



## **Guidelines for UAS operations in the open and specific category – Ref to Regulation (EU) 2019/947**

Issue no.: 2

Date: 04.10.2024

### Revision record

Issue	Date of issue	Summary of changes
01	31.01.2024	Initial issue
02	04.10.2024	Introduction of the conditions to operate UAS in the open category over railways

### Change revision summary of latest issue

Paragraph no.	Description of change
Part A.I	Introduction of the table summarising the condition to overfly a railway
Part A.I.4	Addition of the paragraph for the best practices for the overflight of railways

### Abbreviations

Please refer to the list of abbreviation included in the [easy access rule on UAS](#).

## Introduction and purpose of these Guidelines

Since 2021, when Regulations (EU) No 2019/945 and No 2019/947 became applicable, Europe became one of the first region in the world regulating drone operations. To allow the use of new technology, the regulations were developed following a performance-based, flexible approach, identifying the minimum safety performance required, and leaving to UAS operators the possibility to define the 'how' to reach it. This has the benefit of not slowing down the evolution of the drone market, that is continuously evolving at a fast pace; however, sometimes it may be more difficult for UAS operators to identify solutions that may reach the minimum safety performance while being compliant with the regulation.

To support application of Regulations (EU) No 2019/945<sup>1</sup> and No 2019/947<sup>2</sup>, EASA is developing, with the support of NAAs and of the industry, acceptable means of compliance (AMC) and guidance material (GM) (see [easy access rule on UAS](#)). Nevertheless, the UAS community is asking to share additional material based on lessons learned and best practices resulting from the experience gained in the last 2 years of implementation of both regulations.

The purpose of the guidelines here is to share such additional material with the UAS Community, so that both industry and Member States may use it as a reference to support application of Regulations (EU) No 2019/945 and No 2019/947. EASA will continue to collect feedback from the community and, once the material contained in these guidelines is considered sufficiently mature, will apply the rulemaking process, transferring them in AMC and GM that are regularly integrated in the [easy access rule on UAS](#).

These guidelines are therefore not to be construed as Guidance Material adopted under Article 76 (3) of Regulation (EU) 2018/1139. They are not legally binding and shall be considered as a working document only, which summarises and disseminates the experience of application of the drone regulatory framework to facilitate of application by the competent authorities, operators and addressees of Regulations (EU) No. 2019/945 and No. 2019/947. The content of these guidelines shall not be interpreted or used to contradict or modify the requirements of Regulations (EU) No 2019/945 and No 2019/947 and shall not be in and of themselves, be used to justify the opening of findings of non-compliance during oversight and standardisation activities, conducted by either the Agency or by national competent authorities.

---

<sup>1</sup> 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, 11.06.2019.

<sup>2</sup> Commission Implementing Regulation (EU) 2019/947 of 24 May 2019 on the rules and procedures for the operation of unmanned aircraft, OJ L 152, 11.06.2019.

## Contents

<b>Introduction and purpose of these Guidelines</b> .....	<b>iii</b>
<b>Guidelines applicable to operations in both open and specific category</b> .....	<b>5</b>
I. Calculation of the VLOS distance (ref. Article 2 point (7)) .....	5
<b>Part A: Open category</b> .....	<b>7</b>
I. Overflight of moving vehicles in the open category (Ref. UAS.OPEN.060 point (1)(c)).....	7
1. Introduction on the risk of overflying moving vehicles .....	9
2. Best practices for the overflight of highways .....	11
3. Best practices for the overflight of other roads .....	12
4. Best practices for the overflight of railways.....	13
<b>Part B: Specific category</b> .....	<b>14</b>
I. SORA- Guidelines for the determination of the air risk (ref. Article 11) .....	14
1. USE CASES.....	14
1.1. Introduction .....	14
1.2. Flight in atypical air environment .....	14
1.3. Flight in a segregated airspace .....	15
1.4. Flight in class A/B/C/D airspace outside of airport/heliport environment.....	15
1.5. Flight in class E/F/G airspace below 500 ft (~ 120 m) outside of airport/heliport environment	16
1.6. Flight in controlled airport/heliport environment.....	17
1.7. Flight in uncontrolled airport/heliport environment.....	17
2. Additional considerations on ARC reduction and TMPR .....	18
2.1. VLOS / EVLOS flights .....	18
2.2. Use of conspicuity devices as TMPR measures.....	18
2.3. Information to other airspace users .....	19
2.4. Detectability of air traffic.....	19
2.5. Coordination with ATC.....	19
3. Guidelines for identification of an arc-b airspace where at least 50% of manned aircraft are	
detected .....	20
<b>3.1 Introduction</b> .....	20
3.2. Determination of ARC-b airspace where at least 50% of manned aircraft are detected. ....	20
3.3. Method for estimation of the other airspace users in the intended volume of operation and	
adjacent airspace, and whether they are cooperative .....	21
II. Operational authorisations with generic vs precise locations (ref UAS.SPEC.030(2)) .....	24
1. 'Generic' versus 'precise' operational authorisation .....	24
2. Conditions for issuing a 'generic' operational authorisation .....	24
3. Conditions for issuing a 'precise' operational authorisation.....	25
4. Example of 'generic' and 'precise' authorisations.....	25

## Guidelines applicable to operations in both open and specific category

### I. Calculation of the VLOS distance (ref. Article 2 point (7))

Operating a UA in VLOS means that the remote pilot is able to clearly scan the sky for presence of other aircraft, be able to clearly see the UA and avoid that it gets close to other aircraft (manned or unmanned) or obstacles or people that may be endangered.

The VLOS distance is affected by a range of factors such as:

- visibility: the operational area and meteorological conditions should allow to maintain unaided visual contact with the UA and the be able to detect the presence of other aircraft in the volume where the UA is operating. A recommended minimum visibility is at least 5km;
- size of the UA;
- UA characteristics such as: UA colour (in relation to how different it is from the background colour) and brightness of UA lights.

When planning a VLOS operation, the VLOS distance should be measured as the air-line distance between the remote pilot and the UA.

Different methods and formulas providing a quantitative assessment of the VLOS distance exist. Here below a formula is proposed, for fixed-wing and multirotor UA. It is based on evaluating two parameters and setting the VLOS at the smallest value between the two:

- maximum distance at which the remote pilot may be able to detect the position and orientation of the UA, based on its size, called 'attitude line of sight' (ALOS); and
- distance up to which other aircraft can be visually detected, and sufficient time is available for an avoidance manoeuvre, called 'detection line of sight' (DLOS).

In order to determine an acceptable VLOS distance the following procedure may be used:

#### 1. Calculate the ALOS:

- for rotorcraft and multirotor UA:

$$\text{ALOS [m]} = 327 \times \text{CD [m]} + 20\text{m}$$

- for fixed-wing UA:

$$\text{ALOS [m]} = 490 \times \text{CD [m]} + 30\text{m}$$

where CD is the characteristic dimension of the UA (i.e. the maximum dimension).

2. Calculate the (DLOS):

$$\text{DLOS [m]} = 0.3 \times \text{GV}$$

where GV is the ground visibility, which minimum value should be at least 5 km and depends on the operational area conditions.

3. Define the VLOS distance as the smaller value among ALOS and DLOS<sup>3</sup>.

---

<sup>3</sup> Additional information for the computation of the VLOS distance may be found using the following link:  
[https://www.lba.de/SharedDocs/Downloads/DE/B/B5\\_UAS/Leitfaden\\_FG\\_CV\\_GRB\\_eng.html?nn=2996768](https://www.lba.de/SharedDocs/Downloads/DE/B/B5_UAS/Leitfaden_FG_CV_GRB_eng.html?nn=2996768)



## Part A: Open category

### I. Overflight of moving vehicles in the open category (Ref. UAS.OPEN.060 point (1)(c))

UAS CLASSES	TRANSIT OVER <u>HIGHWAYS</u>	CONDITIONS (risk mitigations)
Category A1 - Until 31/12/23: all UAS < 500g - From 01/12/24: C0, C1 or privately built <250g	<ul style="list-style-type: none"> <li>- <b>Crossing allowed if needed (ref to conditions)</b></li> <li>- <b>No hovering</b></li> <li>- <b>No sustained flights above or along the infrastructure</b></li> </ul>	<ul style="list-style-type: none"> <li>- Minimum height 20 meters AGL and obstacles;</li> <li>- Always keep an unobstructed view of the UA;</li> <li>- No distractions caused to drivers (e.g. banners behind the drone, laser lights etc)</li> </ul>
Category A2 - Until 31/12/23: 500g < UAS < 2kg - From 01/12/24: C2 (or C0, C1 or privately build <250g)		<ul style="list-style-type: none"> <li>- No vehicles are present during highway crossing (ref. Chapter 2, point 3(b) );</li> <li>- Minimum height 20 meters AGL and obstacles;</li> <li>- Always keep an unobstructed view of the UA;</li> <li>- No distractions caused to drivers (e.g. banners behind the drone, laser lights etc)</li> </ul>
Category A3 - Until 31/12/23: 2kg < UAS < 25kg - From 01/12/24: C3 or privately build (<25kg) (or C0, C1 or privately build <250g)	<ul style="list-style-type: none"> <li>- <b>No operation (never)</b></li> </ul>	<ul style="list-style-type: none"> <li>- Not applicable, no operations should be conducted</li> </ul>

Note: for operations in close proximity of highways, use the 1:1 rule

UAS CLASSES	TRANSIT OVER <u>RAILWAYS</u>	CONDITIONS (risk mitigations)
Category A1 - Until 31/12/23: all UAS < 500g - From 01/12/24: C0, C1 or privately built <250g		
Category A2 - Until 31/12/23: 500g < UAS < 2kg - From 01/12/24: C2 (or C0, C1 or privately build <250g)	<ul style="list-style-type: none"> <li>- <b>Crossing allowed if needed (ref to conditions)</b></li> <li>- <b>No hovering (*)</b></li> <li>- <b>No sustained flights above or along (*)</b></li> </ul>	<ul style="list-style-type: none"> <li>- No moving trains are present;</li> <li>- Minimum height 20 meters AGL and obstacles;</li> <li>- Always keep an unobstructed view of the UA;</li> </ul>
Category A3 - Until 31/12/23: 2kg < UAS < 25kg - From 01/12/24: C3 or privately build (<25kg) (or C0, C1 or privately build <250g)		

**(\*) = hovering or flying along railways is possible provided that the operation is performed in coordination with railway operator(s)**

Note: for operations in close proximity of railways, use the 1:1 rule (see AMC1 UAS.OPEN.030(1) for a description of the 1:1 rule)



UAS CLASSES	TRANSIT OVER <u>OTHER ROADS</u>	CONDITIONS (risk mitigations)
Category A1 - Until 31/12/23: all UAS < 500g - From 01/12/24: C0, C1 or privately built <250g		
Category A2 - Until 31/12/23: 500g < UAS < 2kg - From 01/12/24: C2 (or C0, C1 or privately build <250g)	<ul style="list-style-type: none"> <li>- <b>Crossing allowed if needed (ref to conditions)</b></li> <li>- <b>No hovering (*)</b></li> <li>- <b>No sustained flights above or along (*)</b></li> </ul>	<ul style="list-style-type: none"> <li>- No moving vehicles should be present;</li> <li>- Minimum height 20 meters AGL and obstacles;</li> <li>- Always keep an unobstructed view of the UA;</li> <li>- Using a trajectory that minimise the time flying over the road</li> </ul>
Category A3 - Until 31/12/23: 2kg < UAS < 25kg - From 01/12/24: C3 or privately build (<25kg) (or C0, C1 or privately build <250g)		

Note: for operations in close proximity of roads, use the 1:1 rule

## 1. Introduction on the risk of overflying moving vehicles

Regulation (EU) 2019/947 does not discuss explicitly the risks associated to the overflight of moving vehicles in the open category. However, the regulation contains some generic safety objectives to ensure that safety margins are always kept during UAS operations.

In general terms, the overall risk can be defined as the combination of the frequency (probability) of an occurrence and the associated level of hazard.

With respect to hazards, the following categories have been evaluated:

- **Direct hazards** generated by the crash of a drone into the roof/windshield of a moving vehicle. The severity of this hazard is mainly influenced by the kinetic energy transmitted to the vehicle (=> weight of the drone and speed of the vehicles);
- **Indirect hazards** generated as a consequence of a drone crash. For instance, car accidents occurring in a busy highway as a result of a sudden steering done by a car driver in the attempt to avoid the

impact with a drone or with its wreckage. Typically, indirect hazards are more relevant for roads than for other kind of infrastructures and they are mainly influenced by the speed of the vehicles, the mass of the drone, the amount of the traffic volume in the road and by the presence of fences around the road (as they would not allow the prompt removal of a drone wreckage).

With respect to the probability of a drone crash in the open category, currently there are no quantitative evaluations available, therefore a reference basis could be taken from the draft SORA Annex F<sup>4</sup>. According to that document, the operation failure rate for a drone in SAIL II could be in the order of magnitude of  $10^{-2}$  per flight hour. Although in some specific cases a SAIL II drone could differ significantly from drones in the Open category, it can be assumed with an acceptable level of approximation that the operational failure rate is similar.

The riskiest scenario is represented by operations over highways and busy roads. For this reason, some additional considerations and mitigations are needed.

Operations over railways still deserve some considerations and mitigations.

These additional considerations and mitigations are described in the next paragraphs.

Operations over inland waterways with large traffic density are not considered particularly risky and the already available material is deemed to be sufficient.

While the final goal is to protect vehicles and occupants, it is impractical to introduce provisions based on the intrinsic protection ensured by vehicles because they might move faster than UAS in the open category and because the intrinsic level of protection of vehicles is significantly different considering different types of them (e.g. motorbikes vs vans). As a result, the drafted material is not directly addressing the overflight of vehicles, but it is rather addressing the overflight of infrastructures (e.g. roads and railways).

Finally, EASA MS may use geographical zones (refer to Article 15 of the EU drone regulation) in order to address the risks associated to the overflight of moving vehicles, e.g. by introducing specific limitations or conditions for the operations of UAS over roads and railways. However, it is expected that UAS pilots and operators would benefit from the availability of this guidelines as it will increase their awareness regarding possible risks providing as well hands-on best practices.

It should also be noted that, when a geographical zone exists, the restrictions and conditions introduced by it take the precedence over the contents of this document.

---

<sup>4</sup> Please refer to: <http://jarus-rpas.org/jarus-external-consultation-wg-srm-sora>

## 2. Best practices for the overflight of highways

While planning UAS operations in the open category over highways, the following elements should be considered.

- 1) Hover and sustained flights above, or along, highways are posing the highest risks to uninvolved persons and therefore should always be avoided.
- 2) Crossing of highways in the subcategory A3 should always be avoided.
- 3) Limited to subcategories A1 and A2, in case of operational needs, crossing of highways may be possible under the following conditions:
  - a) a minimum height of at least 20 meters above the highway is maintained;
  - b) the pilot is positioned in a place that allows to maintain visual line of sight (VLOS) operation especially in case of arrival of vehicles. The pilot should also be able to keep sight of the traffic on the highway;
  - c) the remote pilot minimises the risk of distraction to the drivers of vehicles as far as possible (e.g. using a trajectory that minimise the time flying over the road; they should not attach banners behind the UA);
  - d) only in case of operations in the A2 subcategory: no moving vehicles is present during the crossing of the highway.
- 4) Operations in close proximity to (not directly over) highways in the open category could be conducted provided that the UAS is kept at a safe distance from them (e.g. at least respecting the 1:1 rule distance from the highway).
- 5) For the purpose of this material, highways are considered as any road that satisfies at least one of the following criteria:
  - a) The road is listed in the TEN-T network<sup>5</sup>; or,
  - b) The road has 4 or more lanes in total and it is intended for motorway traffic only;

Note 1: once this material is transferred in the EU regulatory framework, it is EASA intention to introduce specific provisions allowing competent authorities to classify, for this specific purpose, other roads as highways, if deemed appropriate.

Note 2: in case the highway is already covered by a geographical zone, the prohibitions, conditions or flight authorisations for the geographical zone take precedence.

---

<sup>5</sup> <https://ec.europa.eu/inea/en/ten-t/ten-t-projects>

### 3. Best practices for the overflight of other roads

While planning UAS operations in the open category over roads other than highways, the following elements should be considered:

- 1) to reduce potential risks to third parties, the remote pilot should avoid flying over any road with high traffic density when there is no operational need.
- 2) Motorbikes, bicycles, or other vehicles where occupants are not sheltered, should be considered uninvolved persons that could potentially be affected by the UAS operation and, therefore, the relevant limitations apply.
- 3) While operating in proximity of roads, the potential risk to third parties should be reduced as much as possible.

Examples of good practices are:

- 1) no hover or fly along the road when vehicles are present;
- 2) cross the road under the following conditions:
  - a) at a minimum height of at least 20 meters over the road;
  - b) when no vehicles are present;
  - c) using a trajectory that minimise the time flying over the road. Keep visual line of sight on the UAS and on the roads;
- 3) when operating close to a road keep the UA at a safe distance from the road by respecting the 1:1 rule distance from it;
- 4) minimise the risk of distraction to the drivers of vehicles as far as possible (e.g. do not attach banners behind the UAS).

Note: in case the road is already covered by a geographical zone, the prohibitions, conditions or flight authorisations for the geographical zone take precedence.

#### 4. Best practices for the overflight of railways

While planning UAS operations in the open category over railways the following elements should be considered:

- 1) Hovering and sustained flights above, or along, railways are posing high risks for third parties not involved in the UAS operations and therefore should be always avoided unless they are performed in coordination with the railway operator(s).
- 2) Crossing of railways in the open category may be possible under the following conditions:
  - a) a minimum height of at least 20 meters above the railway is maintained;
  - b) using a trajectory that minimise the time flying over the railroad (e.g. using a trajectory perpendicular to the railway);
  - c) the remote pilot is positioned in a place that allows to maintain visual line of sight operation even in case of arrival of a train. The remote pilot should also be able to keep sight of the traffic on the railway;
  - d) no moving trains are present.
- 3) Operations in close proximity to (not directly over) railways in the open category are possible under the condition the UAS is kept at a safe distance from them (e.g. at least respecting the 1:1 rule distance from the railway).

Note: in case the railway is already covered by a geographical zone, the prohibitions, conditions or flight authorisations for the geographical zone take precedence over this material.

## Part B: Specific category

### I. SORA- Guidelines for the determination of the air risk (ref. Article 11)

#### 1. USE CASES

##### 1.1. Introduction

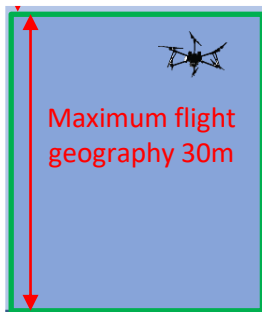
Steps #4 to #6 of the SORA, complemented by Annexes C and D, have been designed to provide the broadest possible scope to assess air risk for new situations/concept of operations. Therefore, these annexes are very detailed and the UAS operators struggle to implement them. The following guidelines aim at providing a more simple and more usable framework for the assessment of air risk by UAS operators.

The following use cases cover the traffic situations that are met in most operations. For each use case, a final ARC and TMRP are proposed. If a type of innovative operation does not enter one of these use cases, a more refined SORA analysis may be needed to assess the air risk.

The following use cases are not prescriptive and should be considered as guidelines only. National aviation authorities may impose alternative ARC/TMRP classifications to the ones proposed based on local conditions.

##### 1.2. Flight in atypical air environment

Flight below 30 meters AGL, far from airports, airfields, and areas where manned air traffic can be reasonably expected at low altitudes (e.g., designated landing zones for parachutes and paragliders), or below 15m above the maximum height of an artificial obstacle within a horizontal distance of 30 meters.



Such flights may be considered as taking place in an atypical air environment. However, depending on the activity that is expected below 30 meters (landing helicopters or gliders, etc.), the Competent authority may decide that the manned activity is not low enough for the air environment to be considered as atypical.

**Final ARC:** a, or ARC-b if the air environment cannot be considered as “atypical”.

**TMPR measures:** not required if ARC-a, low if ARC-b.

Note: Volumes could be defined by the Member State to help the operator decide whether the operation can be considered as “far” from airports and airfields. Several types of volumes have already been defined by Member States, such as forbidden airspace at a given horizontal distance from the centre of the airport/airfield, or volumes based on ICAO’s Obstacle Limitation Surfaces and standard flight procedures of General Aviation, defining maximum height for UAS operations.

Competent authorities are likely to publish details of any activity that may take place in such an area, within the AIP (ENR 5.1/5.5, etc.). The determination of whether it is atypical, should consider not just airspace restrictions, but other manned aviation activity that may be hazardous (model aircraft sites, parachuting activity, gliding activity, etc.). The operator would have to demonstrate that the flight is outside these areas.

### 1.3. Flight in a segregated airspace

If the airspace has been designed to separate the UAS from any other manned traffic.

In such a case, contingency volumes of SORA operations and the optional air risk buffer are designed appropriately to meet an actual segregation.

**Final ARC:** a.

**TMPR measures:** Additional deconfliction scheme and mitigations may be necessary, to deal with HEMS (helicopter emergency medical service) and emergency aircraft, such as announcement of TSAs (temporary segregated area)/TRAs (temporary reserved area) via NOTAM (notice to airmen), coordination with ATSP (air traffic service provider) when relevant, or with the UAS operator.

*Caution: restricted or dangerous airspace cannot always be considered as segregated. If manned traffic is allowed to enter the regulated airspace (usually when it meets some conditions), it may necessarily be considered as « segregated » and ARC-a may not always be assumed. Although in certain cases a regulated airspace for the purpose of UAS operation may justify an ARC-a, local conditions should be assessed. Furthermore, the SORA does not consider simultaneous operations of UAS in the same airspace: drone operations in the same reserved airspace should, at minimum, be coordinated and/or limited.*

### 1.4. Flight in class A/B/C/D airspace outside of airport/heliport environment

The ATC unit controls all the manned traffic, and it can perform tactical deconfliction between manned traffic and the UAS, provided that appropriate coordination procedures are implemented between UAS operators and ATC (air traffic control). Contrary to tactical deconfliction between certified manned aircraft, ATC may not have to know the position of the UAS at all times and may manage the separation

by allocating a static or dynamic airspace to the UAS operation<sup>6</sup>. ATC will need to know the operation area, to apply the conditions of the protocol between ATC and the UAS operator.

**Final ARC:**

ARC-a may be considered when the ATC guarantees that no manned aircraft is allowed to fly within the agreed operational volume reserved for the UA. The agreement between operator and ATC must be handed in when filing for an authorization and using ARC-a.

ARC-b may be considered when the ATC does not guarantee that no manned aircraft is allowed to fly within the agreed operational volume but guarantees to provide separation services between manned and unmanned traffic. This agreement should be handed in during the authorization process for mitigation purposes.

**TMPR measures:** low or none, depending on the ARC level. The ATC unit knows all the manned traffic in the airspace. The tactical measures to ensure separation are agreed by protocol to ensure segregation and management of contingency situations. (see also §3.5). The ATC coordination should not be understood as the only possible TMPR measure applicable and further options might be available in a specific situation.

*Caution: the authorisation to fly in a controlled airspace provided by an ATC unit to a UAS operator by itself does not ensure that the ATC unit will actively deconflict the manned traffic and the UAS, unless specifically mentioned. If this is not the case, ARC-a or b cannot be assumed and a more refined SORA analysis should be performed.*

1.5. Flight in class E/F/G airspace below 500 ft (~ 120 m) outside of airport/heliport environment

The determination of the final ARC will depend on the density of observed traffic. The SORA makes the distinction between rural and urban areas, but a more refined analysis may be needed.

**Final ARC:**

- Urban areas: except for cities where a high level of tourist or police helicopter traffic is expected (which is very rarely the case in Europe), the classification should be ARC-b. ARC-c on the contrary.
- Rural areas: ARC-b is usually appropriate, but some areas may have a high density of low-height traffic (VFR and glider routes, parachutes, paragliders, etc.). In that case an ARC-c may be considered.

**TMPR:** to be determined, based on the final ARC.

---

<sup>6</sup> As ATC separates the manned aircraft from the flight area of the UAS, the flight area should be kept simple (e.g. small, circular, square, rectangular, elongated corridor).



## 1.6. Flight in controlled airport/heliport environment

The area around an airport/heliport where it should be considered that the flight takes place in the airport/heliport environment is usually determined by the CA. (Examples: 5 km around the centre of the runway or the reference point of the airport, stair-shaped areas around runways, etc.).

**Final ARC:** ARC-a may be considered when the ATC guarantees that no manned aircraft is allowed to fly within the agreed operational volume reserved for the UA. The agreement between operator and ATC must be handed in when filing for an authorization and using ARC-a.

ARC-b may be considered when the ATC does not guarantee that no manned aircraft is allowed to fly within the agreed operational volume but guarantees to provide separation services between manned and unmanned traffic. This agreement should be handed in during the authorization process for mitigation purposes.

**TMPR measures:** The ATC unit knows all the traffic in the airspace. The tactical measures to ensure separation are agreed by protocol to ensure segregation and management of contingency situations. Additional measures, such as U-space services (flight authorizations, traffic information) may also be needed to reach an acceptable level of tactical deconfliction (see also §3.5). The ATC coordination should not be considered as the only possible TMPR measure and other options, such as VLOS or monitoring conspicuous traffic, might be applicable depending on the local conditions.

*Caution: the agreement provided by the ATC unit alone does not ensure that the ATC unit will actively deconflict the manned traffic and the UAS, unless specifically mentioned. If this is not the case, ARC-a or b cannot be assumed and a more refined SORA analysis should be performed.*

## 1.7. Flight in uncontrolled airport/heliport environment

On uncontrolled airport/heliport environment, there is no assurance of strategic nor tactical deconfliction between manned traffic and the UAS, even when an AFIS is active and/or the airport operator has issued a flight authorization. Arguably, some level of mitigation can be achieved by coordinating with the airfield manager if the airfield is PPR. A more refined SORA analysis should be performed to determine the ARC and TMPR. By default:

- Final ARC: ARC-c
- TMPR: medium

## 2 Additional considerations on ARC reduction and TMPR

### 2.1 VLOS / EVLOS flights

VLOS<sup>7</sup> is described in Annex D as one acceptable measure to comply with detect and avoid requirements (TMPR on low medium and high robustness). The justification is that a remote pilot should be able to detect an incoming aircraft and to take appropriate actions to separate the UAS from incoming aircraft.

Regarding EVLOS<sup>8</sup>, Paragraph 2.4.4.1 (c) of Step #6 of SORA states that “*In general, all VLOS requirements are applicable to EVLOS. EVLOS may have additional requirements over and above those of VLOS.*”. In EVLOS, the airspace surrounding the operation area is monitored by additional airspace observers<sup>9</sup>. Airspace observers function as part of the “Detect” function of the respective TMPR. However, the remote pilot does not have direct view on the UAS and on the incoming traffic, so the detect/see and avoid functions do not have the same levels of assurance and integrity as in VLOS. For these reasons, compared to VLOS, additional measures may be required to ensure the ‘remain well clear from’ and ‘avoiding collisions’ requirements of point SERA.3201 of the SERA Regulation:

- Use of complementary detection/conspicuity devices;
- Airspace observer’s procedures for providing clear and unambiguous information about an incoming aircraft (e.g., “aircraft coming from the left/right/front of the UAS trajectory”) and surrounding obstacles (thus defining the possibility for the UAS to descent);
- Definition of deconfliction procedures, depending on the information provided by the airspace observers or information from the conspicuity/information devices, etc.

*Note: The use of the VLOS/EVLOS criteria to mitigate the strategic air risk is a deviation from the SORA but seems acceptable from a safety point of view. The SORA may be amended to include this possibility.*

### 2.2 Use of conspicuity devices as TMPR measures

Conspicuity devices (ADS-B, FLARM, etc.) may be used as means to ensure detection of manned aircraft. However, the UAS operator needs to demonstrate the appropriateness of the proposed measures, by

---

<sup>7</sup> VLOS (“Visual line of sight”) means a type of UAS operation in which, the remote pilot is able to maintain continuous unaided visual contact with the unmanned aircraft, allowing the remote pilot to control the flight path of the unmanned aircraft in relation to other aircraft, people and obstacles for the purpose of avoiding collisions.

<sup>8</sup> EVLOS (“Extended visual line of sight”) is a UAS operation whereby the remote pilot maintains uninterrupted situational awareness of the airspace in which the UAS operation is being conducted via visual airspace surveillance through one or more human airspace observers (AOs), possibly aided by technological means. The remote pilot always has direct control of the UAS.

<sup>9</sup> An airspace observer is a person who assists the remote pilot by performing unaided visual scanning of the airspace in which the unmanned aircraft is operating for any potential hazard in the air

showing that the proportion of aircraft equipped with these conspicuity devices and/or sensors able to detect the signals emitted by these devices is sufficient to ensure proper detection and deconfliction.

### 2.3 Information to other airspace users

UAS operators may propose to inform other airspace users about their operations. They may consider that such information will contribute to reducing the number of manned aircraft and/or non-cooperative manned aircraft in the operation area, to justify an ARC reduction or to increase the proportion of aircraft equipped with a conspicuity device (TMPR).

However, the information alone is not sufficient to claim for an ARC reduction. The UAS operator also needs to demonstrate the efficiency of this measure by ensuring that the different types of informed traffic (military, police, general aviation, etc.) will actually take this information into account and that they will accept not to fly in the UAS operation area during the operation. This is usually not the case.

### 2.4 Detectability of air traffic

In the process of strategic reduction of air risk and TMPR, the UAS operator should account for the percentage of detectable air traffic. Strategic reduction of air risk may be easier to argue in areas where more air traffic can be detected by sensor or services used by the operator. For example, the robustness of an ADS-B in/out system may be higher in transponder mandatory zones (TMZ) compared to controlled airspaces. There may also be differences between countries as regards coverage and equipment requirements.

### 2.5 Coordination with ATC

Coordination with ATC may be regarded as strategic mitigation of air risk or as part of TMPR, depending on the procedures and standards agreed upon. If the aim of coordination with ATC is to reduce the airspace encounter rate (by means of segregation through ATC), it may generally be regarded as strategic mitigation of air risk. If, however, the coordination with ATC is only foreseen to be used in case of an airspace encounter (i.e., traffic alert), it should be accounted for within the TMPR.

### 3 Guidelines for identification of an arc-b airspace where at least 50% of manned aircraft are detected

#### 3.1 Introduction

3.1.1. This document aims to provide guidelines to UAS operators or competent authorities to identify within an airspace classified ARC-b the subset where at least 50% manned all aircraft are detectable. Based upon an airspace evaluation the competent authority may choose to designate areas portions of ARC-b airspace where at least 50% of manned aircraft are detected, in which case the operator is relieved from this evaluation.

3.1.2. The UAS operator should be able to receive the signals emitted by cooperative manned aircraft and take action to remain well clear and avoid collisions. This scenario does not rely on radar or similar technology to detect non-cooperative manned aircraft. No credit is taken from the use of U-space/UTM or web-based services for the detection requirement in this scenario but those may be used as additional mitigation means, if available.

3.2. Determination of ARC-b airspace where at least 50% of manned aircraft are detected.

3.2.1. The UAS operator should:

3.2.1.1 determine those areas where the operation should not take place. The competent authority should define (in case based on a proposal from the applicant) the minimum distances to any area with known airspace activities that may preclude UAS operations in accordance with PDRA 05. This could include but is not limited to:

- (a) controlled airspace;
- (b) any known location used for take-off and landing of all types of aircraft operation (airports, helipads, ULM airfields, paraglider areas...)
- (c) site of known UAS operations in the framework of model aircraft clubs and associations;
- (d) area used for en-route operations below 150m (military routes etc.);

3.2.1.2 determine the other airspace users that might be present in the volume of the intended UAS operation and in the airspace adjacent to it, and whether at least 50% of manned traffic can be expected to be cooperative. Moreover, the applicant should determine the types of cooperative systems used. The determination may be done using the method defined in section 3, up to date surveillance data of the intended volume from a radar or any other source or any method accepted by the competent authority.

3.2.2. In order to reinforce a low probability of encounters (thus, confirming an ARC-b airspace) and to potentially increase the ratio of cooperative aircraft the UAS operator is required to notify in

advance the other airspace users (e.g. local aerodromes, flight clubs, RC model associations etc.) about the intended UAS operation so that:

- (a) airspace users potentially avoid the area,
- (b) ATS provides traffic information, when possible,
- (c) pre-flight coordination and/or information is enabled by contacting the UAS operator,
- (d) airspace users become cooperative (if possible).

3.2.3. If deconfliction is required following notification, the competent authority may establish a process to prioritise access to airspace. Furthermore, the competent authority should promote the notification system to maximise the number of informed non-cooperative aircraft operators.

3.3 Method for estimation of the other airspace users in the intended volume of operation and adjacent airspace, and whether they are cooperative

3.3.1. The following airspace users need to be taken into consideration (non-exhaustive list): military aircraft, all helicopters including those operated for emergency and medical services (HEMS), flight training aircraft, gliders, paragliders, hang gliders, parachutes, balloons, aircraft for specialised operations (aerial work), other general aviation aircraft, ultra-light aircraft, unmanned aircraft (including those operated in the framework of model aircraft clubs and associations)<sup>10</sup>, etc.

3.3.2. Step 1 Data gathering.

3.3.2.1 Gather the information needed on a national/regional basis from the competent authority and other relevant stakeholders e.g., aerodrome managing entity. The analysis will provide an average percentage of manned aircraft being cooperative in VLL away from any exclusion area previously defined (refer to point 2.1.1) at national/regional level. This average may have a high degree of variation depending on the local conditions (e.g., gliders do not flight at night, balloons tend to operate in known weather and areas) and hence the analysis is unlikely to be applicable for the intended area of operation. Therefore, the next phase described in point 3.2.2 should be performed to adjust the analysis accordingly.

3.3.2.2 Gather and apply data applicable for the intended volume of operation taking into account all relevant local conditions. This will provide an adjustment to the local conditions of the intended area of operation.

If sufficient data is available to directly perform the analysis for the intended area of operation, points 3.2.1 and 3.2.2 can be accomplished in a single phase.

---

<sup>10</sup> UA are included in the types of aircraft that should be taken into account even though the SORA does not address UAS on UAS collision risk in the air risk model. However, if the UAS operations is performed in areas with high density of unmanned aircraft (e.g. area of model flying sites), this will pose an increased ground risk which is undesirable.

Step 1 can optionally be performed again in which limitations can be imposed in terms of time of the day or the year, weather conditions etc. to achieve a further reduction of non-cooperative traffic.

### 3.3.3 Step 2. Analysis

3.3.3.1 Determine all aircraft categories that might be present in the operational volume, in as much details as possible depending upon the data available. Some data will be available from the registry of the competent authority while other data may require engaging in the completion of a surveys with all airspace users (e.g., contacts with national/regional organisations representing airspace users, etc.) Any data subject to judgement should be assessed conservatively to ensure the analysis rather overestimate the number of non-cooperative aircraft operating in the intended volume of operation.

3.3.3.2 For each aircraft category, determine the following data:

3.3.3.2.1 category of aircraft in which they fall. If a category of aircraft is utilised for different type of operations in VLL ARC-b airspace, such a category should, if possible, be subdivided in categories for each type of operation. For example, fixed wing GA aircraft used for crop dusting in VLL should be listed separately from other fix wing GA, since they spend a much higher percentage in VLL compared to the other GA aircraft operations;

3.3.3.2.2 number of aircraft;

3.3.3.2.3 yearly flight hours per aircraft;

3.3.3.2.4 type of operation performed in VLL;

3.3.3.2.5 any information which can better define the typical areas where this aircraft category will operate (e.g. paragliders often operate from cliffs);

3.3.3.2.6 Any information that can define the areas where this aircraft category unlikely will operate (e.g. hot air balloons very seldom operate over the sea);

3.3.3.2.7 percentage of the time in which this aircraft category operates in VLL away from any exclusion area previously defined (refer to point 3.2);

3.3.3.2.8 percentage of aircraft having cooperative systems like ADS-B, FLARM (a cooperative system should not be considered if the UAS operator cannot directly access to its signals);

3.3.3.2.9 type of cooperative systems.

3.3.3.3 For each aircraft category, the total number of yearly flights hours in VLL can be calculated as well as the number of yearly flight hours that are performed with a cooperative system.

3.3.3.4 Once all aircraft categories have been determined and values assigned, the total percentage of cooperative flight hours in VLL can also be calculated.

3.3.3.5 If needed, steps 1 and 2 are subsequently may be repeated for the intended area of operation including any further restrictions that may be imposed such as time of day, weather conditions etc.



## II. Operational authorisations with generic vs precise locations (ref UAS.SPEC.030(2))

### 1. 'Generic' versus 'precise' operational authorisation

According to Article 12 of the UAS Regulation, a competent authority may decide to grant a 'generic' operational authorisation (i.e., an operational authorisation that is taking place in locations generically identified, according to the conditions set in the operational authorisation). Contrary to the 'generic' operational authorisation, an operational authorisation that is limited to locations identified by geographical coordinates will be called 'precise' operational authorisation.

The UAS operator should anyhow check whether the MS where the operation takes place has published a geographical zone in the area of operation according to Article 15 of the UAS Regulation, requiring a flight authorisation (e.g., this may be the case for the areas covered by U-Space). A flight authorisation to enter a geographical zone (as per Article 15(1)) should not be confused with an operational authorisation based on the SORA risk assessment.

### 2. Conditions for issuing a 'generic' operational authorisation

A 'generic' operational authorisation does not contain any precise location (geographical coordinates) but applies to all locations that meet the approved conditions/limitations (e.g., density of population of the operational and adjacent area, class of airspace of the operational and adjacent area, maximum height, etc.). The UAS operator should develop appropriate procedures described in the operations manual for checking that each flight they conduct:

- meets the mitigations and operational safety objectives derived from the SORA and the requirements listed in the operational authorisation; and
- takes place in an area whose characteristics and local conditions are consistent with the GRC and ARC classification of the SORA as approved by the NAA.

The limitations regarding the operational scenario, the operational volume and the buffers defined in the operational authorisation should be expressed in such a way that it is simple for the UAS operator to ensure compliance with those limitations.

The UAS operator should have a diligent and documented process in the OM to identify/assess that the operational volume complies with the criteria defined in the 'generic' authorisation and with the local conditions.

The UAS operator should train its personnel to assess the operational volume, buffers, and mitigations to prepare for the next operations.

The UAS operator should also document and record the assessment of locations (e.g., in mission files), so that adherence to this process can be verified by the NAA on a regular basis.



### 3. Conditions for issuing a ‘precise’ operational authorisation

A ‘precise’ operational authorisation rather than a ‘generic’ one should be required when the following conditions occur:

- M1 mitigation at medium or high level of robustness is applied;
- the initial air risk class is iArc-c or higher;
- strategic mitigations are applied to lower the initial ARC (SORA Step #5), except when operating in a U-space airspace.

Up to SAIL II, operations conducted in VLOS should be eligible for a generic authorization independently from the conditions listed above.

### 4. Example of ‘generic’ and ‘precise’ authorisations

A ‘generic’ operational authorisation may be relevant for operations conducted according to PDRA-S01 and S02, since the conditions are similar to the ones of the declarative STS and it is relatively easy for the UAS operator to ensure compliance with those conditions.

It will usually be easier for the UAS operator to ensure compliance when the conditions are unambiguous and not open to interpretation. This is the case, for instance, when:

- a controlled ground area is required, or the density of population is very low;
- the operation takes place in ARC-a (e.g. segregated airspace).

The following examples may be considered suitable for the scope of a ‘generic’ authorisation, due to the simplicity to identify suitable operational volumes and apply the mitigation measures:

- agricultural operations conducted at very low level, such as fields spraying;
- swarm light shows over a controlled ground area in ARC-a or ARC-b.

On the contrary, the use of some strategic measure mitigation (M1 for GRC or Step 5 for ARC) often prompt debate between the UAS operator and the NAA regarding the relevance/validity of the data sources (density of population, density/type of traffic in given airspace, etc.), and the efficiency of the proposed strategic mitigation measures. Furthermore, some of these measures are difficult to implement and it is not always possible for the NAA to simply trust the capacity of the UAS operator to do so.

For instance, the following examples show measures that are difficult to implement / open to interpretation and therefore should result in ‘precise’ authorisations:

- achieving a local reduction of the density of population;
- ensuring the absence of uninvolved persons in very large, controlled ground areas, or reserving large, controlled ground areas in densely populated environments;
- starting an operation in airspace that requires a new protocol with the ANSP/ATSP, etc.

A UAS operator with a LUC may receive the privilege to conduct operations with different locations, even if the operations qualify for 'precise' locations.

