



Explanatory Note to Decision 2022/002/R

Regular update of the acceptable means of compliance and guidance material to Regulation (EU) 2019/947 on the rules and procedures for the operation of unmanned aircraft

RMT.0730

EXECUTIVE SUMMARY

The objective of this Decision is to maintain a high level of safety for the operation of unmanned aircraft systems (UASs) in the ‘open’ and ‘specific’ categories.

Both the amended and the new AMC and GM are expected to maintain safety as regards UAS operations in the ‘open’ and ‘specific’ categories, and increase the harmonisation of UAS operations across the European Union by providing additional clarity regarding the interpretation and implementation of the related regulatory material.

The European Union Aviation Safety Agency (EASA) developed this Decision under rulemaking task (RMT).0730, which is divided into the following two subtasks:

- Subtask 1a providing:
 - new AMC and GM for the establishment of ‘geographical zones’;
 - revised forms for the application and issue of operational authorisations in the ‘specific’ category;
 - new AMC defining the procedure to be applied by UAS operators and the competent authorities for cross-border operations, including the related forms;
 - new AMC and GM for the standard scenarios (STs);
 - new AMC that provides the syllabus for training modules for remote pilots operating in the ‘specific’ category; and
 - revision of the AMC following the feedback received from national aviation authorities (NAAs) and UAS operators.
- Subtask 1b providing new predefined risk assessment ‘PDRA G-03’.

Domain:	Unmanned aircraft systems (UASs)		
Related rules:	AMC and GM to Regulation (EU) 2019/947 (‘UAS Regulation’) and to its Annex ‘UAS operations in the “open” and “specific” categories’		
Affected stakeholders:	UAS operators (private and commercial); competent authorities; EASA; remote pilots; UAS manufacturers; other airspace users (manned aircraft); general public		
Driver:	Safety	Rulemaking group	No
Impact assessment:	No	Rulemaking procedure	Standard; accelerated (only AMC6 Article 11)

EASA rulemaking procedure milestones

Start	Public consultation	Decision
Terms of Reference	NPA 2021-09	Acceptable Means of Compliance and Guidance Material
26.7.2019	14.7.2021	7.2.2022



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1. About this Decision

The European Union Aviation Safety Agency (EASA) developed Decision 2022/002/R in line with Regulation (EU) 2018/1139¹ (the ‘Basic Regulation’) and the Rulemaking Procedure².

This Rulemaking Task (RMT).0730 is included in Volume II of the European Plan for Aviation Safety (EPAS) for 2021–2025³. The scope and timescales of the task were defined in the related Terms of Reference (ToR)⁴.

The *draft* text of this Decision has been developed by EASA. It consists of two parts:

- (a) The first part (*Subtask 1a*) has been developed based on the feedback received from the EASA Member States (MSs) and stakeholders since the publication of Decision 2019/021/R⁵, which amended the AMC and GM to Regulation (EU) 2019/947⁶ (the UAS Regulation) and to its Annex. All the interested parties were consulted⁷ through Notice of Proposed Amendment (NPA) 2021-09⁸. Comments were received from interested parties, including industry, national aviation authorities (NAAs), UAS operators and associations. The NPA was consulted for 3 months, and more than 1 000 comments were submitted by 115 users. The NPA proposed amendments to several topics, including AMC1 Article 11 (SORA) to Regulation (EU) 2019/947. Some topics were considered particularly time critical in order to facilitate a harmonised approach to UAS operations throughout the EU (e.g. NAAs are currently in the process of developing geographical zones); therefore, it was decided to split the topics and issue two Decisions. The present Decision addresses all the amendments except those that affect AMC1 Article 11 (SORA) to Regulation (EU) 2019/947. A second Decision is intended to be published by 2022/Q2 with the amendments to AMC1 Article 11 to Regulation (EU) 2019/947. The comments received and EASA’s responses to them will be presented in Comment-Response Document (CRD) 2021-09 that will be published with the second Decision.
- (b) The second part (*Subtask 1b*) includes the predefined risk assessment PDRA G-03 developed by the Joint Authorities for Rulemaking on Unmanned Systems (JARUS) and consulted through the

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/document-library/general-publications/european-plan-aviation-safety-2021-2025>

⁴ ToR RMT.0730 Issue 1 (<https://www.easa.europa.eu/document-library/terms-of-reference-and-group-compositions/tor-rmt0730>).

⁵ Executive Director Decision 2019/021/R of 9 October 2019 issuing Acceptable Means of Compliance and Guidance Material to Commission Implementing Regulation (EU) No 2019/947 ‘Rules and procedures for the operation of unmanned aircraft’ (<https://www.easa.europa.eu/document-library/agency-decisions/ed-decision-2019021r>).

⁶ 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%3A32019R0947&qid=1642535430484>).

⁷ In accordance with Article 115 of Regulation (EU) 2018/1139, and Articles 6(3) and 7 of the Rulemaking Procedure.

⁸ <https://www.easa.europa.eu/document-library/notices-of-proposed-amendment/npa-2021-09>



JARUS website. All comments, including those provided by European stakeholders, were addressed and EASA participated in its disposition.

The *final* text of this Decision and of the related AMC and GM has been developed by EASA on the basis of the inputs received during the public consultation.

The major milestones of this RMT are presented on the cover page.



2. In summary — why and what

2.1. Why we need to amend the AMC and GM — issue/rationale

Regulation (EU) 2019/947 (the UAS Regulation) lays down harmonised rules and procedures for UAS operations in the ‘open’ and ‘specific’ categories across the European Union (EU) with the objective to foster the development of the UAS market in the EU. The EASA Member States (MSs) are responsible for implementing that Regulation and for issuing authorisations for UAS operations in the ‘specific’ category. Decision 2019/021/R of 9 October 2019 issued the first issue of the AMC and GM for the implementation of the UAS Regulation, thus facilitating the regulatory harmonisation among the EASA MSs.

However, since the publication of that first issue of the AMC and GM, the following developments have taken place, which require the amendment of some of the AMC and GM and the introduction of new ones:

- AMC and GM to establish UAS geographical zones in line with Article 15 ‘Operational conditions for UAS geographical zones’ of the UAS Regulation have been developed by a task force created by the Member States Advisory Board (MAB);
- feedback has been received by stakeholders on the forms for the application and issue of operational authorisations, requesting their update;
- stakeholders have requested the development of an AMC that describes the approval process for cross-border UAS operations, the related application form, and the form to be used by the competent authority for confirming that the operation is permitted to take place;
- Regulation (EU) 2020/639⁹ introduced the first two standard scenarios (STs), for which new AMC and GM needed to be developed;
- EASA, with the support of JARUS and the EASA MSs, has developed new training modules to be used by UAS operators when defining the competence of remote pilots that operate in the ‘specific’ category;
- feedback has been received from the EASA MSs requesting the improvement of some AMC and GM, and the introduction of new ones, to provide for a uniform interpretation and harmonised implementation of the rules; and
- a new predefined risk assessment that was developed by JARUS.

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 Decision will contribute to achieving the overall objectives by addressing the issues described in Section 2.1.

The specific objectives of this Decision are, therefore, to:

- increase safety, efficiency, and harmonisation of the implementation of the UAS Regulation;

⁹ Commission Implementing Regulation (EU) 2020/639 of 12 May 2020 amending Implementing Regulation (EU) 2019/947 as regards standard scenarios for operations executed in or beyond the visual line of sight (OJ L 150, 13.5.2020, p. 1) (<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32020R0639&qid=1642589306974>).

- support the harmonised implementation of the published STSs across the EASA MSs;
- improve some of the AMC and GM and introduce new ones for a consistent interpretation and harmonised implementation of the rules;
- introduce new AMC and GM for the establishment of UAS geographical zones; and
- foster the development of the UAS market in the EU.

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

2.3.1 AMC and GM to Article 2 ‘Definitions’

In the next paragraph, the major changes compared to the text proposed in NPA 2021-09 are described. The changes are the result of the comments received on the NPA during its public consultation.

Definition of ‘dangerous goods’

GM1 to Article 2(11) has been revised to clarify that articles and substances required to be on board the aircraft for the propulsion of the UAS or for the operation of its equipment, which would be classified as dangerous goods (e.g. fuel, batteries and other goods used during flight to supply energy to the drone’s system), should not be considered as transported dangerous goods. In this case, their safety is verified during the design verification of the UAS.

In AMC1 to Article 5, a clarification has been added on the use of a crashworthy container for the transport of dangerous goods in the ‘specific’ category and on the need to establish and maintain a training programme as required by the ICAO *Technical Instructions*.

Definition of ‘privately built UASs’ and modification to UASs that bear class identification labels

Following several comments received on GM2 UAS.OPEN.040(4) on the impact on changes to UASs that bear a class identification label, a new GM1 Article 2(16) clarifying the definition of ‘privately built UAS’ has been added.

Some stakeholders have asked the reason why a modification to a UAS invalidates the class identification label not allowing to operate the UAS even in subcategory A3, while in this subcategory privately built UASs (without any class identification label) are allowed. The reason is in the definition of ‘privately built UAS’, meaning that such UASs are assembled or manufactured by the UAS operator for its own use. In order to build a privately built UAS, individuals need to have the technical knowledge and, therefore, it is assumed that they are able to assess the impact of a change. Individuals that buy a commercial UAS instead, normally do not have access to design data and they may not be able to assess the impact of the change and potentially they may impair some of its safety features.

The new GM1 to Article 2(16) clarifies that a change to a commercial UAS does not make it a ‘privately built UAS’. Modifications to UASs with class identification labels are only possible when they are described in the manufacturer instructions. This applies to the replacement of parts or the installation of payload.

However, for UASs with class identification label C4, since the UAS Regulation does not establish any technical requirement (it only focuses on the availability of appropriate manufacturer’s instructions), modifications do not breach the compliance of the UAS with the class identification label. Therefore,



a modified UAS with class identification label C4 may be continued to be operated in the ‘open’ subcategory A3.

Definition of ‘uninvolved persons’

GM1 to Article 2(18) has been amended to clarify that persons protected under a shelter are considered ‘uninvolved persons’. The sentence that requires that the uninvolved person should only focus on the UAS operation has been deleted following several comments received. It has been replaced by a clarification that the UAS operator is responsible for ensuring that all persons involved are able to follow in a timely manner the emergency procedures.

Definition of ‘controlled ground area’, ‘operational volume’, and other related definitions

The definition of ‘controlled ground area’ has been separated from the others, and it has been included in the new GM1 to Article 2(21).

The other definitions have been amended to specify that the UAS operator should also consider the UA positioning errors.

2.3.2 Predefined risk assessments (PDRAs)

Changes to existing PDRAs

The new structure of the PDRA, including the two new columns where the UAS operator should describe how they meet the integrity and assurance of each condition, has been positively commented by the stakeholders. Several commentators requested to even better specify in these new columns what is expected from the UAS operator. Therefore, in the column ‘integrity’, for each requirement, the information the UAS operator is expected to fill in to show compliance has been added. The column ‘proof’ has been prefilled with the declaration or the additional elements expected. Appropriate instructions have been added in GM1 Article 11. In addition, it has been clarified that if an operation does not fit completely in a PDRA, the UAS operator should carry out a full risk assessment, unless the NAA explicitly consents to making minor changes to the PDRA.

It has also been requested to list in the PDRAs all the applicable requirements, avoiding referring to other points in the UAS Regulation, which anyway imposes an additional burden to the UAS operator. Therefore, in Section 4 of all PDRAs, where the UAS operator was required to comply with the additional requirements listed in point UAS.SPEC.050, the reference to this point has been removed and the requirements has been added in the PDRAs. Similar to the remote pilot responsibilities in Section 5, the reference to point UAS.SPEC.050 has been deleted and the applicable requirements have been listed in the PDRAs.

In addition, in PDRA G-01, some adjustments have been made to improve consistency with the other PDRAs, namely:

- it has been specified that it should not be used for operations that involve dropping of material;
- if the operation is limited at a height below 120 m, no additional vertical air risk buffer is needed;
- the C2 link should be protected against unauthorised access; and

- it has been specified that a reliable and predictable method to recover the command-and-control link of the UA should intervene in case of a loss of the C2 link, or a flight termination system should be present.

In PDRA G-02, some adjustments have been made to improve consistency with the other PDRA, namely:

- it has been clarified that the range for this PDRA is the one defined by the C2 link (radio line of sight); however, as soon as experience is gained with the use of other technologies, the range may be extended;
- designate for each flight a remote pilot with adequate competency and other personnel in charge of duties essential to the UAS operation if needed;
- the C2 link should be protected against unauthorised access; and
- it has been specified that a reliable and predictable method to recover the command-and-control link of the UA should intervene in case of a loss of the C2 link, or a flight termination system should be present.

In PDRA S-01 and S-02, it has been clarified that the UAS operator may use either a UAS with a class identification label C5 or C6 respectively, or a UAS without a class identification label but compliant with some of their technical requirements. Section 4.2 has been removed since most of the conditions were repetitions and the relevant ones have been placed in the appropriate section.

In PDRA S-02, the requirement to establish an air risk buffer when the operation is conducted at a height between 120 and 150 m has been added. Moreover, it has been specified that the ground risk buffer should cover a distance that is at least equal to the distance most likely to be travelled by the UA after activation of the flight termination system specified by the UAS manufacturer's instructions.

New PDRA G-03

A new PDRA G-03 has been included as AMC in Amendment 2 to Issue 1.

In line with the approach followed for the development of the already published PDRA and considering the limited experience gained so far, it was deemed necessary to keep the intrinsic risk of these operations low, so that the final SAIL is not higher than SAIL II. Once more experience is gained, PDRA for higher-risk operations might be proposed. The PDRA is based upon the SORA version 2.0 and any future changes to this SORA version may lead to changes of the provision in this PDRA. Details on how the SORA has been applied can be found in Appendix 1 to this Explanatory Note.

The development of PDRA G-03 was triggered by the request from some EASA MSs to facilitate operational authorisations for UAS operations for routine and automated surveillance and inspection of facilities and infrastructures, with the UA flying very close to such facilities and infrastructures. These types of UAS operations are characterised by the shielding provided by the artificial obstacles of facilities and infrastructures that qualifies the airspace where the UA flies as 'atypical', since no manned aircraft is expected to fly so close to those obstacles. The maximum distance from facility and



infrastructure obstacles (or from natural obstacles in the area) is established to 30 m, following the criteria discussed within JARUS and already applied in some national standard scenarios¹⁰.

This PDRA may be used also for very low-level operations (below 30 m), and for reserved or segregated airspace that also qualifies as ‘atypical’ airspace.

PDRA G-03 covers, therefore, linear inspections and operations conducted at a height (flight geography) less than 30 m above the overflown surface of the Earth (see Figure 1). Such a low height ensures that the probability of encounter with manned aircraft is negligible even if the UAS does not fly close to objects.

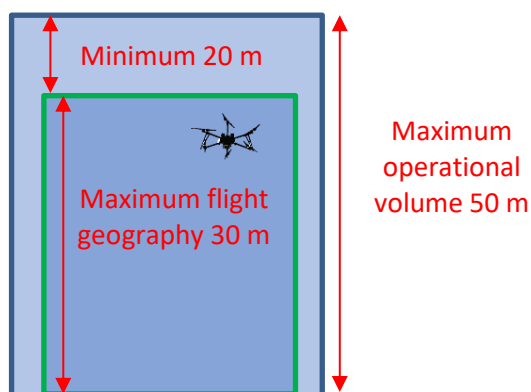


Figure 1 — Flight geography

For this kind of operation, the contingency volume should be set at least to 20 m, making the height of the operational volume (e.g. flight geography plus the operational volume) limited to 50 m, which is consistent with (and, in some cases, a bit more conservative) the maximum height in some States for BVLOS operations¹¹.

If the operation is conducted in close proximity (within 30-m distance) to a higher obstacle, the height limitation can be increased up to (see Figure 2):

- 30 m above the obstacle, if it is below 20 m; or
- 15 m above that obstacle, if it is above 20 m.

This approach is consistent with the ‘open’ category and the ‘standard scenarios’ (STSs).

¹⁰ Standaard scenario's — STS-2A-CAA-NL-CONGESTED-CLOSEPROX-V1.4 'Standard Scenario (STS) — UAS OPERATIONS IN CLOSE PROXIMITY AND ABOVE AN OBJECT WITHIN AND OVER CONGESTED AREAS' (<https://www.ilent.nl/documenten/publicaties/2019/2/7/standaard-scenarios-sts-2a-caa-nl-congested-closeprox-v1.4>).

¹¹ E.g. French scenario S-2 limits the height to 50 m above the Earth's surface for operations with UA with an MTOM above 2 kg, as there are low-level flights of military aircraft across the French territory.

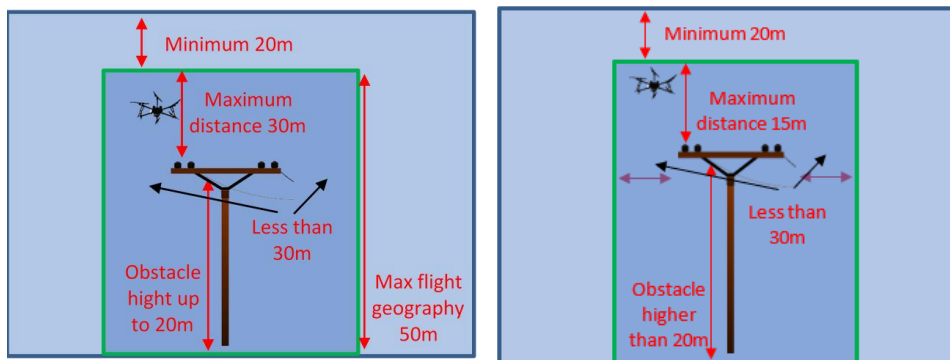


Figure 2 — Flight geography in case of inspection of an obstacle higher than 30 m

These restrictions on the airspace allow operators to use an automated UAS, conducting the UAS operation according to a preprogrammed path uploaded onto the flight control system of the UA. The intervention of the remote pilot may be reduced up to only start and interrupt the operation if needed. In this last case, the UAS will automatically return to the home position predefined by the UAS operator. This provides the ability to perform the BVLOS operation at very low level (below 30 m from the ground) or very close to obstacles and in a very small operational volume. As an alternative to conducting the operation using preprogrammed paths defined before take-off, the operation may be performed using preplanned flexible routes with a UA which through sensors and/or remote pilot intervention is capable during flight of avoiding obstacles while staying within the intended operational volume.

Given the current lack of relevant experience in the use of communication services to extend the C2 link coverage through communication networks (e.g. mobile networks) for the type of UAS operations addressed by this PDRA, the scope of the PDRA has been initially limited to the coverage of a direct C2 link (direct link between the control station and the UA). Once more experience is gained with the use of those services, this PDRA might be revised to encompass their use with the introduction of the appropriate conditions.

The main characteristics of the operation covered by this PDRA are summarised below:

- (1) operate a UA with maximum characteristic dimensions¹² up to 3 m and typical kinetic energy up to 34 kJ;
- (2) over sparsely populated areas;
- (3) at very low level, as described above;
- (4) operated in BVLOS within the range of a direct C2 link;
- (5) the operation should be limited to preprogrammed or preplanned flexible routes, which decrease the risk of collision with obstacles (given the short distance to those), allowing for a better protection of third parties on the ground, also due to prior knowledge of the routes (thus avoiding overflight above people).

In addition to the above limitations, the main conditions are the following:

¹² E.g. wingspan, rotor diameter/area or in case of a multirotor, the maximum distance between the rotors.

- UA range limit: as in previous PDRAs for BVLOS operations, the launch/recovery should be conducted in VLOS distance from the remote pilot, if the remote pilot does not operate from a safe prepared area¹³. As mentioned before, the range is limited in flight by the use of a direct C2 link, keeping operations within its coverage so that the safe conduct of the flight is ensured. Given the current lack of relevant experience in the use of communication services to extend the C2 link coverage through communication networks (e.g. mobile networks) for the type of UAS operations addressed by this PDRA, the scope of the PDRA has been initially limited to the coverage of a direct C2 link (direct link between the control station and the UA). Once more experience is gained with the use of those services, this PDRA might be revised to encompass their use with the introduction of the appropriate conditions.
- Ground risk: in addition to the conditions included in previous PDRAs, the UAS operator should ensure that the person or the entity responsible for the facility or infrastructure over which the operation takes place, has taken the necessary measures to protect the uninvolved persons present within its limits during the entire UAS operation.
- Air risk: in addition to the limitations previously mentioned to ensure that the airspace can be considered 'atypical', other limitations are also considered to further reduce the likelihood of airspace users in the vicinity, i.e. including that UAS operations are away from known or potential areas for take-off and landing, transit or operational areas of other airspace users. Advance notification of the intended UAS operations to the identified potential airspace users in the vicinity is also part of the proposed method to reinforce a low probability of encounter and to potentially increase the ratio of 'cooperative' aircraft. In case of operations in reserved or segregated airspace, the claim for ARC-a is met if that airspace is established and approved for the purpose of the UAS operation under this PDRA, with the operational volume and air risk buffer entirely contained in that airspace. In addition, the UAS operator should establish an air risk buffer if there is adjacent airspace classified as ARC-d (the likelihood of encounter with another aircraft in that airspace is high) or if the competent authority or the entity responsible for the airspace management considers it necessary to establish such buffer. Moreover, in addition, prior to the flight, the UAS operator should assess the proximity of the planned UAS operation to manned aircraft activity.
- UAS operator and UAS operations conditions: same conditions as in previous PDRAs.
- Technical conditions: in addition to the conditions in previous PDRAs, specific conditions are included considering that the UA flies close to obstacles: the UAS performance, in particular its position-keeping capabilities, should allow flying safely close to those obstacles, and the UAS should be protected against potential electromagnetic interference from the infrastructure/facilities in the overflown area. Besides, conditions for enhanced containment related to adjacent airspace (i.e. SORA Step# 9 point (c)) are also applied when such airspace can be classified as ARC-c (and not only ARC-d, as per the SORA criteria), in order to ensure that the design of the UAS and of any external system that supports the operation can provide enough assurance of containment within the operational volume. Given that BVLOS operations under this PDRA rely on being conducted in 'atypical airspace' (based on the limitations

¹³ 'Safe prepared area' means a controlled ground area that is suitable for the safe conduct of the launch/recovery of the UA.

indicated above) and in line with the SORA criteria, no tactical mitigations addressing the air risk are required.

2.3.3 Operational authorisation forms and cross-border UAS operations

The forms to apply for an operational authorisation and its issuance, proposed in the NPA, have been amended to simplify the effort required by the UAS operator to fill them in, by introducing more prefilled answers with check boxes. The operational authorisation application form has been kept short to reduce the information to the minimum, focusing on those that may help the authority receiving the application to quickly identify the unit in charge of evaluating the proposed operation. The definition of the information included in the form for the issuance of the authorisation was based on the information needed in support of a cross-border operation (an operation conducted in a MS other than the State of registration). As a matter of fact, in this case, the NAA of the MS of operation will only receive a copy of the operational authorisation issued by the MS of operation, the identification of the new locations where the operation is intended to be conducted and, if applicable, the revised procedures and adaptations of the risk assessment. So, the form for issuing the operational authorisation contains all the information that is needed for the NAA of the MS of operation to assess the acceptability of the operation in the new location.

The forms in support of UAS cross-border operations have also been lightly amended, mostly to maintain consistency with the other forms. The description of the process for applying for a cross-border UAS operation was improved by clarifying that an organisation that has a LUC may self-authorise the operation in the new location if the privileges defined in the LUC's terms of reference allow so.

Lastly, GM2 UAS.SPEC.030(2) has been introduced to clarify the conditions when the locations in the operational authorisation should be defined in a 'generic' or 'precise' way.

2.3.4 AMC and GM to Article 15 — Operational conditions for UAS geographical zones

With the support of the UAS Geographical Zones Task Force, EASA has developed a new set of AMC and GM to support Member States with the establishment of UAS geographical zones. This section attracted several comments, and following the major changes compared to the text published in NPA 2021-09 are described.

GM1 Article 15 — Means to inform manned aviation of UAS geographical zones

Following the inputs received from some commentators, the text initially proposed in GM2 Article 15(2) on the means to inform manned aviation of UAS geographical zones has been moved to new GM 1 Article 15, considering that for its importance for safety it should be at the upfront. The text has been amended to specify that EASA MSs may use AIPs and NOTAMs, as deemed appropriate, to inform manned aviation. However, for temporary zones, NOTAMs may be used whereas for zones with longer duration, a publication in the AIP is more appropriate.

AMC2 Article 15(1) 'Data integrity'

The text initially proposed in GM3 Article 15(1) has been transposed into new AMC2 Article 15(1) with amended text to clarify that when UAS geographical zones' data is processed, 'data integrity' as the minimum needs to be ensured.

GM3 Article 15(1) ‘Data quality’

This GM, in the consulted version, was explaining the requirements related to data quality for the cases of the location of a UAS geographical zone located either within or beyond controlled airspace. Following the comments received, in the new version the examples have been dedicated to the case where a UAS geographical zone is of relevance to manned aviation and to the case of relevance to UAS operations only.

GM1 and 2 Article 15(2) ‘Exemption from one or more of the ‘open’ category requirements’

Former ‘AMC1 Article 15(2)’ has been amended to ‘GM1 Article 15(2)’ since the text provides an explanation of the requirement. The content has been kept; however, it has been reworded to improve clarity.

The text of GM2 Article 15(2) has been improved, making it clearer that exemptions may also apply to categories other than the ‘open’ category.

AMC1 Article 15(3) ‘Common unique digital format’

This AMC, in its initial version, identified Chapter 8 of ED-269 as the acceptable standard for the common unique digital format; however, this chapter refers only to the data model. It was requested to also add a reference to the section related to the format, that is ‘Appendix 2 — INFORMATION DEFINITION AND DATA STRUCTURES’.

AMC2 Article 15(3) ‘PUBLICATION OF INFORMATION ON UAS GEOGRAPHICAL ZONES IN THE AERONAUTICAL INFORMATION PRODUCTS AND SERVICES

In order to clarify that there is no contradiction between ICAO Doc 10066 and Regulation (EU) 2020/469 (and related ED Decision 2020/008/R), the revised version of this AMC refers to ‘aeronautical information products and services (the official Annex 15 term) instead of ‘AIP’ only.

AIP tables in which UAS geographical zones data might need to be published are allowed to be empty if equivalent data is provided in digital data sets. AIS products and services include AIP and data sets.

AMC3 Article 15(3) ‘Cross-border UAS geographical zone(s)’

As a result of the consultation, it has been decided that all affected neighbouring EASA MSs should make data available for the entire cross-border UAS geographical zone and not for the part of the cross-border UAS geographical zone that is located in their own territory only.

GM1 Article 15(3) ‘Publication of maps on UAS geographical zones’

The majority of the comments received proposed to keep this guidance on the publication of maps in addition to making the data available in the common unique digital format.

Additional explanation has been included to make it clearer that the example provided represents the approach developed by one MS in a way which is proven to be compliant with the ED-269 standard. It is offered as guidance so that other EASA MSs may follow to achieve a harmonised publication of the UAS geographical zones.

Further, it makes it clear that such maps are not intended to be used by manned aviation but by UAS operators which in general are non-ATM professionals. The content of the first two paragraphs of the

proposed GM was in fact providing an acceptable means of compliance; therefore, it has been moved into new AMC4 Article 15(3).

2.3.5 Training of personnel

There was a general support of the changes introduced in the NPA.

- For the theoretical knowledge required for remote pilots that conduct the online training, some more details on the knowledge of geographical zones have been added, including the upload of geographical zones. Moreover, the knowledge required to ensure a safe separation with other traffic in VLOS has been added. This last addition was based on a comment from the FAA and will help also to harmonise the knowledge required for remote pilots that operate in VLOS between EASA MSs and the US.
- Regarding the proposed new format of the certificate of remote pilot for the ‘open’ category and STSs, no comment was received; so, the forms proposed in the NPA are now included in Annex I to the Decision.
- The proposed methodology for conducting exams in subcategory A2 (face-to-face or online proctored) also received few comments; so, the approach can be considered now final. The NPA proposes four elements a proctored system should have. It has been decided to remove the last two since they were considered welcome but not essential.
- The practical-skills self-training for remote pilots that intend to operate in subcategory A2 received several comments. Few stakeholders expressed the opinion that the practical-skills self-training should include training in emergency situations by inducing failures (e.g. disconnect the GPS system), even if such training should be done under the supervision of an expert pilot. It was considered that this proposal would depart from the original approach defined for remote pilots in the ‘open’ category A2. So, it was decided to include in the training the simulation of abnormal conditions, avoiding disconnecting some safety functions of the UAS.
- The AMCs related to training for the remote pilots that operate in the ‘specific’ category also received a general support. It is recognised that more guidance needs to be developed, and EASA will work on this with the support of its MSs.
- A few changes have been introduced in those AMCs and in particular to consider that the UAS operator may adapt the training depending on the level of automation of the UAS and should also consider additional theoretical topics on privacy, security and data protection, based on the national regulations of the MS of operations. For the practical topics, it has been specified that appropriate simulators may be used to conduct some or all the tasks.

2.3.6 Other amendments

The following AMCs and GM have been amended or added:

- A new GM has been introduced to clarify that in the ‘open’ category hand over of the control unit to another remote pilot during flight is not permitted.
- AMC2 UAS.SPEC.030(3)(e) has been slightly amended: the paragraph related to crew resource management (CRM) training has been deleted since in reality this is covered by OSO Step# 16; to specify that the dedicated flight test should be conducted in an area with reduced air and



ground risk and to require the identification of the configuration of the UAS hardware and software.

- AMC1 UAS.STS-02.050(2) has been introduced to define that an aerial observer (AO) employed for operations in STS-02 may maintain awareness of the UA position by using a system that is compliant with the requirement defined in Part 17(3) of Regulation (EU) 2019/945.

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

The topics that attracted most of the comments were the following:

- UAS geographical zones;
- definition of 'uninvolved person';
- definition of 'populated area';
- transport of dangerous goods;
- changes to PDRA S-01 and S-02 to increase the operational volume up to 150 m;
- authorisation process in the 'specific' category and cross-border UAS operations;
- training for remote pilots in the 'specific' category;
- amendments to AMC1 Article 11 'SORA' to Regulation (EU) 2019/947 (the amendments related to this topic will be issued with Decision #2, to be published in 2022/Q2).

In Section 2.3, an overview of the comments driving a change of the AMC and GM has been provided.

Some additional major comments to report are the following:

- Definition of uninvolved people: some commenters asked if personal safety protections like helmets could be used in order to protect involved persons. Since in the open category UAS up to 25 kg are allowed and considering that a drone may have a horizontal speed when impacting a person that may cause some damages to the neck, this option was considered as not appropriate. However, as discussed in Section 2.3, the GM has been simplified allowing the operator to identify safety measures to protect the involved persons (such as put in place an effective alarm system allowing the person to identify the threat and protect themselves).
- Changes to PDRA S-01 and S-02 to increase the operational volume up to 150 m: some commentators were concerned that such changes make the PDRAs different from the operational limitations of the STSs (where they derive from) and could be detrimental to safety. It is EASA's opinion that these PDRAs provide all the required additional conditions in terms of establishing an air risk buffer and deliver additional training to remote pilots when the operation is conducted up to 150 m. Being a PDRA subject to an operational authorisation, the competent authority will be required to review that the safety measures proposed by the UAS operator are sufficient to increase the height of the operation above 120 m. As a general rule for the 'open' category and STSs, a 30-m air risk buffer is always imposed making the flight geography limited to 120 m. However, for the 'specific' category, the SORA air risk model uses the threshold of 150 m for the operational volume to classify the air risk, and an air risk buffer may be added depending on the condition under which the operation takes place.

- Training of the UAS operator in the ‘specific’ category: even if the proposed amendments were substantially welcome, several commentators have requested EASA to provide additional AMC and GM to facilitate a uniform implementation throughout the EASA MSs. EASA supports this and a drafting activity will start as soon as possible in order to develop additional material that will be published in one of the next revisions of the related AMC and GM.
- Definition of ‘populated area’: several commentators have requested EASA to provide additional guidance for the quantitative assessment of the population density. EASA with the EU MSs is highly involved in the JARUS activities to develop a new SORA version (v. 2.5) that will not change the overall concept but will introduce some clarifications and a quantitative methodology for evaluating the ground risk (defining thresholds in terms of population density). It is expected that this document will be publicly consulted during 2022/Q2. The JARUS website¹⁴ will be used to carry out the consultation. Once this phase is concluded, EASA will consider introducing the outcome into the EU regulatory framework.
- AMC and GM to Article 15 — Geographical zones: the NPA contained four questions to stakeholders to receive feedback to be used to develop the text of the related Decisions. The questions were related to aeronautical data quality, the means to inform manned aviation on geographical zones where exemptions may apply to UASs, what parts of data MSs should make available in case of cross-border UAS geographical zones, and the usefulness of examples of maps. Apart from the first question on aeronautical data quality, the responses received provided clear feedback and indicated what the majority of the MSs expects from these AMC and GM. Related to the issue of aeronautical data quality and its applicability to all kinds of geographical zones, the responses indicated that MSs’ positions did not indicate a common view. EASA decided to apply the smallest common denominator and leave flexibility to MSs as far as possible for this first version of these AMC and GM. Further harmonisation and standardisation will be the aim and being implemented gradually in the next revisions of this AMC/GM.

Detailed answers to the individual comments will be provided in the CRD to NPA 2021-19, which will be published in 2022/Q2, together with Decision #2 issuing the amendments to AMC1 Article 11 (SORA) to Regulation (EU) 2019/947.

2.5. What are the benefits and drawbacks of the amendments

Based on the amendments to the AMC and GM to the UAS Regulation, the harmonised implementation of several elements will be fostered:

- EASA MSs will be able to publish UAS geographical zones in a common unique digital format so that UAS operators can identify the area(s) within which UAS operations are allowed.
- A new PDRA is expected to benefit UAS operators and competent authorities by facilitating the application for and issue of operational authorisations for a considerable number of common UAS operations.

¹⁴ <http://jarus-rpas.org/>

- UAS operators will use the same form when applying for an operation authorisation in different EASA MSs, and consequently for EASA MSs to issue the operational authorisation. The same applies for cross-border UAS operations.
- The identification of the competency necessary to ensure the safe operation of UASs in the 'specific' category.

Additionally, the amendments to the published PDRAs provide a simplification for UAS operators by including in the PDRAs all the other requirements derived from points of the UAS Regulation, other than the SORA, and providing indication of what information should be provided to show compliance.

No drawbacks have been identified.



3. How we monitor and evaluate the amended AMC and GM

Monitoring is a continuous and systematic process of data collection and analysis about the implementation/application of a rule/activity. It generates factual information for future possible evaluations and impact assessments; it also helps to identify actual implementation problems.

During standardisation meetings and audits to NAAs, EASA will verify the application of the AMC and GM, and will collect feedback to be considered for possible future amendments.

The following indicators will be checked:

What to monitor	How to monitor	Who should monitor	How often to monitor
Occurrences, incidents, and accidents involving UASs that conduct BVLOS operations over populated areas and assemblies of people	European Co-ordination Centre for Accident and Incident Reporting Systems (ECCAIRS)	EASA and/or NAAs	On a regular (e.g. yearly) basis

4. References

4.1. Related EU regulations

- 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)
- Commission Implementing Regulation (EU) 2020/639 of 12 May 2020 amending Implementing Regulation (EU) 2019/947 as regards standard scenarios for operations executed in or beyond the visual line of sight (OJ L 150, 13.5.2020, p. 1)

4.2. Related EASA decisions

- Executive Director Decision 2019/021/R of 9 October 2019 issuing Acceptable Means of Compliance and Guidance Material to Commission Implementing Regulation (EU) 2019/947 'Rules and procedures for the operation of unmanned aircraft'

4.3. Other reference documents

- 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)



5. Appendix: Risk assessment for PDRA-G03

The following risk assessment has been conducted by applying the specific operations risk assessment (SORA) (AMC1 to Article 11) to PDRA-G03.

5.1. Step #1 — Description of the concept of operations (ConOps)

UAS operators that intend to perform UAS operations under this PDRA should elaborate a concept of operations (ConOps) and describe it in the operations manual (OM) (see AMC1 UAS.SPEC.030(3)(e) in Chapter 3 of the Explanatory Note). This ConOps needs to fit the operational limitations defined in this PDRA.

As part of the ConOps, the UAS operator should define the required operational volume and risk buffers (ground and air risk buffers).

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

The initial UAS ground risk relates to the unmitigated risk of a person being struck by the UA (in case of a loss of control of the UAS) and can be represented by the ground risk classes (GRCs) derived from the intended UAS operation and the UAS lethal area, as shown in Table A1 below.

Intrinsic UAS ground risk class (GRC)				
Maximum UAS characteristic dimension	1 m / approx. 3 ft	3 m / approx. 10 ft	8 m / approx. 25 ft	> 8 m / approx. 25 ft
<i>Typical kinetic energy expected</i>	<i>< 700 J (approx. 529 ft lb)</i>	<i>< 34 KJ (approx. 25 000 ft lb)</i>	<i>< 1 084 KJ (approx. 800 000 ft lb)</i>	<i>> 1 084 KJ (approx. 800 000 ft lb)</i>
Operational scenarios				
VLOS/BVLOS over controlled ground area	1	2	3	4
VLOS in sparsely populated environment	2	3	4	5
BVLOS in sparsely populated environment	3	4	5	6
VLOS in populated environment	4	5	6	8
BVLOS in populated environment	5	6	8	10
VLOS over gathering of people	7			
BVLOS over a gathering of people	8			

Table A1 — Determination of the intrinsic UAS ground risk class (GRC)

From the limitations defining the proposed PDRA:

- operational scenarios: BVLOS over sparsely populated environment (overflowed areas uniformly inhabited with low-density population);
- UA characteristics:
 - up to 3 m of characteristic dimensions (e.g. wingspan or rotor diameter);
 - maximum typical kinetic energy expected: 34 kJ.

Thus, the maximum **intrinsic UAS GRC = 4**.

5.3. Step #3 — Determination of the final GRC

For this PDRA, only the following mitigations for the final GRC determination are considered:

- M1 — Strategic mitigations for ground risk with a ‘low’ level of robustness and, consequently:
 - Integrity:

Criterion #1 (definition of the ground risk buffer)

As per point 3.4.1 of Table PDRA-G03.1, the UAS operator should define a ground risk buffer following at least the ‘1:1 rule’. For example, if the UA is planned to operate at a height of 25 m, the ground risk buffer should be at least 25 m.

Criterion #2 (evaluation of people at risk)

As per point 3.6 of Table PDRA-G03.1, the UAS operator should evaluate the area of operations typically by means of an on-site inspection or appraisal, and should be able to justify a significant lower density of people at risk within the entire operational volume.

As per point 3.7 of Table PDRA-G03.1, the UAS operator should ensure that the person or entity responsible for that facility or infrastructure has taken the necessary measures to protect the uninvolved persons present within the limits of the facility or infrastructure.

Note: The control by the facility/infrastructure management is typically done through means like fencing, surveillance systems (e.g. CCTV), ground observers, etc.
 - Assurance:

The UAS operator should declare that the required level of integrity has been achieved for the above-indicated integrity criteria. Supporting evidence may or may not be available.
- M3 — An emergency response plan (ERP) should be in place, operator validated and effective with a ‘medium’ level of robustness. As per point 4.1.2 of Table PDRA-G03.1, the UAS operator should develop an ERP in accordance with the conditions for a ‘medium’ level of robustness included in AMC3 UAS.SPEC.030(3)(e).



Consequently, as highlighted in Table A2, the **final GRC is 3**.

Mitigation Sequence	Mitigations for ground risk	Robustness			Correction
		Low / None	Medium	High	
1	M1 — Strategic mitigations for ground risk ¹⁵	0: None - 1: Low	- 2	- 4	- 1
2	M2 — Effects of ground impact are reduced ¹⁶	0	- 1	- 2	0
3	M3 — An emergency response plan (ERP) is in place, operator validated and effective	1	0	- 1	0
Total correction					- 1

Table A2 — Mitigations for the final GRC determination

5.4. Steps #4 to #6 — Air risk assessment

This PDRA is intended for UAS operations conducted in airspace where manned aircraft normally cannot operate — thus, considered ‘atypical’ airspace —, or in airspace reserved /segregated for the purpose of that operation.

In particular, this PDRA focuses on those UAS operations where the UA flies very close to the facilities or infrastructure targeted by the operation (e.g. surveillance or inspection of an industrial plant) and, therefore, such artificial obstacles provide the ‘shielding’ that allows the airspace where the UA flies to be considered as ‘atypical’, since no manned aircraft can be expected to fly that close to those obstacles.

Thus, the main issue is establishing how close from obstacles the UA must remain to ensure that the likelihood of encountering a manned aircraft is negligible, while not imposing a too conservative limitation could make this PDRA impractical for most UAS operators.

It is also important to note that this PDRA encompasses routine UAS operations, which drives the need for a rather conservative approach. Indeed, events like a HEMS flying in the proximity of a UAS operation at very low level may not be that seldom if that UAS operation is being conducted regularly.

Considering the above, a maximum lateral distance of 30 m from the obstacle and a maximum height of 15 m above the obstacle (or 30 m above the obstacle with a maximum height of 20 m) is established in this PDRA based on the following:

- JARUS experts contributing to the air risk model in the SORA indicated that airspace within 100 ft (30 m) from buildings or structures would be a reasonable example for ‘atypical’ airspace under the above-mentioned criterion of ‘airspace where manned aircraft normally cannot operate’.
- Some MSs have already implemented that recommended distance, e.g. Dutch standard scenario STS-2A-CAA-NL-CONGESTED-CLOSEPROX-V1.47.

¹⁵ This mitigation is meant as a means to reduce the number of people at risk.

¹⁶ This mitigation is meant as a means to reduce the energy absorbed by the people of the ground upon impact.

- With regard to height above obstacles, this PDRA considers the 15-m limitation that the UAS Regulation allows to overfly obstacles taller than 120 m in operations in the ‘open’ category or in the ‘specific’ category under standard scenarios (i.e. STS-01 and STS-02). Therefore, a more conservative approach for the height has been considered than in the above-mentioned examples, which is expected to be reasonable at this initial stage when there is not enough experience yet with this type of UAS operations. Furthermore, as indicated above, the fact that this PDRA covers routine UAS operations reinforces the need for a more conservative approach.

As indicated in the SORA, the competent authority, the ANSP, or the U-space service provider may elect to directly map the airspace collision risks using airspace characterisation studies. These maps would directly show the initial air risk class (ARC) for a particular airspace. If the competent authority, the ANSP, or the U-space service provider provides an air collision risk map (static or dynamic), the UAS operator should use that service to plan its UAS operations in airspace that is characterised as ‘atypical’.

If not mapped, considering the airspace encounter categories (AECs) and the ARCs associated shown in the diagram of Figure 4 (ARC assignment process) of the SORA, it can be concluded that the airspace where UAS operations under this PDRA must take place can be classified as ARC-a. Therefore, as this is the lowest ARC, the **final ARC is ARC-a**. According to the SORA (see Table 4 — TMPRs and TMPR level of robustness assignment), no tactical mitigation performance requirement (TMPR) is considered for ARC-a.

Therefore, considering all the above, it can be concluded that the provisions for this PDRA comply with the SORA criteria for ARC-a.

5.5. Step #7 — Determination of the final SAIL

Considering that:

- ground risk: final GRC is 3;
- air risk: final ARC is ARC-a,

then, the resulting SAIL for this PDRA is SAIL II, as indicated in Table A3 below:

SAIL determination				
	Final ARC			
Final GRC	a	b	c	d
1	I	II	IV	VI
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

Table A3 — Determination of the final SAIL

5.6. 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 the SAIL. Table A4 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 this PDRA is highlighted in yellow in Table A4 to show the required level of robustness for the different OSOs.

OSO Number <i>(Annex E to the SORA)</i>		SAIL					
		I	II	III	IV	V	VI
Technical issue with the UAS							
OSO#01	Ensure the operator is competent and/or proven	O	L	M	H	H	H
OSO#02	UAS manufactured by a competent and/or proven entity	O	O	L	M	H	H
OSO#03	UAS maintained by a competent and/or proven entity	L	L	M	M	H	H
OSO#04	UAS developed to authority-recognised design standards ¹⁷	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 to 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 trained and current, and able to control the abnormal situation	L	L	M	M	H	H
OSO#10	Safe recovery from the technical issue	L	L	M	M	H	H
Deterioration of external systems that support the UAS operation							

¹⁷ The robustness level does not apply to mitigations for which credit has been taken to derive the risk classes. This is further detailed in point 3.2.11(a).

OSO Number (Annex E to the SORA)		SAIL					
		I	II	III	IV	V	VI
OSO#11	Procedures are in place to handle the deterioration of external systems that support the UAS operation	L	M	H	H	H	H
OSO#12	The UAS is designed to manage the deterioration of external systems that support the UAS operation	L	L	M	M	H	H
OSO#13	External services that support the UAS operation are adequate to 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	The remote crew is trained and current, and able to control the abnormal situation	L	L	M	M	H	H
OSO#16	Multi-crew coordination (MCC)	L	L	M	M	H	H
OSO#17	The 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 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#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, are measurable, and adhered to	L	L	M	M	H	H
OSO#24	UAS designed and qualified for operation in adverse environmental conditions	O	O	M	H	H	H

Table A4 — Recommended operational safety objectives (OSOs)

5.7. Step #9 — Adjacent area/airspace considerations

In the context of this PDRA, the following provisions derived from the SORA apply:

- No probable failure of the UAS or of any external system that supports the operation should lead to operation outside the operational volume. Compliance with this should be substantiated by a design and installation appraisal, and include at least:
 - design and installation features (independence, separation and redundancy);
 - particular risks (e.g. hail, ice, snow, electromagnetic interference (EMI), etc.) relevant to the ConOps.
- The following additional enhanced containment provisions should apply if the adjacent area/airspace is a gathering of people or ARC-c / -d:
 - The probability of the UAS leaving the operational volume shall be less than $10^{-4}/FH$.

- No single failure of the UAS or of any external system that supports the operation shall lead to operation outside the ground risk buffer.
- Software (SW) and airborne electronic hardware (AEH) whose development error(s) could directly lead to operations outside the ground risk buffer shall be developed to an industry standard or methodology recognised as adequate by the competent authority.

Compliance with the requirements above shall be substantiated by analysis and/or test data with supporting evidence.

For this PDRA, enhanced containment is required also when the adjacent airspace is classified as ARC-c (in addition to ARC-d, as per SORA Step #9, point (c)). This is intended to ensure that if adjacent airspace poses a risk of encounter with manned aircraft higher than 'low' (ARC-b), the design of the UAS and of any external system that supports the operation can provide enough assurance of containment within the operational volume, given that BVLOS operations under this PDRA are relying on being conducted in 'atypical airspace' that may be based on the UA flying close to an infrastructure / facility, with no tactical mitigations required to be put in place.

5.8. Step #10 — Comprehensive safety portfolio

This step addresses the satisfactory substantiation of mitigations and objectives required by the SORA process, ensuring also that any additional requirements to those identified by the SORA process (e.g. security, environmental protection, etc.), as well as the relevant stakeholders (e.g. environmental protection agencies, national security bodies, etc.), are adequately addressed.

For the purpose of the assessment of this PDRA, under this step, the compliance of the proposed provisions for the PDRA against the SORA criteria is performed as shown in the following:

- for mitigations used to modify the intrinsic GRC: see Table A5 in point **Error! Reference source not found.** of this Appendix;
- for strategic mitigations for the initial ARC: not applicable;
- for tactical mitigations for the final ARC: not applicable;
- for OSOs: see Table A6 in point **Error! Reference source not found.** of this Appendix.

5.9. Compliance with mitigations and OSOs

Mitigations used to reduce the intrinsic GRC



Mitigations used to modify the intrinsic GRC	Level of robustness	Criteria in the SORA	Conditions for the PDRA
<p>M3 — An emergency response plan (ERP) is in place, operator validated and effective</p>	<p>LEVEL of INTEGRITY</p>	<p>Medium</p> <p>An ERP should be defined by the applicant in the event of a loss of control of the UAS operation. These are emergency situations where the operation could result in an unrecoverable state, and in which:</p> <ul style="list-style-type: none"> (a) the outcome of the situation highly relies on providence; or (b) could not be handled with a contingency procedure; or (c) when there is grave and imminent danger of fatalities. <p>The ERP proposed by the applicant is different from the emergency procedures. The ERP is expected to cover:</p> <ul style="list-style-type: none"> (a) a plan to limit the escalating effect of an eminent crash (e.g. first notify the responders); and (b) the conditions to alert ATM. <p>The ERP:</p> <ul style="list-style-type: none"> (a) is suitable for the situation; (b) limits the escalating effects; (c) defines the criteria to identify an emergency situation; (d) is practical to use; (e) clearly delineates remote crew member(s) duties. 	<p>AMC3 UAS.SPEC.030(3)(e) includes conditions for the development of an ERP for a ‘medium’ level of robustness, which are aligned with the SORA integrity criteria.</p>



Mitigations used to modify the intrinsic GRC		Level of robustness	Criteria in the SORA	Conditions for the PDRA
	LEVEL of ASSURANCE		<p>Criterion #1 (Procedures)</p> <ul style="list-style-type: none"> (a) The ERP is developed to standards considered adequate by the competent authority and/or in accordance with the means of compliance acceptable to that authority. (b) The ERP is validated through a representative tabletop exercise consistent with the ERP training syllabus. 	<p>AMC3 UAS.SPEC.030(3)(e) includes conditions for the development of an ERP for a ‘medium’ level of robustness, which are aligned with the SORA assurance criteria.</p>
			<p>Criterion #2 (Training)</p> <ul style="list-style-type: none"> (a) Training syllabus is available. (b) Competency-based theoretical and practical training is organised by the UAS operator. 	<p>This criterion is also addressed in AMC3 UAS.SPEC.030(3)(e), in line with the SORA.</p>
M2 — Effects of UA impact dynamics are reduced (e.g. parachute)	LEVEL of INTEGRITY	None	n/a	n/a
	LEVEL of ASSURANCE		n/a	n/a
M1 — Technical containment in place and effective (e.g. emergency recovery function)	LEVEL of INTEGRITY	Low	<p>Criterion #1 (Definition of the ground risk buffer)</p> <p>The applicant defines a ground risk buffer with at least the use of the ‘1:1 rule’.</p>	<p>Point 3.4 of the table in PDRA-G03.1: <i>The UAS operator should establish a ground risk buffer to protect third parties on the ground outside the operational volume.</i></p> <p>Point 3.4.1 of the table in PDRA-G03.1: <i>The minimum criterion should be the use of the ‘1:1 rule’ (e.g. if the UA is planned to operate at a height of 25 m, the ground risk buffer should at least be 25 m)’</i></p>



Mitigations used to modify the intrinsic GRC		Level of robustness	Criteria in the SORA	Conditions for the PDRA
			<p>Criterion #2 (Evaluation of people at risk)</p> <p>The applicant evaluates the area of operations by means of on-site inspections/appraisals to justify lowering the density of people at risk (e.g. residential area during daytime when some people may not be present or an industrial area at night for the same reason). There may be other examples.</p>	<p>Point 3.6 of the table in PDRA-G03 indicates that the UAS operator should evaluate the area of operations typically by means of an on-site inspection or appraisal, and should be able to justify a lower density of people at risk.</p> <p>Point 3.7 of the table in PDRA-G03 indicates that the UAS operator should ensure that the person or entity responsible for the facility or infrastructure indicated they have taken the necessary measures to protect the uninvolved persons present within the limits of the facility or infrastructure during the UAS operation.</p>
	LEVEL of ASSURANCE		<p>Criterion #1 (Definition of the ground risk buffer)</p> <p>The applicant declares that the required level of integrity has been achieved.</p> <p>Criterion #2 (Evaluation of people at risk)</p> <p>The applicant declares that the required level of integrity has been achieved.</p>	<p>Point 3.8 of the table in PDRA-G03 indicates that the UAS operator should include points 3.4 to 3.7 of the table in PDRA-G03 in the operations manual (OM) and declare compliance with those conditions.</p>

Table A5 — Compliance check of the PDRA conditions against the SORA criteria for mitigations used to modify the intrinsic GRC



5.10. Operational safety objectives (OSOs)

Please note that the OSOs that are considered as ‘optional’ for SAIL II are not addressed in Table A6 below.

Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in the SORA for SAIL II	Conditions for the PDRA
<p>OSO #01 Ensure the operator is competent and/or proven</p>	LEVEL of INTEGRITY	Low	The applicant is knowledgeable of the UAS being used and, as a minimum, has the following relevant operational procedures in place: checklists, maintenance, training, responsibilities, and associated duties.	<p>Point UAS.SPEC.050 of Regulation (EU) 2019/947 requires the UAS operator to establish procedures and limitations adapted to the type of the intended operation and the risk involved, which implies knowledge of the UAS intended to be used and of the relevant operational procedures.</p> <p>Furthermore, point 4.1.1 of the table in PDRA-G03 indicates that the UAS operator should develop an operations manual (OM), referring to AMC1 UAS.SPEC.030(3)(e) and the complementary information in GM1 UAS.SPEC.030(3)(e), where all these elements mentioned by the SORA criterion are indicated to be included.</p>
	LEVEL of ASSURANCE		The elements requested for the level of integrity are addressed in the ConOps.	<p>Point 4.1.1 of the table in PDRA-G03 indicates that the UAS operator should develop an operations manual (OM), referring to AMC1 UAS.SPEC.030(3)(e) and the complementary information in GM1 UAS.SPEC.030(3)(e). The chapter/section in the OM on the ConOps indicates that the elements mentioned by the SORA criterion should be included.</p>



Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in the SORA for SAIL II	Conditions for the PDRA
OSO #03 UAS maintained by a competent and/or proven entity (e.g. industry standards)	LEVEL of INTEGRITY	Low	<ul style="list-style-type: none"> — The UAS maintenance instructions are defined and, when applicable, cover the UAS designer 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 carrying out maintenance. 	<ul style="list-style-type: none"> — Point UAS.SPEC.050(1)(i) of Regulation (EU) 2019/947 requires the UAS operator to maintain the UAS in a suitable condition for safe operation by, as a minimum, defining maintenance instructions and employing adequately trained and qualified maintenance staff. Besides, point 4.2.1 of the table in PDRA-G03 indicates that the UAS maintenance instructions defined by the UAS operator should cover at least the UAS manufacturer’s instructions and requirements, when applicable. — Point 4.2.2 of the table in PDRA-G03 indicates that the maintenance staff should use the UAS maintenance instructions while carrying out maintenance.



	LEVEL of ASSURANCE		<p>Criterion #1 (Procedures):</p> <ul style="list-style-type: none"> — The maintenance instructions are documented. — The maintenance carried out on the UAS is recorded in a maintenance log system^{1,2}. — A list of maintenance staff authorised to carry out maintenance is established and kept up to date. <p>¹ <i>The objective is to record all the maintenance carried out on the aircraft, and why it has been carried out (rectification of defects or malfunctions, modification, scheduled maintenance, etc.)</i></p> <p>² <i>The maintenance log may be requested for inspection/audit by the approving authority or an authorised representative.</i></p> <p>Criterion #2 (Training):</p> <ul style="list-style-type: none"> — A record of all relevant qualifications, experience and/or training completed by the maintenance staff is established and kept up to date. 	<p>Criterion #1:</p> <ul style="list-style-type: none"> — Point 4.2 of the table in PDRA-G03 indicates that the UAS maintenance instructions defined by the UAS operator should be included in the OM. The OM template in AMC1 UAS.SPEC.030(3)(e) indicates to include the maintenance instructions required to keep the UAS in a safe condition. — Point UAS.SPEC.050(1)(g)(ii) of Regulation (EU) 2019/947 requires the UAS operator to keep for a minimum of 3 years a record of the maintenance activities conducted on the UAS and keep it up to date. — Point UAS.SPEC.050(1)(k) of Regulation (EU) 2019/947 requires the UAS operator to establish a list of the maintenance staff employed by the operator to carry out maintenance activities and keep it up to date. <p>Criterion #2: Point UAS.SPEC.050(1)(g)(i) of Regulation (EU) 2019/947 requires the UAS operator to keep and maintain and it up to date a record of all the relevant qualification training courses completed by the maintenance staff for at least 3 years after that staff have ceased to be employed by the organisation or have changed positions within the organisation.</p>
		LEVEL of INTEGRITY	Low	<ul style="list-style-type: none"> — The applicant determines that the performance, the RF spectrum usage¹ and the environmental



<p>OSO #06 The C3 link performance is appropriate for the operation</p>			<p>conditions for C3 links are adequate to safely conduct the intended UAS operation.</p> <ul style="list-style-type: none"> — The UAS remote pilot has the means to continuously monitor the C3 performance and to ensure that the performance continues to meet the operational requirements². <p>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. for the EU: Directive 2014/53/EU; for the US: CFR Title 47 Part 15 Federal Communication Commission (FCC) rules), by showing that the UAS equipment complies with these requirements (e.g. FCC marking), and the use of mechanisms to protect against interference (e.g. FHSS, frequency deconfliction by procedure).</p> <p>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.</p>	<p>all operations effectively use and support the efficient use of the radio spectrum in order to avoid harmful interference.</p> <p>Besides,</p> <ul style="list-style-type: none"> — point UAS.SPEC.060(2)(b) of Regulation (EU) 2019/947 requires the remote pilot to 'ensure that the operating environment is compatible with the authorised or declared limitations and conditions'; — point 6.7 of the table in PDRA-G03 indicates that the UAS should comply with the appropriate requirements for radio equipment and the use of the RF spectrum; — point 6.8 of the table in PDRA-G03 indicates that protection mechanisms against interference should be used, especially if unlicensed bands (e.g. ISM) are used for the C2 link (mechanisms such as FHSS, DSSS or OFDM technologies, or frequency deconfliction by procedure); — regarding the use of 'unlicensed frequency bands', as indicated in recital 8 of Regulation (EU) 2019/945, 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;
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Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in the SORA for SAIL II	Conditions for the PDRA
				<ul style="list-style-type: none"> — point 6.1 of the table in PDRA-G03 indicates that means to monitor the critical parameters for a safe flight should be available, and point 6.1.3 includes the status of critical functions and systems; as a minimum, for services based on RF signals (e.g. C2 link, GNSS, etc.). <p>In addition,</p> <ul style="list-style-type: none"> — point 6.10 of the table in PDRA-G03 indicates that in case of a loss of the C2 link, the UAS should have a reliable and predictable method for the UA to recover the command-and-control link or terminate the flight in a way that reduces the effect on third parties in the air or on the ground; — point 6.11 of the table in PDRA-G03 indicates that in the event of an emergency, the remote pilot should have effective means to communicate with the relevant bodies.
	LEVEL of ASSURANCE		<p>The applicant declares that the required level of integrity has been achieved¹</p> <p>¹ Supporting evidence may or may not be available.</p>	<p>This information should be included in the operations manual (OM).</p>



Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in the SORA for SAIL II	Conditions for the PDRA
OSO #07 <i>Inspection of the UAS (product inspection) to ensure consistency with the ConOps</i>	LEVEL of INTEGRITY	Low	The remote crew ensures that the UAS is in a condition for safe operation and conforms to the approved ConOps.	<ul style="list-style-type: none"> — Point UAS.SPEC.060(2)(c) of Regulation (EU) 2019/947 requires the remote pilot to ‘ensure that the UAS is in a safe condition to complete the intended flight safely’. — Pre-flight inspection is included in the operations manual (OM) (see AMC1 UAS.SPEC.030(3)(e) and GM1 UAS.SPEC.030(3)(e)).



Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in the SORA for SAIL II	Conditions for the PDRA
	LEVEL of ASSURANCE		<p>Criterion #1 (Procedures):</p> <ul style="list-style-type: none"> — Product inspection is documented and accounts for the manufacturer’s recommendations, if available. <p>Criterion #2 (Training):</p> <ul style="list-style-type: none"> — The remote crew is trained to perform the product inspection, and that remote crew training is self-declared (with evidence available). 	<p>Criterion #1:</p> <ul style="list-style-type: none"> — The verification that the UAS is in safe condition for the intended operation to be conducted safely is included as one of the aspects to be documented in the OM (see AMC1 UAS.SPEC.030(3)(e) and GM1 UAS.SPEC.030(3)(e)). <p>Criterion #2:</p> <ul style="list-style-type: none"> — Point UAS.SPEC.050 of Regulation (EU) 2019/947 requires the UAS operator to ensure 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 remote pilots, ‘have completed the on-the-job-training developed by the operator, and have been informed about the UAS operator’s operations manual’. — Appendix A to AMC2 to Article 11 (also applicable to this PDRA) indicates in point A.1.1.3.1 that the training programme should be documented (at least the training syllabus should be available).



<p>Operational procedures (OSO #08, OSO #11, OSO #14 and OSO #21)</p>	<p>LEVEL of INTEGRITY</p>	<p>Medium</p>	<p>Criterion #1 (Procedure definition):</p> <ul style="list-style-type: none"> — Operational procedures¹ appropriate for the proposed UAS operation are defined and, as a minimum, cover the following elements: <ul style="list-style-type: none"> • flight planning; • pre- and post-flight inspections; • normal procedures; • procedures to evaluate 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 that is not approved for icing conditions); • 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 (OM). — The limitations of the external systems that are used to support the safe operation of UASs are defined in an OM. <p>Criterion #2 (Procedure complexity):</p>	<p>Criterion #1:</p> <ul style="list-style-type: none"> — Point UAS.SPEC.050(1)(a) of Regulation (EU) 2019/947 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’. — Point 4.1.1 of the table in PDRA-G03 indicates that the UAS operator should develop an operations manual (OM) (for the OM template, please refer to AMC1 UAS.SPEC.030(3)(e) and the complementary information in GM1 UAS.SPEC.030(3)(e)), which should include all the elements indicated in the SORA Criterion #1. <p>Criterion #2:</p> <ul style="list-style-type: none"> — The UAS operator should follow AMC2 UAS.SPEC.030(3)(e), which addresses the evaluation of ‘procedure complexity’. — Since taking manual control of the UAS is still under JARUS discussion (as indicated in the note), it has not been considered in the assessment. <p>Criterion #3:</p> <ul style="list-style-type: none"> — The UAS operator should follow AMC2 UAS.SPEC.030(3)(e), which addresses the
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Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in the SORA for SAIL II	Conditions for the PDRA
			<p>— Operational procedures involve the remote pilot to take manual control¹ when the UAS is usually automatically controlled.</p> <p>Criterion #3 (Consideration of potential human error):</p> <p>— Operational procedures take human error into consideration.</p> <p>¹ As a minimum, operational procedures provide:</p> <ul style="list-style-type: none"> — a clear distribution and assignment of tasks; — an internal checklist to ensure that staff perform their assigned tasks. 	<p>consideration of ‘potential human error’, including the aspects indicated in the SORA.</p>



Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in the SORA for SAIL II	Conditions for the PDRA
	LEVEL of ASSURANCE		<ul style="list-style-type: none"> — Operational procedures are validated against recognised standards. — The adequacy of the contingency and emergency procedures is proved through: <ul style="list-style-type: none"> • dedicated flight tests; or • simulation, provided the simulation is proven valid for the intended purpose with positive results. 	<ul style="list-style-type: none"> — Point 4.1.3 of the table in PDRA-G03 indicates that the UAS operator should validate the operational procedures in accordance with the conditions for a ‘medium’ level of robustness included in AMC2 UAS.SPEC.030(3)(e). — Point 4.1.4 of the table in PDRA-G03 indicates that the UAS operator should ensure the adequacy of the contingency and emergency procedures, and prove it through any of the following: <ul style="list-style-type: none"> • dedicated flight tests; • simulation, provided that the representativeness of the simulation means is proven for the intended purpose with positive results; • any other means acceptable to the competent authority. <p>AMC2 UAS.SPEC.030(3)(e) includes conditions on the validation of operational procedures, including the above.</p>



Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in the SORA for SAIL II	Conditions for the PDRA
Remote crew training (OSO #09, OSO #15 and OSO #22)	LEVEL of INTEGRITY	Low	<p>The competency-based theoretical and practical training ensures knowledge of:</p> <ul style="list-style-type: none"> • the UAS Regulation; • the UAS airspace operating principles; • airmanship and aviation safety; • human performance limitations; • meteorology; • navigation/charts; • the UA; • operating procedures, <p>and is adequate for the intended operation.</p>	<ul style="list-style-type: none"> — Article 8 of Regulation (EU) 2019/947 lists the competencies required for remote pilots that operate UASs in the ‘specific’ category. — Point UAS.SPEC.050(1)(d)(i)&(ii) of Regulation (EU) 2019/947 requires the UAS operator to ensure before conducting operations that the remote pilot has the appropriate competencies. — Point UAS.SPEC.060(1)(b) of Regulation (EU) 2019/947 requires the remote pilot to have the appropriate remote pilot competencies. — Point A.1 of Appendix A to AMC2 to Article 11 is applicable to this PDRA and it contains conditions for the training and assessment (both theoretical and practical) of personnel in charge of duties essential to the UAS operation, in particular for remote pilots. It includes the elements indicated in the SORA criteria.



Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in the SORA for SAIL II	Conditions for the PDRA
	LEVEL of ASSURANCE		Training is self-declared (with evidence available).	<ul style="list-style-type: none"> — Point UAS.SPEC.060(1)(b) of Regulation (EU) 2019/947 requires the remote pilot to carry a proof of competency while operating the UAS. — Point A.1.1.3 of Appendix A to AMC2 to Article 11 is applicable to this PDRA, and it indicates that: <ul style="list-style-type: none"> • the training programme should be documented (at least the training syllabus should be available); and • evidence of training should be presented for inspection upon request from the competent authority or authorised representative.



<p>Safe design: OSO #10 Safe recovery from technical issue and OSO #12 The UAS is designed to manage the deterioration of external systems that support the UAS operation</p>	<p>LEVEL of INTEGRITY</p>	<p>Low</p>	<p>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.</p> <p>External systems that support the operation are defined as systems not already part of the UAS but used:</p> <ul style="list-style-type: none"> • for the launch / take-off of the UAS; • to make pre-flight checks; • to keep the UA within its operational volume (e.g. GNSS, satellite systems, ATM, UTM). <p>External systems activated/used after the loss of control of the operation are excluded from this definition.</p> <p>It is expected that when operating over populated areas or gatherings of people, a fatality will not occur from any probable¹ failure² of the UAS or of any external system that supports the UAS operation.</p> <p>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.'</p> <p>² Some structural or mechanical failures may be excluded from the criterion if it can be shown that these mechanical parts were designed to aviation industry best practices.</p>	<p>Not applicable as operations are planned in sparsely populated areas.</p>
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Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in the SORA for SAIL II	Conditions for the PDRA
	LEVEL of ASSURANCE		<p>A design and installation appraisal is available. In particular, this appraisal shows that:</p> <ul style="list-style-type: none"> the design and installation features (independence, separation and redundancy) satisfy the 'low integrity' criterion; particular risks relevant to the ConOps (e.g. hail, ice, snow, electromagnetic interference, etc.) do not violate the independence claims, if any. 	Not applicable as operations are planned in sparsely populated areas.
OSO #13 <i>External services that support UAS operations are adequate for the intended operation</i>	LEVEL of INTEGRITY	Low	<p>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.</p> <p>Roles and responsibilities are defined between the applicant and the external service provider.</p>	<p>Point 4.3 of the table in PDRA-G03 indicates that the UAS operator should ensure that the level of performance for any externally provided service necessary for the safety of the flight is adequate for the intended operation. The UAS operator should declare that this adequate level of performance is achieved.</p> <p>Point 4.4 of the table in PDRA-G03 indicates that the UAS operator should define the allocation of the roles and responsibilities between the operator and the external service provider(s), if applicable.</p>
	LEVEL of ASSURANCE		<p>The applicant declares that the requested level of performance for any externally provided service necessary for the safety of the flight is achieved (without evidence being necessarily available).</p>	This information should be included in the operations manual (OM).



Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in the SORA for SAIL II	Conditions for the PDRA
OSO #16 Multi-crew coordination (MCC)	LEVEL of INTEGRITY	Low	<p>Criterion #1 (Procedures):</p> <ul style="list-style-type: none"> — Procedure(s) to ensure coordination among the crew members, and that a robust and effective communication channel(s) is (are) available and as a minimum cover: <ul style="list-style-type: none"> • assignment of tasks to crew members; • establishment of step-by-step communications. <p>Criterion #2 (Training):</p> <ul style="list-style-type: none"> — Remote crew training covers multi-crew coordination (MCC). 	<p>Criterion #1:</p> <ul style="list-style-type: none"> — Point A.4 of Appendix A to AMC2 to Article 11 is applicable to this PDRA and it indicates that in situations where multi-crew coordination (MCC) might be required, the UAS operator should include procedures to ensure coordination among the remote crew members with robust and effective communication channels. Those procedures should cover as a minimum: <ul style="list-style-type: none"> • the assignment of tasks to the remote crew members; and • the establishment of step-by-step communications. <p>Criterion #2:</p> <ul style="list-style-type: none"> — Point A.4 of Appendix A to AMC2 to Article 11 indicates that in situations where MCC might be required, the UAS operator should ensure that the training of the remote crew covers MCC.



Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in the SORA for SAIL II	Conditions for the PDRA
	LEVEL of ASSURANCE		<p>Criterion #1 (Procedures):</p> <ul style="list-style-type: none"> — Procedures are not required to be validated against a recognised standard. — The adequacy of the procedures and checklists is declarative. <p>Criterion #2 (Training):</p> <ul style="list-style-type: none"> — Training is self-declared (with evidence available). 	<p>Criterion #1 (Procedures):</p> <ul style="list-style-type: none"> — See the ‘level of assurance’ for operational procedures (OSO #08, OSO #11, OSO #14 and OSO #21). <p>Criterion #2 (Training):</p> <ul style="list-style-type: none"> — See the ‘level of assurance’ for remote crew training (OSO #09, OSO #15 and OSO #22).
OSO #17 <i>Remote crew is fit to operate</i>	LEVEL of INTEGRITY	Low	The applicant has a policy that defines how the remote crew can declare themselves fit to operate before conducting any operation.	Point 4.1.5 of the table in PDRA-G03 indicates that the UAS operator should have a policy that defines how the remote pilot and any other personnel in charge of duties essential to the UAS operation can declare themselves fit to operate before conducting any operation.
	LEVEL of ASSURANCE		The remote crew declare they are fit to operate before conducting any operation based on the policy defined by the applicant.	Point A.5.2 of Appendix A to AMC2 to Article 11 is applicable to this PDRA and it indicates that the personnel in charge of duties essential to the UAS operation should declare that they are fit to operate before conducting any operation based on the policy defined by the UAS operator.



Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in the SORA for SAIL II	Conditions for the PDRA
OSO #20 <i>A human factors evaluation has been performed and the human-machine interface (HMI) is found appropriate for the mission</i>	LEVEL of INTEGRITY	Low	The UAS information and control interfaces are clearly and succinctly presented, and do not confuse, cause unreasonable fatigue, or contribute to remote crew error that could adversely affect the safety of the operation.	Point 6.5 of the table in PDRA-G03 indicates that the UAS information and control interfaces should be clearly and succinctly presented, and should not confuse, cause unreasonable fatigue, or contribute to causing any disturbance to the personnel in charge of duties essential to the UAS operation such that this could adversely affect the safety of the operation.
	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.	Point 6.6 of the table in PDRA-G03 indicates that the UAS operator should conduct an evaluation of the UAS considering and addressing human factors to determine whether the HMI is appropriate for the mission.



<p>OSO #23 <i>Environmental conditions for safe operations are defined, are measurable, and adhered to</i></p>	<p>LEVEL of INTEGRITY</p>	<p>Low</p>	<p>Criterion #1 (Definitions)</p> <ul style="list-style-type: none"> — Environmental conditions for safe operations are defined and reflected in the aircraft flight manual (AFM) or equivalent document. <p>Criterion #2 (Procedures)</p> <ul style="list-style-type: none"> — Procedures to evaluate environmental conditions before and during the mission (i.e. real-time evaluation) are available and include the assessment of meteorological conditions (METAR, TAFOR, etc.) with a simple record system. <p>Criterion #3 (Training):</p> <ul style="list-style-type: none"> — Training covers the assessment of meteorological conditions. 	<p>Criterion #1:</p> <ul style="list-style-type: none"> — Point 3.2 of the OM template (see AMC1 UAS.SPEC.030(3)(e)) indicates that the weather and environmental conditions should be described for each operation. <p>Criterion #2:</p> <ul style="list-style-type: none"> — In accordance with point 4.1(e)(2) of the guidance to the OM template (GM1 UAS.SPEC.030(3)(e)), the OM should contain a point on environmental and weather conditions, including: <ul style="list-style-type: none"> • environmental and weather conditions adequate to conduct the UAS operation; and • methods of obtaining weather forecasts. <p>Criterion #3:</p> <ul style="list-style-type: none"> — Point A.1.1.2.5 of Appendix A to AMC2 to Article 11 is applicable to this PDRA and it indicates ‘meteorology’ as one of the basic competencies for the remote pilot that are necessary from the competency framework. — Point (b)(7) of the guidance to point (1)(d) of point UAS.SPEC.050 of Regulation (EU) 2019/947 (GM1 UAS.SPEC.050(1)(d)) includes ‘meteorology’ among the recommended ‘theoretical knowledge subjects for remote pilot training for the “specific” category’, which should cover:
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Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in the SORA for SAIL II	Conditions for the PDRA
				(i) obtaining and interpreting advanced weather information: <ul style="list-style-type: none"> (A) weather reporting resources; (B) reports; (C) forecasts and meteorological conventions appropriate for typical UAS flight operations; (D) local weather assessments; (E) low-level charts; and (F) METAR, SPECI, TAF; (ii) regional weather effects — standard weather patterns in coastal, mountain or desert terrains; and (iii) weather effects (wind, storms, mist, variation of wind with altitude, wind shear, etc.) on the UA.



Operational safety objectives (OSOs)		SAIL II expected level of robustness	Criteria in the SORA for SAIL II	Conditions for the PDRA
	LEVEL of ASSURANCE		<p>Criterion #1 (Definition):</p> <ul style="list-style-type: none"> — The applicant declares that the required level of integrity has been achieved¹. <p>Criterion #2 (Procedures):</p> <ul style="list-style-type: none"> — See the ‘level of assurance’ for operational procedures (OSO #08, OSO #11, OSO #14 and OSO #21). <p>Criterion #3 (Training):</p> <ul style="list-style-type: none"> — See the ‘level of assurance’ for remote crew training (OSO #09, OSO #15 and OSO #22). <p>¹ Supporting evidence may or may not be available.</p>	<p>Criterion #1 (Definition):</p> <ul style="list-style-type: none"> — This information should be included in the operations manual (OM). <p>Criterion #2 (Procedures):</p> <ul style="list-style-type: none"> — See the ‘level of assurance’ for operational procedures (OSO #08, OSO #11, OSO #14 and OSO #21). <p>Criterion #3 (Training):</p> <ul style="list-style-type: none"> — See the ‘level of assurance’ for remote crew training (OSO #09, OSO #15 and OSO #22).

Table A6 — Compliance check of the PDRA conditions against the SORA criteria for operational safety objectives (OSOs)



5.11. Adjacent area/airspace consideration

Mitigations used for containment		Level of robustness	Criteria in the SORA	Conditions for the PDRA
	LEVEL of INTEGRITY	Medium	No probable failure of the UAS or of any external system that supports the operation shall lead to operation outside the operational volume.	Point 6.12 of the table in PDRA-G03 indicates that in order to ensure the safe recovery from a technical issue involving the UAS or an external system that supports the operation, the UAS operator should ensure that: <ul style="list-style-type: none"> no probable failure of the UAS or of any external system that supports the operation should lead to operation outside the operational volume; and it is reasonably expected that a fatality will not occur from any probable failure of the UAS or of any external system that supports the operation.
	LEVEL of ASSURANCE		Compliance with the requirement above shall be substantiated by a design and installation appraisal, and shall include at least the following: <ul style="list-style-type: none"> design and installation features (independence, separation and redundancy); particular risks (e.g. hail, ice, snow, electromagnetic interference, etc.) relevant to the ConOps. 	Point 6.13 of the table in PDRA-G03 indicates that a design and installation appraisal should be made available, and should include at least the following: <ul style="list-style-type: none"> design and installation features (independence, separation and redundancy); particular risks (e.g. hail, ice, snow, electromagnetic interference, etc.) relevant to the ConOps.



Mitigations used for containment		Level of robustness	Criteria in the SORA	Conditions for the PDRA
	LEVEL of INTEGRITY		<p>The following additional requirements shall apply if adjacent area/airspace is a gathering of people or ARC-d:</p> <ul style="list-style-type: none"> • The probability of leaving the operational volume shall be less than $10^{-4}/FH$. • No single failure of the UAS or of any external system that supports the operation shall lead to operation outside the ground risk buffer. 	<p>Point 6.14 of the table in PDRA-G03 indicates that the following additional conditions should apply if the adjacent area includes an assembly of people or if the adjacent airspace is classified as ARC-c or ARC-d (in accordance with the SORA of the UAS Regulation):</p> <ul style="list-style-type: none"> • The probability of leaving the operational volume shall be less than $10^{-4}/FH$. • No single failure of the UAS or of any external system that supports the operation shall lead to operation outside the ground risk buffer.
	LEVEL of ASSURANCE		<p>Compliance with the requirements above should be substantiated by analysis and/or test data with supporting evidence.</p>	<p>Point 6.15 of the table in PDRA-G03 indicates that compliance with the conditions in point 6.14 (see above) should be substantiated by analysis and/or test data with supporting evidence.</p>
	LEVEL of INTEGRITY		<p>Software (SW) and airborne electronic hardware (AEH) whose development error(s) could directly¹ lead to operations outside the ground risk buffer should be developed to an industry standard or methodology that is recognised as being adequate by the competent authority.</p> <p>¹ This does not imply a systematic need to develop the SW and AEH according to an industry standard or methodology recognised as adequate by the competent authority. The use of the term 'directly' means that a development error in software or in airborne electronic hardware would lead the UA outside the ground risk buffer without the possibility for another system to prevent the UA from exiting the operational volume.</p>	<p>Point 6.14.2 of the table in PDRA-G03 indicates that the SW and 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 (the same note in the SORA for 'directly' is also included in this conditions).</p>



Mitigations used for containment		Level of robustness	Criteria in the SORA	Conditions for the PDRA
	LEVEL of ASSURANCE		<p>[Not explicitly indicated in the SORA]</p> <p>Evidence exists of compliance with an industry standard or methodology that is recognised as being adequate by the competent authority.</p>	<p>Evidence of compliance standard(s) or means of compliance considered adequate by the competent authority (or EASA, when applicable).</p>

Table A7 — Compliance check of the PDRA-G03 conditions against the SORA criteria for mitigations used for containment

