This decision was taken because for low-risk operations (i.e. SAIL I and SAIL II), SORA considers a declaration by the UAS operator as an acceptable means to demonstrate compliance with the mitigation measures and the operational suitability objectives (OSOs) required to make the operation safe. When the UAS operators are not the manufacturers of the UAS, they do not necessarily have the competency to assess the compliance of the UAS with the technical requirements, and therefore they cannot systematically take the responsibility that belongs to the manufacturer. According to the Basic Regulation, a 'certificate' may be granted to the manufacturer through the 'aviation regulation' (i.e. Part 21) or the 'CE' mark process. Considering the risk of the UAS operations covered by STSs, the CE mark process is considered the most proportionate approach. Therefore, two new classes of UAS, C5 and C6, have been developed, and the requirements are listed in two new Parts, 16 and 17, of the Annex to the DA.

The requirements for these new classes are based on those already defined for class C3; however, in some cases, it was considered that a requirement defined for the 'open' category was not essential for safe operations of these STSs (e.g. the height limitation). It is envisaged that future STSs may not necessarily drive the creation of new UAS classes; rather than that, they may accept the use of a UAS of an already existing class, reducing thus the proliferation of classes. It should be noted that a manufacturer may mark a UAS with multiple CE markings (e.g. C3 and C5) if it complies with the technical requirements defined in the relevant parts.

The possible conformity assessment procedures (called 'modules') that the manufacturer can use to demonstrate that a class C5 and C6 UAS conforms to the technical requirements are defined in Decision No 768/2008/EC[31]. The modules allowed were selected based on the consideration that the level of risk of UAS operations covered by STS-01 and ST-02 is at least similar to that related to the 'open' category, and that the availability of some of the technical requirements imposed may directly

[31] Decision No 768/2008/EC of the European Parliament and of the Council of 9 July 2008 on a common framework for the marketing of products, and repealing Council Decision 93/465/EEC (OJ L 218, 13.8.2008, p. 82) (https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1570531772632&uri=CELEX:32008D0768).

affect the safety of the UAS operation (e.g. the FTS). Similarly to UAS classes C1, C2 and C3, it was therefore decided to impose on UAS classes C5 and C6 the verification by notified bodies that the design complies with the technical requirements or the implementation of a quality assurance system. The possibility to accept also a declaration by the manufacturer of demonstration of compliance with technical requirements was also considered; however, it was deemed that this would not provide sufficient assurance.

Finally, it should be noted that UAS operations similar to those defined in STS-01 and STS-02, conducted with a UAS not marked as class C5 or C6 (e.g. with a privately built UAS), may still be conducted under the authorisation of an NAA. For these UAS operations, EASA will develop a predefined risk assessment, mirroring STS-01 and STS-02, allowing a simplified process for the UAS operator to receive an authorisation.

2.3.4. Applicability

The amendment introducing the STSs cannot be made applicable immediately after the date of entry into force of the regulation, since manufacturers may need some time to develop and put on the market UAS marked class C5 and class C6. It was therefore decided to postpone the applicability to 18 months after the entry into force (i.e if the amendment is adopted by the end of 2020, the entry into force will be 20 days after the entry into force date, and the applicability will be from June 2022). This means that until the date when the amendement becomes applicable, UAS operators may appy national regulations and they may submit declarations based on national STSs, if the national regulatory framework allows it. After this date (i.e. June 2022), only declarations based on the EU STSs can be submitted. Declarations based on national STSs, submitted until the date of applicability (i.e. June 2022), may still be valid for 2 years (i.e. until June 2024).

2.3.5. Additional improvements proposed for Commission Implementing Regulation (EU) 2019/947 (IA)

The following improvements to the IA are proposed.

— According to some commenters, the definition of 'uninvolved person' was not clear, since the conditions to fit within the definition are all expressed in a negative way. It is therefore proposed to replace this definition with 'involved person' having a similar content with the conditions made positive. Therefore, the text 'uninvolved person' was replaced with 'involved persons' in all instances where it appears in the IA.

— STS-02 introduces the role of 'visual observer'. This role should not be confused with the 'UA observer' mentioned in point UAS.OPEN.060(4). Therefore, the definitions of both roles have been introduced. The UA observer supports the remote pilot in keeping the UA in VLOS to make sure that the operation is conducted safely in regard to both ground and air risk. The UA observer needs to be situated alongside the remote pilot. This role was introduced to allow operations in first-person view (FPV) when the remote pilot does not have a wide view of the area where the UA is flying. Visual observers instead have the role to scan the sky and inform the remote pilot when they see other airspace users or obstacles (such as paragliders, parachutes, search and rescue (SAR) operations, etc.). The VO does not play any role in the mitigation of the ground risk since this is already ensured by using the ground-controlled area.

— The definitions of 'flight geography', 'flight geography area', 'contingency volume', 'contingency area', 'operational volume' and 'ground risk buffer' have been introduced to support the identification of the areas where the UAS needs to be operated when applying an STS.

The UAS operator is required to identify:

— the flight geography, where the UAS operator plans to conduct the operation under normal procedures;

— the contingency volume, in which the UA will be contained when the contingency procedures are applied; and

— the ground risk buffer to protect third parties on the ground in the event of any unexpected behaviour of the UA that could result in the UA leaving the operational volume.

Figure 3 provides a representation of the flight geography, the contingency volume and the ground risk buffer.

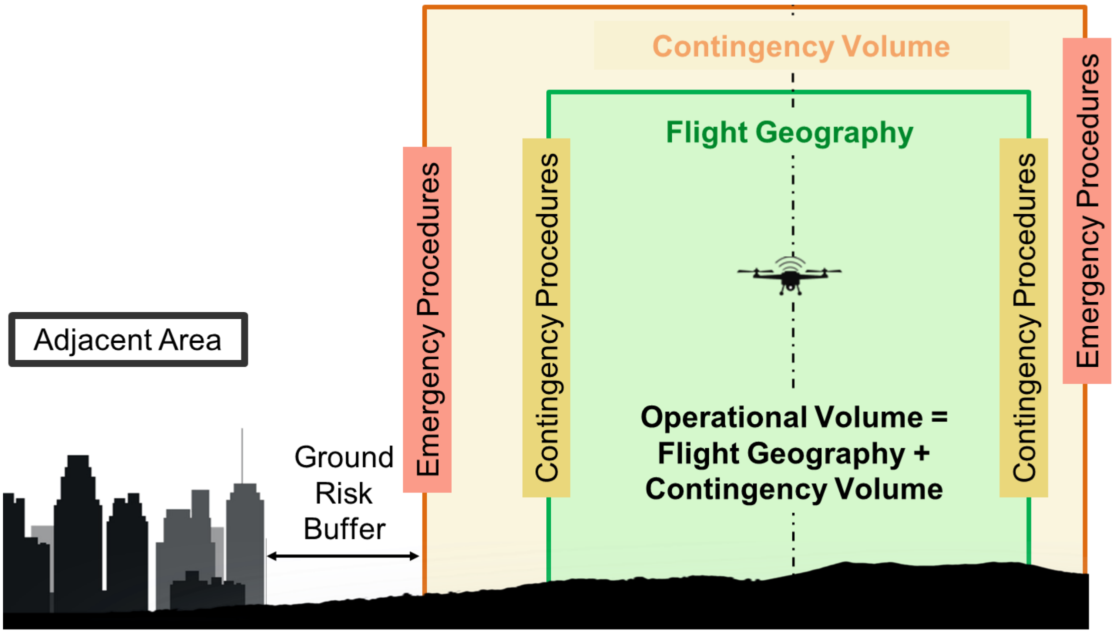

Figure 3: Flight geography, contingency volume and ground risk buffer

— Paragraph 5 of Article 5 has been modified to specify that the declaration to be submitted by the UAS operator is defined in Appendix 2 to the Annex to the IA.

— Points UAS.OPEN.020 and UAS.OPEN.030 have been modified to clarify that the training can be provided by the competent authority or by an entity recognised by the competent authority of one EU Member State, not necessarily the Member State of registration.

— Point UAS.OPEN.040 has been modified to require the remote pilot to be familiar with the user's manual provided by the manufacturer of the UAS.

— Point UAS.OPEN.050 has been modified to specify that the UAS operator is responsible for the identification of a remote pilot for each flight and not for each operation, since an operation may be made up of multiple flights.

— Point UAS.SPEC.020 has been modified to limit the operations of UAS to the airspace where the probability of encountering manned aircraft is considered low, when in uncontrolled airspace. Member States are required to make this determination through geographical zones. Operations in controlled airspace still require coordination in accordance with the published procedure for the area of operation, but an individual authorisation may not always be necessary. Moreover, it has been clarified that this requirement is to ensure a low probability of encountering a manned aircraft.

— Point UAS.SPEC.050 has been modified to require the UAS operator to keep, and maintain up to date for a minimum of 3 years, a record of the qualifications of the personnel employed and the maintenance activities conducted on the UAS. In addition, a requirement was added to ensure that the UAS is equipped with a green flashing light when operating at night and at a height lower than 120 m. This decision was based on the need for the enforcement authority to differentiate a UAS from a manned aircraft, consistent with the requirement imposed on the UAS operated in the 'open' category. Therefore, the purpose of this light is not to make the UAS visible from other traffic but rather to allow the UAS to be seen from ground during night. The decision on the type and colour of the light to be used for these UAS was based on the capability of the human eye to distinguish colours and on the schemes already used on manned aircraft. It was considered that manned aircraft already use white and red flashing lights, while blue flashing lights are used for emergency purposes. According to the 1931 CIE chromacity diagram[32], the colours that the human eye can best distinguish are green, blue and red. Therefore, the only available possibility to use a distinguishable flashing light on a UAS is to mandate a green one. The requirement has been imposed on the UAS operator rather than on the manufacturer to leave the flexibility to add this type of light to the UA using an add-on kit provided by the manufacturer, to be installed when needed. Operations conducted at higher altitude will be subject to a risk assessment and different requirements on lights may be applicable, considering the airspace where they will operate.

— Point UAS.SPEC.060 has been modified to require the remote pilot to be familiar with the user's manual provided by the manufacturer of the UAS.

— A new point UAS.SPEC.085 has been added to define the fixed duration and validity of the operational declaration as being for 2 years.

2.3.6. Additional improvements proposed for Commission Delegated Regulation (EU) 2019/945 (DA)

The following improvements to the DA have been proposed:

— Several recitals, Articles 1, 2, 4, 5, 6, 8, 9, 12, 13, 14, 16, 17, 30, 36 and 40 have been modified to introduce the concept that the market regulation also applies to UAS used in STS, and two new Parts, 16 and 17, have been added.

— Article 5 has been modified to introduce a new paragraph extending the applicability of Regulation (EU) 2019/1020[33] to UAS covered by the IA. Regulation (EU) 2019/1020 (the

[32] https://en.wikipedia.org/wiki/CIE_1931_color_space

[33] Regulation (EU) 2019/1020 of the European Parliament and of the Council of 20 June 2019 on market surveillance and compliance of products and amending Directive 2004/42/EC and Regulations (EC)

enforcement Regulation), adopted on 20 June 2019, amends Regulation (EC) No 765/2008[34] to strengthen the market surveillance of products covered by the Union harmonisation legislation.

Article 4 of the enforcement Regulation requires that, for each product placed on the EU market, a responsible economic operator is established in the EU, and it defines the precise obligations on such economic operators. The applicability of this Article is, however, restricted to products that are subject to a limited amount of Union harmonisation legislation, some of which is already applicable to UAS (i.e. the Radio Equipment Directive).

— Article 40 has been modified to clarify in the title that it is only applicable to UAS operated in the 'certified' and in the 'specific' categories, except when conducted under a declaration. Moreover, a new paragraph has been added to mandate a remote identification system for all UA intended to be operated below 120 m, to address primarily the security and privacy risks. Such a requirement had been extensively discussed during the development of the text of the DA; however, at that time, only the requirement for a 'direct'[35] remote identification system was proposed for UAS to be operated in the 'open' category. It was indeed considered not proportionate to mandate all UAS (including those operated in the 'specific' category) to be equipped with a 'direct' remote identification system. With the development of the new regulation on U-space, the requirements for a 'network' remote identification system are being developed. While the 'network' remote identification will be developed mostly to address the safety risk, it may also fit the purpose of addressing the security and privacy risks if the signal may be detected by a mobile device without the need to be connected to a service provider. It was therefore decided to keep the requirement flexible and mandate, for all UAS intended to be operated in very low level (VLL[36]), a remote identification system transmitting data in a way that it can be received by existing mobile devices. This system can be 'direct' or 'network'.

— The term 'data link' used in Parts 1 to 5 has been replaced with the term 'command and control link' to be consistent with the terminology used in aviation.

— The requirements of the 'direct remote identification' in Parts 2 to 4 have been slightly amended to allow additional information to be broadcast, and to include the time stamp.

— The requirement for a green flashing light has been added to Parts 2 to 4 to make it applicable to UAS classes C1, C2 and C3.

— The information to be included in the user's manual defined in Parts 2 to 4 has been updated to clarify that the description of the method for the UA to recover the command and control link needs to be provided, and, in addition, that the procedures to upload the airspace limitations into the geo-awareness system need to be provided.

No 765/2008 and (EU) No 305/2011 (OJ L 169, 25.6.2019, p. 1) (https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1570630772254&uri=CELEX:32019R1020)

[34] Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products and repealing Regulation (EEC) No 339/93 (OJ L 218, 13.8.2008, p. 30) (https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1570631076377&uri=CELEX:32008R0765).

[35] The term 'direct' remote identification refers to a system broadcasting a signal that can be directly received by a mobile device (i.e. using Bluetooth or Wi-Fi). On the contrary, a 'network' remote identification is a system that transmits information through a connection with a network (i.e. the Internet). In this case, the receiver does not receive the information directly, but through the network.

[36] VLL is the minimum height below which a VFR flight needs to have a permission as defined in paragraph f of point SERA.5005 of Commission Implementing Regulation (EU) No 923/2012.

2.4. What are the stakeholders' views — outcome of the consultation

The draft opinion was consulted with advisory bodies and representatives of UAS industry. More than 300 comments were received and lead to the following changes:

Delegated act:

- a definiton of 'control unit' has been added. The definition provided in the Basic Regulation related to the 'equipment to control the unmanned aircraft remotely' is very broad and it includes also the infrastructure supporting the C2 link service between the UA and the control unit (e.g. 5g network, satellite, etc.). It is necessary therefore to add the definition of 'control unit' as an element of the 'equipment to control the unmanned aircraft remotely', excluding the C2 link service;
- a definition of 'C2 link service' has been added to clarify the term used in the definition of contol unit. The C2 link is the service, provided by a third party, which may be used to establish a communication between the UA and the control unit;
- the reference to the 'A' edition of the ANSI/CTA-2063 standard, published in September 2019 was added. The 'A' version of the standard includes only one type of serial number, corresponding to the one that in the previous version was referred as 'physical' serial number. In addition, the applicability of this requirement has been extended to all UAS not subject to registration, as defined by Article 16 of the IA, in order to allow the trasmission of the unique serial number by the electronic identification;
- both 'geo-awareness system' and 'geo-awareness function' were used to refer to geo-awareness function. As there is no reason to use both, it was decided to consistenlty use 'geo-awareness function';
- the definiton of very low level (VLL) has been introduced, replacing the term with the reference to Regulation (EU) 923/2012 (SERA) and in particular to paragraphs (1) and (2) of point (f) of point SERA.5005;
- for all UAS with CE class mark the local electronic identification system has been complemented with an optional network electronic identification system, to allow them to be used in areas where the U-space will be deployed, as it will be defined by a future regulation. The system is required to check the validity of the UAS registration number by verifying the compatibility with a checksum that will be provided to the UAS operator by the registration system. In addition the requirement to upload the UAS operator registration number into the electronic identification system has been included in the user's manual;
- the table in Part 15 has been replaced with a new one to cover also the class C2 UAS with a MTOM < 900g;
- tethered aircraft were excluded for class C6 UAS since they were considered not applicable to BVLOS operations;
- the text related to the requirement for class C5 and C6 UAS to provide the remote pilot with means to continuously monitor the status of the command and control link, was improved including the provision of an alert when the signal is degraded to the extent of compromising the safe conduct of the operation;

- it has been clarified that the accessory kit to transform a class C3 UAS into a class C5 cannot include software changes to the class C3 UAS since only the UAS manufacturer is able to update the software and verify it. This means that some requirements such as the selectable low speed mode cannot be included in the accessories kit, therefore only class C3 UAS already developed with such requirements are eligible for an accessory kit. The manufacturer of the accessory kit will be anyway responsible to demonstrate that the UAS, upgraded with the accessory kit, meet all requirements defined in Part 16. Lastly, the requirement to ensure that the UAS cannot be operated when one element of the kit is not properly installed has been removed since this is technically difficult to implement. The manufacturer of the accessories kit is still responsible to identify all elements of the kit in such a way that the UAS operator, and a possible enforcement officer, can ensure that they are all installed (e.g. mark each piece with a number and specifying the total number of the components such as 1 of 3, 2 of 3 etc.).

Implementing act

- the definition of control station has been added as in the Delegated Act;
- the text in point (1)(b) of point UAS.SPEC.020 was improved to specify that Member States are required to define UAS geographical zones to limit or forbid operations in areas where the probability of encountering manned aircraft is not low;
- the requirement for record keeping of the relevant qualifications, experience and/or training courses completed by the remote pilot and the other personnel in charge of duties essential to the UAS operation and by the maintenance staff, has been amended to extend the period to at least 3 years after the persons have ceased employment with the organisation or has changed their position in the organisation;
- a brief title to each STS has been added;
- a validity of 5 years for the certificate of of remote pilot theoretical knowledge for operations in the standard scenarios has been added;
- a requirement was added for the visual observer to maintain a thorough visual scan of the airspace surrounding the unmanned aircraft in order to identify any risk of a collision with any manned aircraft.

2.5. What are the expected benefits and drawbacks of the proposals

The impact of STSs was already discussed in the impact assessment published with Opinion No 01/2018.

2.6. How we monitor and evaluate the rules

Please refer to Chapter 8 ‘Monitoring and evaluation’ of NPA 2017-05 (B).

Cologne, 6 November 2019

Patrick KY
Executive Director

3. References

3.1. Affected regulations

— 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).

— Commission Implementing Regulation (EU) 2019/947 of 24 May 2019 on the rules and procedures for the operation of unmanned aircraft (OJ L 152, 11.6.2019, p. 45).

3.2. Affected decisions

n/a

3.3. Other reference documents

n/a

4. Appendices

Appendix 1: Risk assessment for STS-01

The following risk assessment has been conducted by applying SORA (AMC1 to Article 11 of the IA).

1. Step #1 — ConOps description

UAS operators that intend to perform a UAS operation under STS-01 are required to elaborate a concept of operations (ConOps) and describe it in the OM as required in point 4 of the proposed Appendix 5 to the Annex to the IA. The ConOps needs to fit the operational limitations defined in STS-01.

As part of the ConOps, the UAS operator will need to define the required operational volume and ground risk buffer.

2. Step #2 — determination of the intrinsic UAS ground risk class

The intrinsic UAS ground risk relates to the unmitigated risk of a person being hit by the UA (in case of a loss of control of the UA) and it can be represented by the UAS ground risk class (GRC). The GRC is derived from the intended operation and the UAS lethal area, as shown in Table A11.1.

Intrinsic UAS ground risk class (GRC)				
Max UAS characteristic dimension	1 m	3 m	8 m	> 8 m
Typical kinetic energy expected	*< 700 J*	*< 34 kJ*	*< 1 084 kJ*	*> 1 084 kJ*
Operational scenarios				
VLOS/BVLOS over a controlled ground area	1	2	3	4
VLOS in a sparsely populated environment	2	3	4	5
BVLOS in a sparsely populated environment	3	4	5	6
VLOS in a populated environment	4	5	6	8
BVLOS in a populated environment	5	6	8	10
VLOS over a gathering of people	7			
BVLOS over a gathering of people	8			

Table A1.1: Determination of the intrinsic UAS GRC

Considering the operational scenario defined for STS-01 (VLOS over a controlled ground area) and the UA characteristics:

— a rotorcraft or a tethered aircraft other than a fixed-wing aircraft;

— a characteristic dimension[37] of up to 3 m; and

— an MTOM up to 25 kg;

[37] Considering the above characteristics, the typical kinetic energy can be expected to be less than 34 kJ.

as highlighted in Table A1.1, the intrinsic GRC is **2.**

3. Step #3 — final GRC determination

Table A1.2 lists the mitigations that need to be evaluated.

Mitigation sequence	Mitigations for ground risk	Robustness: Low / None	Robustness: Medium	Robustness: High	Correction
1	M1 — Strategic mitigations for ground risk[38]	**0: None** **-1: Low**	**-2**	**-4**	**0**
2	M2 — Effects of ground impact are reduced[39]	**0**	**-1**	**-2**	**0**
3	M3 — An emergency response plan (ERP) is in place, validated by the operator and effective	**1**	**0**	**-1**	**0**
Total correction					**0**

Table A1.2: Mitigation measures for determination of the final GRC

An evaluation of the different possible ground risk mitigations was made:

— M1 (strategic mitigations for ground risk): in the assessment of the initial GRC, credit is already taken for operations over controlled ground; if a tether is used, M1 may be claimed, but SORA does not allow the GRC to be reduced to a lower value than the lowest value in the applicable column. Thus, a correction of 0 is determined.

— M2 (effects of ground impact are reduced): even if the UAS is equipped with a system to reduce the effect of the UA impact dynamics (e.g. a parachute), it was decided to not take any credit for that, since no further technical requirements are imposed on the system used to reduce the effect of the UA impact dynamics. The system is required only for human factors considerations. No specific requirements are included for its robustness. Therefore, also for this case, a correction of 0 is determined.

— M3 (ERP): in order to keep the GRC at 2, an ERP is required with a 'medium' level of robustness. This medium level is achieved through the requirements defined in the proposed point UAS.STS-01.030(4) of the IA, ensuring a medium level of integrity, and may be complemented by the remote flight crew training defined in GM1 UAS.SPEC.050(1)(d).

Therefore, the final intrinsic GRC is 2.

4. Steps #4 to 6 — air risk assessment

The strategic mitigation consists of complying with the requirements of the proposed amendment to point UAS.SPEC.020(1)(b) of the IA, according to which the airspace where operations are intended to be conducted must have a low probability of the UA encountering manned aircraft or other airspace users. Therefore, Member States are required to establish the appropriate measures (e.g. UAS geographical zones) to ensure this low probability of encounter.

[38] This mitigation is meant as a means to reduce the number of people at risk.

[39] This mitigation is meant as a means to reduce the energy absorbed by the people on the ground upon impact.

Such a low probability of encounter is equivalent to an ARC that is no higher than ARC-b. Thus, ARC-b is to be considered here as the highest residual (final) ARC.

These considerations lead to a final ARC-b.

5. Step #7 — SAIL determination

Considering that for the ground risk, the final **GRC is 2,** and for the air risk, the final ARC is not more than **ARC-b**, and the resulting SAIL for STS-01 is **SAIL II**, as indicated in Table A1.3 below:

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			

Table A1.3: SAIL determination

6. Step #8 — identification of operational safety objectives (OSOs)

The purpose of this step is to evaluate the defences within the UAS operation in the form of OSOs and the associated level of robustness depending on SAIL. Table A1.4 provides a qualitative methodology to make this determination. In this table, 'O' means optional, 'L' means recommended with low robustness, 'M' means recommended with medium robustness, and 'H' means recommended with high robustness.

SAIL II corresponding to STS-01 is highlighted in yellow in Table A1.4 to show the required level of robustness for the different OSOs. For the discussion on how the OSO are met in STS-01, please refer to paragraph 9 of this Appendix.

OSO number (in line with Annex E to SORA)		**SAIL**					
		I	**II**	**III**	**IV**	**V**	**VI**
	Technical issue with the UAS						
OSO#01	Ensure that the operator is competent and/or proven	O	L	M	H	H	H
OSO#02	UAS manufactured by competent and/or proven entity	O	O	L	M	H	H
OSO#03	UAS maintained by competent and/or proven entity	L	L	M	M	H	H

OSO number (in line with Annex E to SORA)		SAIL					
		I	**II**	**III**	**IV**	**V**	**VI**
OSO#04	UAS developed to authority-recognised design standards	O	O	O	L	M	H
OSO#05	UAS is designed considering system safety and reliability	O	O	L	M	H	H
OSO#06	C3 link performance is appropriate for the operation	O	L	L	M	H	H
OSO#07	Inspection of the UAS (product inspection) to ensure consistency with the ConOps	L	L	M	M	H	H
OSO#08	Operational procedures are defined, validated and adhered to	L	M	H	H	H	H
OSO#09	Remote crew is trained, current and able to control the abnormal situation	L	L	M	M	H	H
OSO#10	Safe recovery from technical issues	L	L	M	M	H	H
	Deterioration of external systems supporting UAS operations						
OSO#11	Procedures are in place to handle the deterioration of external systems supporting UAS operations	L	M	H	H	H	H
OSO#12	The UAS is designed to manage the deterioration of external systems supporting UAS operations	L	L	M	M	H	H
OSO#13	External services supporting UAS operations are adequate for the operation	L	L	M	H	H	H
	Human error						
OSO#14	Operational procedures are defined, validated and adhered to	L	M	H	H	H	H
OSO#15	Remote crew is trained, current and able to control the abnormal situation	L	L	M	M	H	H
OSO#16	Multi-crew coordination	L	L	M	M	H	H
OSO#17	Remote crew is fit to operate	L	L	M	M	H	H
OSO#18	Automatic protection of the flight envelope from human error	O	O	L	M	H	H
OSO#19	Safe recovery from human error	O	O	L	M	M	H
OSO#20	A human factors evaluation has been performed and the HMI has been found appropriate for the mission	O	L	L	M	M	H
	Adverse operating conditions						

OSO number (in line with Annex E to SORA)		SAIL					
		I	**II**	**III**	**IV**	**V**	**VI**
OSO#21	Operational procedures are defined, validated and adhered to	L	M	H	H	H	H
OSO#22	The remote crew is trained to identify critical environmental conditions and to avoid them	L	L	M	M	M	H
OSO#23	Environmental conditions for safe operations are defined, measurable and adhered to	L	L	M	M	H	H
OSO#24	UAS is designed and qualified for adverse environmental conditions	O	O	M	H	H	H

Table A1.4: Recommended OSOs

7. Step #9 — adjacent area/airspace considerations

Since each operation under STS-01 is performed over a controlled ground area and in a populated environment, the following three requirements apply:

1. the probability of leaving the operational volume should be less than 10-4/FH.
2. no single failure of the UAS or any external system supporting the operation should lead to operation outside the ground risk buffer.
3. 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.

Regarding requirement #1, despite the fact that the scenario is built based on experience in some Member States, there is a lack of statistical data to estimate the order of magnitude expected for the probability of the UA leaving the operational volume. However, the technical requirements proposed for the UAS used in STS-01 are deemed sufficient to bring that likelihood down to a tolerable level, probably in the order indicated by SORA.

Requirements #2 and #3 are considered to be met through the mandate to use a UA equipped with a means to terminate the flight, with its activation independent from the on-board automatic flight control and guidance system.

8. Step #10 — comprehensive safety portfolio

Not applicable. This step is only necessary when the operator is requested to present an operational risk assessment to its competent authority. This explanatory note can be considered to be the safety portfolio supporting the declarations made under STS-01 and STS-02.

9. Compliance with OSOs

Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in SORA for SAIL II	Requirements applicable to STS-01
OSO #01 Ensure that the operator is competent and/or proven	LEVEL of INTEGRITY	Low	The applicant is knowledgeable about the UAS being used and as a minimum has the following relevant operational procedures: checklists, maintenance, training, responsibilities, and associated duties.	Point UAS.SPEC.050 of the IA requires the UAS operator to *'establish procedures and limitations adapted to the type of the intended operation and the risk involved'*. Furthermore, the proposed point UAS.STS-01.030 of the IA requires the UAS operator to develop an OM. The proposed Appendix 5 to the Annex to the IA includes all the aspects to be considered and it covers those indicated by SORA.
	LEVEL of ASSURANCE		The elements delineated in the level of integrity are addressed in the ConOps.	The proposed point UAS.STS-01.030 of the IA requires the UAS operator to develop an OM. The proposed Appendix 5 to the Annex to the IA includes elements of the description of the ConOps.
OSO #03 UAS maintained by competent and/or proven entity (e.g. industry standards)	LEVEL of INTEGRITY	Low	The UAS maintenance instructions are defined and, when applicable, cover the UAS designer's instructions and requirements. The maintenance staff are competent and have received an authorisation to carry out UAS maintenance. The maintenance staff use the UAS maintenance instructions while performing maintenance.	The requirements of this OSO are included in point UAS.SPEC.050(1)(i) that requires 'the UAS operator to maintain the UAS in a suitable condition for safe operation, to define maintenance instructions and employ an adequately trained and qualified maintenance staff'. In addition, the AMC to point UAS.SPEC.050(1)(e)(ii) specifies that 'The UAS operator should ensure that the personnel in charge of duties essential to the UAS

Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in SORA for SAIL II	Requirements applicable to STS-01
				operation apply the procedures contained in the operations manual.’
	LEVEL of ASSURANCE		– Criterion #1 (Procedure): – The maintenance instructions are documented. – The maintenance conducted on the UAS is recorded in a maintenance log system. – A list of the maintenance staff authorised to carry out maintenance is established and kept up to date. – Criterion #2 (Training): A record of all the relevant qualifications, experience and/or training completed by the maintenance staff is established and kept up to date.	– Criterion#1: The proposed Appendix 5 to the Annex to the IA requires the UAS operator to include in the OM the maintenance instructions required to keep the UAS in safe condition. – Criterion#2: The proposed amendment to point UAS.SPEC.050 of the IA requires the UAS operator to keep and maintain up to date, for a minimum of 3 years, a record of all relevant qualifications, experience and/or training completed by the maintenance staff and a record of the maintenance activities conducted on the UAS. Moreover, the proposed amendment to point UAS.SPEC.050 of the IA requires the UAS operator to establish and keep up to date a list of maintenance staff authorised by the operator to carry out maintenance activities.
OSO #06 **C3 link performance is appropriate for the operation**	LEVEL of INTEGRITY	Low	The applicant determines that performance, RF spectrum usage[1] and environmental conditions for C3 links are adequate to safely conduct the intended operation.	Point UAS.SPEC.050(1)(c) of the IA requires the UAS operator to ‘ensure that all operations effectively use and support the efficient use of radio spectrum in order to avoid harmful interference’.

Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in SORA for SAIL II	Requirements applicable to STS-01
			The UAS remote pilot has the means to continuously monitor the C3 performance and ensure that the performance continues to meet the operational requirements[2]. [1] *For a low level of integrity, unlicensed frequency bands might be acceptable under certain conditions, e.g.:* – *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* – *the use of mechanisms to protect against interference (e.g. FHSS, frequency deconfliction by procedure).* [2] *The remote pilot has continual and timely access to the relevant C3 information that could affect the safety of flight. For operations with 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 becomes too low.*	In addition, the proposed amendment to the DA includes for class C5 the compliance with the following requirements of class C3: – 'be safely controllable with regards to stability, manoeuvrability and performance of command and control link […]'; and – 'unless tethered, be equipped with a command and control link protected against unauthorised access to the command and control functions'. Furthermore, a requirement is proposed to also provide information on the health of the command and control link. Regarding the use of 'unlicensed frequency bands', as indicated in recital (8) of the DA, Directive 2014/53/EU applies to UA that are not subject to certification, according to Part 21, and are not intended to be operated only on frequencies allocated by the Radio Regulations of the International Telecommunication Union for protected aeronautical use. Moreover, point UAS.SPEC.060(2)(b) of the IA requires the remote pilot to 'ensure that the operating environment is compatible with the authorised or declared limitations and conditions'.

Operational safety objectives (OSOs)		**SAIL II expected level of robustness**	**Criteria in SORA for SAIL II**	**Requirements applicable to STS-01**
	LEVEL of ASSURANCE		The applicant declares that the required level of integrity has been achieved.	A declaration form for the UAS operator is proposed in Appendix 2 to the Annex to the IA. The level of assurance of the compliance with the technical requirements is ensured by the CE mark process.
OSO #07 **Inspection of the UAS (product inspection) to ensure consistency with the ConOps**	LEVEL of INTEGRITY	Low	The remote crew ensures that the UAS is in a condition for safe operation and conforms to the approved concept of operations.	Point UAS.SPEC.060(2)(c) of the IA requires the remote pilot to 'ensure that the UAS is in a safe condition to complete the intended flight safely'. The proposed Appendix 5 to the Annex to the IA requires: – in point 4, the UAS operator to describe the concept of operations including the intended operations; – in point 6(c)(i)(H), the UAS operator to include in the OM the procedures to verify that the UAS is in a condition to safely conduct the intended operation.
	LEVEL of ASSURANCE		– Criterion #1 (Procedure): Product inspection is documented and accounts for the manufacturer's recommendations if available. – Criterion #2 (Training): The remote crew is trained to perform the product inspection, and that training is self-declared (with evidence available).	– Criterion #1: The verification that the UAS is in safe condition for the intended operation is included in the OM. – Criterion #2: Point UAS.SPEC.050 of the IA requires that the UAS operator ensures that remote pilots 'have been informed about the UAS operator's operations manual' and that personnel in charge of duties essential to the UAS operation, other than the

Operational safety objectives (OSOs)		**SAIL II expected level of robustness**	**Criteria in SORA for SAIL II**	**Requirements applicable to STS-01**
				remote pilots, 'have completed the on-the-job-training developed by the operator, and have been informed about the UAS operator's operations manual'. The proposed point UAS.STS-01.020(5) of the IA defines the minimum training for the remote pilot. Pre-flight activities are part of the training. Both the theoretical and practical skills training are accredited (with a certificate of remote pilot theoretical knowledge and an accreditation of completion of STS-01 practical skills training, respectively). Thus, evidence of basic training is available. The declaration proposed in Appendix 2 to the Annex to the IA covers all the requirements defined in each STS; it thus covers the competencies of the personnel involved in the operation.
Operational procedures (OSO #08, OSO #11, OSO #14 and OSO #21)	LEVEL of INTEGRITY	Medium	– Criterion #1 (Procedure definition): – Operational procedures appropriate for the proposed operation are defined and as a minimum cover the following elements: – Flight planning,	– Criterion #1: Point UAS.SPEC.050(1)(a) of the IA requires the UAS operator to 'establish procedures and limitations adapted to the type of the intended operation and the risk involved, including operational procedures to ensure the safety of the operations'. The proposed point UAS.STS-01.030(1) of the IA

Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in SORA for SAIL II	Requirements applicable to STS-01
			– Pre- and post-flight inspections, – Procedures to evaluate the environmental conditions before and during the mission (i.e. real-time evaluation), – Procedures to cope with unintended adverse operating conditions (e.g. when ice is encountered during an operation not approved for icing conditions), – Normal procedures, – Contingency procedures (to cope with abnormal situations), – Emergency procedures (to cope with emergency situations), and – Occurrence reporting procedures. – Normal, abnormal, and emergency procedures are compiled in an operations manual. – The limitations of the external systems used to support UAS safe operations are defined in an operations manual. – Criterion #2 (Procedural complexity which could jeopardise adherence): Operational procedures	requires the UAS operator to develop an OM, which as described in the proposed Appendix 5 to the Annex to the IA, includes all the elements indicated in SORA criterion #1. – Criterion #2: Since this is still under JARUS discussion (as indicated in the note), it has not been fully considered in the assessment. However, since in the case of an emergency situation in which the UA may leave the operational volume, there is a requirement for the remote pilot to terminate the flight, and the activation of this flight termination can be considered as a 'manual control' by the remote pilot, then this criterion could also be considered (at least partially) addressed. – Criterion #3: The proposed Appendix 5 to the Annex to the IA requires the UAS operator to include in the operational procedures considerations to minimise human errors.

Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in SORA for SAIL II	Requirements applicable to STS-01
			involve the remote pilot taking manual control[(1)] when the UAS is usually automatically controlled. *(1) This is still under discussion since not all UAS have a mode where the pilot could directly control the surfaces; moreover, some people claim it requires significant skill to not make things worse.* – Criterion #3 (Consideration of potential human error): Operational procedures take human errors into consideration. At a minimum, operational procedures provide: – a clear distribution and assignment of tasks, and – an internal checklist to ensure staff are performing their assigned tasks.	
	LEVEL of ASSURANCE		Operational procedures are validated against standards considered adequate by the competent authority and/or in accordance with a means of compliance acceptable to that authority. The adequacy of the contingency and emergency procedures are proved through: – dedicated flight tests, or	EASA will provide, in future AMC applicable to the STS, the standard(s) or means of compliance considered adequate by the Agency. The proposed point UAS.STS-01.030(4) of the IA requires the UAS operator to prove the adequacy of the contingency and emergency procedures through dedicated flight tests or simulations.

Operational safety objectives (OSOs)		**SAIL II expected level of robustness**	**Criteria in SORA for SAIL II**	**Requirements applicable to STS-01**
			– simulation, provided the simulation is proven valid for the intended purpose.	
Remote crew training (OSO #09, OSO #15 and OSO #22)	LEVEL of INTEGRITY	Low	The competency-based theoretical and practical training ensures knowledge of: a) UAS regulations, b) UAS airspace operating principles, c) Airmanship and aviation safety, d) Human performance limitations; e) Meteorology, f) Navigation/charts, g) UA knowledge, and h) Operating procedures and is adequate for the operation.	Article 8 of the IA lists the competencies required for remote pilots operating UAS in the 'specific' category; these are further detailed in the proposed Attachment A to STS-01 and they cover the knowledge of the items listed in this OSO. Point UAS.SPEC.050(1)(d)(i) of the IA requires the UAS operator to ensure before conducting operations that the remote pilot has the appropriate competency. The proposed amendment to point UAS.SPEC.060(1)(b) of the IA requires the remote pilot to be familiar with the user's manual provided by the manufacturer of the UAS.
	LEVEL of ASSURANCE		Training is self-declared (with evidence available)	In line with the approach used in subcategory A2 of the 'open' category, in the proposed point UAS.STS-01.020(d) of the IA, the remote pilot is allowed to conduct self-study. However, the examination for the theoretical knowledge is required to be held at an entity recognised by the competent authority.

Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in SORA for SAIL II	Requirements applicable to STS-01
				Regarding the practical training, it is required that an external party provides the practical skill training and assessment. Then, the UAS operator can declare compliance with STS-01, which therefore also includes a declaration that the remote pilot(s) have the necessary competencies and is (are) familiar with the procedures.
Safe design: **OSO #10** **Safe recovery from technical issue** **OSO #12** **The UAS is designed to manage the deterioration of external systems supporting UAS operations**	LEVEL of INTEGRITY	Low	The objective of these OSOs is to complement the technical containment safety requirements by addressing the risk of a fatality occurring while operating over populated areas or gatherings of people. External systems supporting the operation are defined as systems that are not already part of the UAS but are used to: – launch/take-off the UAS, – make pre-flight checks, or – keep the UA within its operational volume (e.g. GNSS, satellite systems, air traffic management, UTM).	STS-01 includes operations in populated environments but over ground controlled areas. Therefore, the condition of the requirement 'When operating over populous areas or gatherings of people' is not met and the requirement is considered not applicable to STS-01.

Operational safety objectives (OSOs)		**SAIL II expected level of robustness**	**Criteria in SORA for SAIL II**	**Requirements applicable to STS-01**
			External systems activated/used after the loss of control of the operation are excluded from this definition. When operating over populated areas or gatherings of people, a fatality will not occur from any probable[1] failure[2] of the UAS or any external system supporting the operation. [1] The term 'probable' needs to be understood in its qualitative interpretation, i.e. 'Anticipated to occur one or more times during the entire system/operational life of an item.' [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.	
	LEVEL of ASSURANCE		A design and installation appraisal is available. In particular, this appraisal shows that: – the design and installation features (independence, separation and redundancy) satisfy the low-integrity criterion;	The requirement is not applicable to STS-01.

Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in SORA for SAIL II	Requirements applicable to STS-01
			– particular risks relevant to the ConOps (e.g. hail, ice, snow, electromagnetic interference, etc.) do not violate the independence claims, if any.	
OSO #13 External services supporting UAS operations are adequate for the operation	LEVEL of INTEGRITY	Low	The applicant ensures that the level of performance of any externally provided service necessary for the safety of the flight is adequate for the intended operation. Roles and responsibilities between the applicant and the external service provider are defined.	Those requirements are included in points (5) and (6) of the proposed point UAS.STS-01.030 of the IA.
	LEVEL of ASSURANCE		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 necessarily being available).	The declaration included in the proposed Appendix 2 to the Annex to the IA ensures compliance with this requirement.
OSO #16 Multi-crew coordination	LEVEL of INTEGRITY	Low	– Criterion #1 (Procedures): A procedure (or procedures) to ensure coordination between the crew members and to ensure that robust and effective communication channels is (are) available and at a minimum cover: – the assignment of tasks to the crew, and – establishment of step-by-step communications.	– Criterion #1: The proposed Appendix 5 to the Annex to the IA requires the UAS operator to include in the OM a clear distribution and assignment of tasks and to define the required communication procedures among remote crew members and with external parties, when needed. – Criterion #2: The proposed Attachment A to STS-01 includes the subject 'operational procedures', under which the training on multi-crew coordination is addressed.

Operational safety objectives (OSOs)		**SAIL II expected level of robustness**	**Criteria in SORA for SAIL II**	**Requirements applicable to STS-01**
			– Criterion #2 (Training): Remote crew training covers multi-crew coordination.	
	LEVEL of ASSURANCE		– Criterion #1 (Procedures): – Procedures are not required to be validated against a recognised standard. – The adequacy of the procedures and checklists is declared. – Criterion #2 (Training): Training is self-declared (with evidence available).	– Criterion #1: Multi-crew coordination, when relevant for the operation, is required to be included as part of the OM operational procedures. As indicated above for the related OSOs (OSO #08, OSO #11, OSO #14 and OSO #21), EASA will provide, in the future AMC applicable to STS, the standard(s) or means of compliance considered adequate by the Agency. – Criterion #2: The declaration proposed in Appendix 2 to the Annex to the IA covers all requirements defined in each STS; it thus covers compliance with the requirements on procedures and training, and therefore also the corresponding part for multi-crew coordination, when relevant.
OSO #17 **Remote crew is fit to operate**	LEVEL of INTEGRITY	Low	The applicant has a policy defining how the remote crew can declare themselves fit to operate before conducting any operation.	The proposed Appendix 5 to the Annex to the IA requires the UAS operator to include a policy defining how the remote crew can declare themselves fit to operate before conducting any operation.

Operational safety objectives (OSOs)		**SAIL II expected level of robustness**	**Criteria in SORA for SAIL II**	**Requirements applicable to STS-01**
	LEVEL of ASSURANCE		The policy to define how the remote crew declares themselves fit to operate (before an operation) is documented.	This policy is documented as it is part of the OM.

OSO #20
A human factors evaluation has been performed and the HMI has been found appropriate for the mission
	LEVEL of INTEGRITY	Low	The UAS information and control interfaces are succinctly presented and do not confuse, cause unreasonable fatigue, or contribute to remote crew errors that could adversely affect the safety of the operation.
			Comments/notes:
			If an electronic means is used to support potential visual observers in their role to maintain awareness of the position of the unmanned aircraft, its HMI:
			– *is sufficient to allow the visual observers to determine the position of the UA during operation;*
			– *does not degrade the visual observer's ability to:*
			  – *scan the airspace where the unmanned aircraft is operating for any potential collision hazard; and*
			  – *maintain effective communication with the remote pilot at all times.*
				Part 4 of the Annex to the DA already includes for UAS in class C3 a requirement for the UAS manufacturers to ensure that the UAS can be safely controlled and manoeuvred by a remote pilot with the competency defined in the IA. The same requirement is also applicable to UAS in class C5.
				No visual observers are mandated in STS-01.

Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in SORA for SAIL II	Requirements applicable to STS-01
	LEVEL of ASSURANCE		The applicant conducts an evaluation of the UAS considering and addressing human factors to determine that the HMI is appropriate for the mission. The HMI evaluation is based on engineering evaluations or analyses.	Compliance with the technical requirement will be ensured through the CE mark process.
OSO #23 Environmental conditions for safe operations are defined, measurable and adhered to	LEVEL of INTEGRITY	Low	– Criterion #1 (Definition): Environmental conditions for safe operations are defined and reflected in the flight manual or equivalent document. – Criterion #2 (Procedures): Procedures to evaluate the environmental conditions before and during the mission (i.e. real-time evaluation) are available and include assessment of the meteorological conditions (METAR, TAFOR, etc.) with a simple recording system. – Criterion #3 (Training): Training covers assessment of the meteorological conditions.	– Criterion #1: Part 4 of the Annex to the DA includes already for UAS in class C3 a requirement for the UAS manufacturers to include in the user's manual the: – 'operational limitations (including but not limited to meteorological conditions and day/night operations)'; and – 'appropriate description of all the risks related to UAS operations'; The same requirements are applicable also to UAS in class C5. – Criterion #2: The proposed Appendix 5 to the Annex to the IA requires the UAS operator to include in the OM the environmental and weather conditions adequate to conduct the UAS operation, as well as contingency procedures to cope with adverse operating conditions. – Criterion #3: The proposed Attachment A to STS-01 includes 'meteorology' as one of the subjects. Future

Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in SORA for SAIL II	Requirements applicable to STS-01
				AMC & GM will include more details, to address obtaining and assessing weather information.
	LEVEL of ASSURANCE		– Criterion #1 (Definition): The applicant declares that the required level of integrity has been achieved[(1)]. [(1)] *Supporting evidence may or may not be available.* – Criterion #2 (Procedures): See the 'level of assurance' for operational procedures (OSO #08, OSO #11, OSO #14 and OSO #21)' – Criterion #3 (Training): See the 'level of assurance' for remote crew training (OSO #09, OSO #15 and OSO #22)'	– Criterion #1: Compliance with the UAS requirements will be ensured through the CE mark process. Standards will be developed. – Criterion #2: See the 'level of assurance' for operational procedures (OSO #08, OSO #11, OSO #14 and OSO #21)' – Criterion #3: See the 'level of assurance' for remote crew training (OSO #09, OSO #15 and OSO #22).

Appendix 2: Risk assessment for STS-02

The following risk assessment has been conducted by applying the SORA (AMC1 to Article 11 to Commission Implementing Regulation (EU) 2019/947).

1. Step #1 — ConOps description

As in STS-01, UAS operators that intend to perform an operation under STS-02 are required to elaborate a ConOps and describe it in the OM as required in point 4 of the proposed Appendix 5. The ConOps needs to fit the operational limitations defined in STS-02.

As part of the ConOps, the UAS operator will need to define the required operational volume and ground risk buffer.

2. Step #2 — determination of the initial UAS ground risk class

The intrinsic UAS ground risk relates to the unmitigated risk of a person being hit by the UA (in case of a loss of control of the UA), and it can be represented by the UAS ground risk class (GRC). The GRC is derived from the intended operation and the UAS lethal area, as shown in Table A1.

Intrinsic UAS ground risk class (GRC)				
Max UAS characteristics dimension	1 m	3 m	8 m	>8 m
Typical kinetic energy expected	*< 700 J*	*< 34 kJ*	*< 1 084 kJ*	*> 1 084 kJ*
Operational scenarios				
VLOS/BVLOS over a controlled ground area	1	2	3	4
VLOS in a sparsely populated environment	2	3	4	5
BVLOS in a sparsely populated environment	3	4	5	6
VLOS in a populated environment	4	5	6	8
BVLOS in a populated environment	5	6	8	10
VLOS over a gathering of people	7			
BVLOS over a gathering of people	8			

Table A2.1: Determination of the intrinsic UAS GRC

Considering the operational scenario defined for STS-02 (BVLOS over controlled ground area) and the UA characteristics:

— a rotorcraft or a tethered aircraft other than a fixed-wing aircraft;

— a characteristic dimension[40] of up to 3 m;

— an MTOM up to 25 kg; and

— a ground speed of up to 50 m/s;

[40] Considering the above characteristics, the typical kinetic energy can be expected to be less than 34 kJ.

as highlighted in Table A1, the intrinsic GRC is **2.**

3. Step #3 — final GRC determination

Table A2.2 lists the mitigations that need to be evaluated.

		Robustness			Correction
Mitigation Sequence	**Mitigations for ground risk**	**Low / None**	**Medium**	**High**	
1	M1 — Strategic mitigations for ground risk[41]	**0: None** **-1: Low**	**-2**	**-4**	**0**
2	M2 — Effects of ground impact are reduced[42]	**0**	**-1**	**-2**	**0**
3	M3 — An emergency response plan (ERP) is in place, validated by the operator and effective	**1**	**0**	**-1**	**0**
Total correction					**0**

Table A2.2: Mitigations for Final GRC determination

An evaluation of the different possible ground risk mitigations was made:

— M1 (strategic mitigations for ground risk): in the assessment of the initial GRC, credit is already taken for operations over controlled ground; if a tether is used, M1 may be claimed, but SORA does not allow the GRC to be reduced to a lower value than the lowest value in the applicable column when using M1. Thus, a correction of 0 is determined.

— M2 (Effects of ground impact are reduced): no system to reduce the effect of the UA impact dynamics is proposed. Therefore, also for this case, a correction of 0 is determined.

— M3 (ERP): in order to keep the GRC to 2, an ERP is required with a 'medium' level of robustness. Such a medium level is achieved through the requirements defined in the proposed UAS.STS-02.030(5), ensuring a medium level of integrity. They may be complemented by the remote flight crew training defined in GM1 UAS.SPEC.050(1)(d).

Therefore, the final intrinsic GRC is **2**.

4. Steps #4 to 6 — air risk assessment

The strategic mitigation consists of complying with the requirements of the proposed amendment to point UAS.SPEC.020(1)(b) of the IA, according to which the airspace in which operations are intended to be conducted must have a low probability of the UA encountering manned aircraft or other airspace users. Therefore, Member States are required to establish the appropriate measures (e.g. UAS geographical zones) to ensure this low probability of encounter.

Such a low probability of encounter is equivalent to an ARC that is no higher than ARC-b. Thus, ARC-b is to be considered here as the highest residual (final) ARC.

[41] This mitigation is meant as a means to reduce the number of people at risk.
[42] This mitigation is meant as a means to reduce the energy absorbed by the people of the ground upon impact.

The main tactical mitigation is the use of visual observers, as explained in Section 2.3.2.2.

5. Steps #7 — SAIL determination

Considering that for the ground risk, the final **GRC is 2** and for the air risk, the final ARC is not more than **ARC-b**, the resulting SAIL for STS-02 is **SAIL II**, as indicated in Table A1. below:

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			

Table A2.3: SAIL determination

6. Step #8 — identification of operational safety objectives (OSOs)

The purpose of this step is to evaluate the defences within the UAS operation in the form of OSOs and the associated level of robustness depending on SAIL. Table A1. A2.4 provides a qualitative methodology to make this determination. In this table, 'O' means optional, 'L' means recommended with low robustness, 'M 'means recommended with medium robustness, and 'H' means recommended with high robustness.

SAIL II corresponding to STS-02 is highlighted in yellow in Table A2.4 to show the required level of robustness for the different OSOs. For the discussion on how the OSOs are met in STS-02, please refer to paragraph 9 of this Appendix.

OSO number (in line with Annex E to SORA)		**SAIL**					
		I	**II**	**III**	**IV**	**V**	**VI**
	Technical issue with the UAS						
OSO#01	Ensure that the operator is competent and/or proven	O	L	M	H	H	H
OSO#02	UAS manufactured by competent and/or proven entity	O	O	L	M	H	H
OSO#03	UAS maintained by competent and/or proven entity	L	L	M	M	H	H
OSO#04	UAS developed to authority-recognised design standards	O	O	O	L	M	H

OSO number (in line with Annex E to SORA)		SAIL					
		I	**II**	**III**	**IV**	**V**	**VI**
OSO#05	UAS is designed considering system safety and reliability	O	O	L	M	H	H
OSO#06	C3 link performance is appropriate for the operation	O	L	L	M	H	H
OSO#07	Inspection of the UAS (product inspection) to ensure consistency with the ConOps	L	L	M	M	H	H
OSO#08	Operational procedures are defined, validated and adhered to	L	M	H	H	H	H
OSO#09	Remote crew is trained, current and able to control the abnormal situation	L	L	M	M	H	H
OSO#10	Safe recovery from technical issues	L	L	M	M	H	H
	Deterioration of external systems supporting UAS operations						
OSO#11	Procedures are in place to handle the deterioration of external systems supporting UAS operations	L	M	H	H	H	H
OSO#12	The UAS is designed to manage the deterioration of external systems supporting UAS operations	L	L	M	M	H	H
OSO#13	External services supporting UAS operations are adequate for the operations	L	L	M	H	H	H
	Human error						
OSO#14	Operational procedures are defined, validated and adhered to	L	M	H	H	H	H
OSO#15	Remote crew is trained, current and able to control the abnormal situation	L	L	M	M	H	H
OSO#16	Multi-crew coordination	L	L	M	M	H	H
OSO#17	Remote crew is fit to operate	L	L	M	M	H	H
OSO#18	Automatic protection of the flight envelope from human error	O	O	L	M	H	H
OSO#19	Safe recovery from human error	O	O	L	M	M	H
OSO#20	A human factors evaluation has been performed and the HMI has been found appropriate for the mission	O	L	L	M	M	H
	Adverse operating conditions						
OSO#21	Operational procedures are defined, validated and adhered to	L	M	H	H	H	H

OSO number (in line with Annex E to SORA)		SAIL					
		I	**II**	**III**	**IV**	**V**	**VI**
OSO#22	The remote crew is trained to identify critical environmental conditions and to avoid them	L	L	M	M	M	H
OSO#23	Environmental conditions for safe operations are defined, measurable and adhered to	L	L	M	M	H	H
OSO#24	UAS is designed and qualified for adverse environmental conditions	O	O	M	H	H	H

Table A2.4: Recommended OSOs

7. Step #9 — adjacent area/airspace considerations

Operations under STS-02 are performed over a controlled ground area and in sparsely populated environments; however, since it cannot be excluded that adjacent areas will include gatherings of people or ARC-d airspace, the same three requirements listed for STS-01 in paragraph 7 of Appendix 1 apply. Moreover, the technical requirements proposed for this purpose for class C5 are also proposed for UAS to be used in STS-02 (class C6).

8. Step #10 — comprehensive safety portfolio

As in STS-01, this step is not applicable. The same considerations apply as those in paragraph 8 of Appendix 1.

9. Compliance with OSOs

Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in SORA for SAIL II	Requirements applicable to STS-02
OSO #01 **Ensure that the operator is competent and/or proven**	LEVEL of INTEGRITY	Low	The applicant is knowledgeable about the UAS being used and as a minimum has the following relevant operational procedures: checklists, maintenance, training, responsibilities, and associated duties.	The same considerations as provided for STS-01 apply. The proposed point UAS.STS-02.030 of the IA provides requirements equivalent to the proposed point UAS.STS-01.030 of the IA.
	LEVEL of ASSURANCE		The elements delineated in the level of integrity are addressed in the ConOps.	The same considerations as provided for STS-01 apply.
OSO #03 **UAS maintained by competent and/or proven entity (e.g. industry standards)**	LEVEL of INTEGRITY	Low	The UAS maintenance instructions are defined, and when applicable, cover the UAS designer's instructions and requirements. The maintenance staff are competent and have received an authorisation to carry out UAS maintenance. The maintenance staff use the UAS maintenance instructions while performing maintenance.	The same considerations as provided for STS-01 apply.
	LEVEL of ASSURANCE		– Criterion #1 (Procedure): – The maintenance instructions are documented. – The maintenance conducted on the UAS is recorded in a maintenance log system.	The same considerations as provided for STS-01 apply.

Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in SORA for SAIL II	Requirements applicable to STS-02
			– A list of the maintenance staff authorised to carry out maintenance is established and kept up to date. – Criterion #2 (Training): A record of all the relevant qualifications, experience and/or training completed by the maintenance staff is established and kept up to date.	
OSO #06 **C3 link performance is appropriate for the operation**	LEVEL of INTEGRITY	Low	The applicant determines that the performance, RF spectrum usage[1] and environmental conditions for C3 links are adequate to safely conduct the intended operation. The UAS remote pilot has the means to continuously monitor the C3 performance and ensure that the performance continues to meet the operational requirements[2]. [1] *For a low level of integrity, unlicensed frequency bands might be acceptable under certain conditions, e.g.:* – *the applicant demonstrates compliance with other RF spectrum usage requirements (e.g. Directive 2014/53/EU), by showing that the UAS*	The same considerations as provided for STS-01 apply. Moreover, the technical requirements proposed for this purpose for class C5 are also proposed for UAS to be used in STS-02 (class C6).

Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in SORA for SAIL II	Requirements applicable to STS-02
			equipment is compliant with these requirements, and – *the use of mechanisms to protect against interference (e.g. FHSS, frequency deconfliction by procedure).* [2] *The remote pilot has continual and timely access to the relevant C3 information that could affect the safety of flight. For operations with 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 becomes too low.*	
	LEVEL of ASSURANCE		The applicant declares that the required level of integrity has been achieved.	The same considerations as provided for STS-01 apply.
OSO #07 Inspection of the UAS (product inspection) to ensure consistency with the ConOps	LEVEL of INTEGRITY	Low	The remote crew ensures that the UAS is in a condition for safe operation and conforms to the approved concept of operations.	The same considerations as provided for STS-01 apply.
	LEVEL of ASSURANCE		– Criterion #1 (Procedure): Product inspection is documented and accounts for the manufacturer's recommendations if available.	The same considerations as provided for STS-01 apply. The proposed point UAS.STS-02.020(8) of the IA defines the minimum training for the remote pilot as described in Section 2.3.2.4.

Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in SORA for SAIL II	Requirements applicable to STS-02
			– Criterion #2 (Training): The remote crew is trained to perform the product inspection, and that training is self-declared (with evidence available).	Both the theoretical and practical skills training are accredited (with a certificate of remote pilot theoretical knowledge and an accreditation of completion of the STS-02 practical skills training, respectively).
Operational procedures (OSO #08, OSO #11, OSO #14 and OSO #21)	LEVEL of INTEGRITY	Medium	– Criterion #1 (Procedure definition): – Operational procedures appropriate for the proposed operation are defined and, as a minimum cover, the following elements: – Flight planning, – Pre and post-flight inspections, – Procedures to evaluate the environmental conditions before and during the mission (i.e. real-time evaluation), – Procedures to cope with unintended adverse operating conditions (e.g. when ice is encountered during an operation not approved for icing conditions), – Normal procedures, – Contingency procedures (to cope with abnormal situations),	The same considerations as provided for STS-01 apply.

Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in SORA for SAIL II	Requirements applicable to STS-02
			– Emergency procedures (to cope with emergency situations), and – Occurrence reporting procedures. – Normal, abnormal, and emergency procedures are compiled in an operations manual. – The limitations of the external systems used to support UAS safe operations are defined in an operations manual. – Criterion #2 (Procedural complexity which could jeopardize adherence to): Operational procedures involve the remote pilot taking manual control(1) when the UAS is usually automatically controlled. (1) *This is still under discussion, since not all UAS have a mode where the pilot could directly control the surfaces; moreover, some people claim it requires significant skill to not make things worse.* – Criterion #3 (Consideration of Potential Human Error): Operational procedures take human errors into consideration. At a minimum, operational procedures provide:	

Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in SORA for SAIL II	Requirements applicable to STS-02
			– a clear distribution and assignment of tasks, and – an internal checklist to ensure staff are performing their assigned tasks.	
	LEVEL of ASSURANCE		Operational procedures are validated against standards considered adequate by the competent authority and/or in accordance with a means of compliance acceptable to that authority. The adequacy of the contingency and emergency procedures are proved through: – dedicated flight tests, or – simulation, provided the simulation is proven valid for the intended purpose.	The same considerations as provided for STS-01 apply. The proposed point UAS.STS-02.030(4) of the IA requires the UAS operator to prove the adequacy of the contingency and emergency procedures through dedicated flight tests or simulations.
Remote crew training (OSO #09, OSO #15 and OSO #22)	LEVEL of INTEGRITY	Low	The competency-based theoretical and practical training ensures knowledge of: i) UAS regulations; j) UAS airspace operating principles; k) Airmanship and aviation safety; l) Human performance limitations; m) Meteorology; n) Navigation/charts;	The same considerations as provided for STS-01 apply.

Operational safety objectives (OSOs)		**SAIL II expected level of robustness**	**Criteria in SORA for SAIL II**	**Requirements applicable to STS-02**
			o) UA knowledge; and p) Operating procedures and is adequate for the operation.	
	LEVEL of ASSURANCE		Training is self-declared (with evidence available)	The same considerations as provided for STS-01 apply; however, the accreditation of completion of practical skills training is for STS-02.
Safe design: **OSO #10** **Safe recovery from technical issue** **OSO #12** **The UAS is designed to manage the deterioration of external systems supporting UAS operations**	LEVEL of INTEGRITY	Low	The objective of these OSOs is to complement the technical containment safety requirements by addressing the risk of a fatality occurring while operating over populated areas or gatherings of people. External systems supporting the operation are defined as systems that are not already part of the UAS but are used to: – launch/take-off the UAS, – make pre-flight checks, or – keep the UA within its operational volume (e.g. GNSS, satellite systems, air traffic management, UTM).	Not applicable as STS-02 is for operations in a sparsely populated environment.

Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in SORA for SAIL II	Requirements applicable to STS-02
			External systems activated/used after the loss of control of the operation are excluded from this definition. When operating over populated areas or gatherings of people, a fatality will not occur from any probable[1] failure[2] of the UAS or any external system supporting the operation. [1] The term 'probable' needs to be understood in its qualitative interpretation, i.e. 'Anticipated to occur one or more times during the entire system/operational life of an item.' [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.	
	LEVEL of ASSURANCE		A design and installation appraisal is available. In particular, this appraisal shows that: – the design and installation features (independence, separation and redundancy) satisfy the low-integrity criterion;	Not applicable, as STS-02 is for operations in a sparsely populated environment.

Operational safety objectives (OSOs)		**SAIL II expected level of robustness**	**Criteria in SORA for SAIL II**	**Requirements applicable to STS-02**
			– particular risks relevant to the ConOps (e.g. hail, ice, snow, electromagnetic interference, etc.) do not violate the independence claims, if any.	
OSO #13 **External services supporting UAS operations are adequate for the operation**	LEVEL of INTEGRITY	Low	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. Roles and responsibilities between the applicant and the external service provider are defined.	The same considerations as provided for STS-01 apply.
	LEVEL of ASSURANCE		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 necessarily being available)	The same considerations as provided for STS-01 apply.
OSO #16 **Multi-crew coordination**	LEVEL of INTEGRITY	Low	– Criterion #1 (Procedures): A procedure (or procedures) to ensure coordination between the crew members and to ensure that robust and effective communication channels are available and at a minimum cover: – assignment of tasks to the crew, – establishment of step-by-step communications.	The same considerations as provided for STS-01 apply; however, for STS-02, more detailed information is planned to be issued in the future in the form of guidance material, for aspects such as the communications between the remote pilot and visual observers.

Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in SORA for SAIL II	Requirements applicable to STS-02
			– Criterion #2 (Training): Remote crew training covers multi-crew coordination.	
	LEVEL of ASSURANCE		– Criterion #1 (Procedures): – Procedures are not required to be validated against a recognised standard. – The adequacy of the procedures and checklists is declared. – Criterion #2 (Training): Training is self-declared (with evidence available)	The same considerations as provided for STS-01 apply.
OSO #17 **Remote crew is fit to operate**	LEVEL of INTEGRITY	Low	The applicant has a policy defining how the remote crew can declare themselves fit to operate before conducting any operation.	The same considerations as provided for STS-01 apply.
	LEVEL of ASSURANCE		The policy to define how the remote crew declares themselves fit to operate (before an operation) is documented.	The same considerations as provided for STS-01 apply.
OSO #20 **A human factors evaluation has been performed and the HMI has been found**	LEVEL of INTEGRITY	Low	The UAS information and control interfaces are succinctly presented and do not confuse, cause unreasonable fatigue, or contribute to remote crew errors that could adversely affect the safety of the operation.	The same considerations as provided for STS-01 apply. The requirement regarding the use of electronic means by the visual observer is included in the proposed point UAS.STS-02(10)(b)(v) of the IA.

<table>
<tr><th colspan="2">Operational safety objectives (OSOs)</th><th>SAIL II expected level of robustness</th><th>Criteria in SORA for SAIL II</th><th>Requirements applicable to STS-02</th></tr>
<tr><td rowspan="2">appropriate for the mission</td><td></td><td rowspan="2"></td><td>Comments/notes:
If an electronic means is used to support potential visual observers in their role to maintain awareness of the position of the unmanned aircraft, its HMI:
– is sufficient to allow the visual observers to determine the position of the UA during operation;
– does not degrade the visual observer's ability to:
  – scan the airspace where the unmanned aircraft is operating for any potential collision hazard; and
  – maintain effective communication with the remote pilot at all times.</td><td></td></tr>
<tr><td>LEVEL of ASSURANCE</td><td>The applicant conducts an evaluation of the UAS considering and addressing human factors to determine whether the HMI is appropriate for the mission. The HMI evaluation is based on engineering evaluations or analyses.</td><td>The same considerations as provided for STS-01 apply.</td></tr>
<tr><td>OSO #23 Environmental conditions for safe operations are defined,</td><td>LEVEL of INTEGRITY</td><td>Low</td><td>– Criterion #1 (Definition): The environmental conditions for safe operations are defined and reflected in the flight manual or equivalent document.</td><td>The same considerations as provided for STS-01 apply.
Moreover, the technical requirements proposed for this purpose for class C5 are also proposed for UAS to be used in STS-02 (class C6).</td></tr>
</table>

Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in SORA for SAIL II	Requirements applicable to STS-02
measurable and adhered to			– Criterion #2 (Procedures): Procedures to evaluate the environmental conditions before and during the mission (i.e. real-time evaluation) are available and include assessment of the meteorological conditions (METAR, TAFOR, etc.) with a simple recording system. – Criterion #3 (Training): Training covers assessment of the meteorological conditions.	The proposed theoretical training is the same as that proposed for STS-01.
	LEVEL of ASSURANCE		– Criterion #1 (Definition): The applicant declares that the required level of integrity has been achieved(1). (1) *Supporting evidence may or may not be available.* – Criterion #2 (Procedures): See the 'level of assurance' for operational procedures (OSO #08, OSO #11, OSO #14 and OSO #21) – Criterion #3 (Training): See the 'level of assurance' for remote crew training (OSO #09, OSO #15 and OSO #22)	The same considerations as provided for STS-01 apply.