Safe AWE Testing CONOPS Guidelines [Reference Document]

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Note: Key statements are indicated with **BOLDFACE** and actions required from AWE developers are highlighted throughout the document in YELLOW.

Contents

Abbreviations

ARC – Air Risk Class

AWE – Airborne Wind Energy

BVLOS – Beyond Visual Line of Sight

CAA – Civil Aviation Authority

CONOPS – Concept of Operations

DAA – Detect and Avoid

ERP – Emergency Response Plan

EVLOS – Extended Visual Line of Sight

GRC – Ground Risk Class

GS – Ground Station

JARUS – Joint Authority on Rulemaking for Unmanned Systems

MAC – Mid Air Collision

NAA – National Aviation Authority

NOTAM – Notice to Airmen

OA – Operational Approval

OSO – Operational Safety Objective

SAIL – Specific Assurance and Integrity Level

SORA – Specific Operation Risk Assessment

TMPR – Tactical Mitigation Performance Requirements

UA – Unmanned Aircraft

UAS – Unmanned Aerial Systems

UTM – Unmanned Traffic Management

VLOS – Visual Line of Sight

1. Introduction and purpose of document

Participants of the AWEurope working group on the topic of Safety and Technical Guidelines for Airborne Wind Energy (WG Safety) have agreed that it makes sense to define a minimum set of guidelines for the safe testing of AWE systems during the technology development, testing and demonstration phase. During this phase all AWE developers in the WG Safety agree that there is always a non-zero chance of a software or hardware failure, a human error or other unexpected event which may lead to the uncontrolled crash of the airborne part of the system. It is also agreed that regardless of the safety factor or inspection procedures employed, a tether failure (element which all AWE systems have in common) can not be fully mitigated and should be planned for accordingly.

These guidelines have been developed based on the process and methodologies defined in the Specific Operations Risk Assessment (SORA) V2.0 Guidelines recently published by JARUS [SORA guidelines (v2.0 package), JARUS]. Although the SORA process is inherently 'specific' in nature, meaning that it is intended to be applied individually to each Concept of Operations (CONOPS), the approach taken here is to define an AWE CONOPS Guideline that would be appropriate **during the testing and demonstration phase**. An overview of the 'Concept of Operation for Drones' including a description of the 'open', 'specific' and 'certified' categories is available from EASA. [Concept of Operations for Drones, A risk based approach to regulation of unmanned aircraft, EASA] More information on the SORA process in the context of AWE systems is available in the document Input to Technical Guidelines: Operational Risk Assessment [Document: Inputs to Technical Guidelines: Operational Risk Assessment. Houle, C.].

This CONOPS Guideline has been defined in order to comply with the Operational Safety Objectives (OSO) appropriate for an operation with a Specific Assurance and Integrity Level (SAIL) <= III. This would be an AWE operation performed over a controlled ground area with a radius defined by the length of the tether. Appropriate strategic air risk mitigation have been applied in order to reduce the residual air risk to that of operations below 500 feet (~150m) in uncontrolled airspace over rural areas. The operation is performed so that the airborne part of the system is always within Visual Line of Sight (VLOS) or appropriate means to comply with 'See & Avoid' have been implemented if the operation is Beyond Visual Line of Sight (BVLOS).

In order to confirm that SAIL <= III operation are indeed the most appropriate for AWE operations currently being performed by AWEurope developers, an assessment of the ground risk, air risk and SAIL for a number of developers in the AWEurope network has been performed based on information published about their respective systems and test operations. This preliminary assessment shows that a SAIL = II operation is currently the most representative case but some developers would have SAIL = III operations due to the maximum characteristic dimension of the airborne part of the system being greater than 8m which results in a higher final Ground Risk Class (GRC) and therefore a higher SAIL assessment.

This document is intended to serve as a general guidance to the actual working document which takes the form of an Excel Workbook shared document AWEurope CONOPS Guidelines and SORA Survey

[Airborne Wind Europe (2019): Introduction to SORA for AWE.] which may eventually be shared with all AWEurope members (not just those in the Working Group on Safety). The workbook has five sheets:

1 – CONOPS: This sheet contains an overview of the key elements which should be described in an AWE CONOPS and for each element the CONOPS Guidelines that AWEurope developers should be able to fulfill during the testing and demonstration phase, assuming a SAIL <= III. It is based on the categories proposed in the SORA guidelines, Annex A [SORA guidelines (v2.0 package), JARUS]. An AWE developer who applies SORA shall confirm that the proposed CONOPS guidelines are relevant for their specific operations. If not, they shall provide a short explanation.

2/3 – Ground/Air Risk: These sheets contains an overview of the ground / air risk mitigation strategies proposed in the SORA guidelines [SORA guidelines (v2.0 package), JARUS] which are relevant to AWE operations as well as a list of the specific ground / air risk mitigation strategies adopted by developers in the AWEurope network. Based on this list, a preliminary estimate of the final GRC and residual ARC for a number of developers has been made. An AWE developer who applies SORA shall confirm that the assessment is accurate or modify it to represent their case accordingly.

4 – SAIL: This sheet contains an assessment of the Specific Assurance and Integrity Level (SAIL) based on the final GRC and residual ARC determined in the previous sheets. The goal of this preliminary analysis is to understand the range of the SAILs which are representative of current AWE operations and to determine a 'representative' case.

5 – OSOs: The final sheet makes a proposal for the Operational Safety Objectives (OSOs) that would be required for a SAIL = II operation. SAIL = II was chosen as it is currently the most representative case based on the preliminary analysis performed. An AWE developer who applies SORA shall confirm that the proposed OSO guidelines are relevant for their specific operations. If not, they should provide a short explanation.

The key outputs of this document, once validated by the inputs and confirmations from the developers in the AWEurope network, will be a preliminary set of guidelines for the safe operation of AWE systems during the development, testing and demonstration phase. The guidelines take the form of a CONOPS Guideline, ground and air risk mitigations and Operational Safety Objectives.

Some additional considerations as well as guidance for using the shared working document will now be given for each of these topics.

2. CONOPS

A Concept of Operations (CONOPS) is the basis for the assessment of the inherent risks associated with a specific operation and should provide the required context by which the appropriateness of the proposed risk mitigation procedures can be evaluated. Developing a CONOPS describing the organization, operation and the Unmanned Aerial System (UAS) is the first step in the SORA process. In the SORA guidelines [SORA guidelines (v2.0 package), JARUS], Annex A provides guidelines on presenting system and operation information for a specific UAS operation. It consists of two main parts, each with a number of sub-sections:

1. **Operation relevant information**

1.1. Organization

1.1.1. Safety

1.1.2. Design and production

1.1.3. Training of staff involved in operations

1.1.4. Maintenance

1.1.5. Crew

1.1.6. Configuration management

1.2. Operations

1.2.1. Types of operations

1.2.2. Standard operating procedures

1.2.3. Normal operational strategy

1.2.4. Abnormal and emergency operation

1.2.5. Accidents, incidents and mishaps

1.2.6. Emergency response plan

1.3. Training

1.3.1. General information

1.3.2. Initial training and qualification

1.3.3. Procedures for maintenance of currency

1.3.4. Flight simulation training devices

1.3.5. Training program

2. **Technical relevant information**

2.1. UAS description

2.1.1. Unmanned Aircraft (UA) segment

2.1.2. UAS control segment

2.1.3. Geo fencing

2.1.4. Ground support equipment (GSE) segment

2.1.5. C2 link segment

2.1.6. C2 link degradation

2.1.7. C2 link lost

2.1.8.Safety features

During the testing and demonstration phase, the CONOPS description of an AWE operation fits quite well to that of a UAS operation. As the systems are mostly operated at a level of automation with which a remote pilot is in the loop and will take over manual control of the airborne part of the system under certain conditions (i.e. to perform an emergency landing) the topics of remote crew (i.e. test team) training as well as C2 (command and control) radio link are safety critical. In addition, as AWE system reliability is mostly quite low during the testing and demonstration phase (due to a low TRL and lack of significant flight hours) and the chance of a crash is relatively high, the operation must rely on the remote crew to implement and execute risk mitigation procedures, so the importance of a well instructed organization with a clear set of procedures to deal with abnormal and emergency operating conditions is paramount.

As AWE systems are developed into commercial products, it is clear that the CONOPS will evolve and eventually become more similar to that of a conventional wind turbine. This may however still depend on the specific configuration of the AWE system as well as certain design choices such as how the safety factor of the tether is selected and if automatic recovery from a tether failure is foreseen. In any case the CONOPS of an AWE system is very different from that of a manned aircraft, and therefore it is important not to put too much emphasis on standards developed for the manned aviation industry, especially at an early stage.

What is most important in the current stage of development, is that all AWE developers (starting with those in the AWEurope network) should follow a set of CONOPS guidelines in terms of the safe testing of AWE systems. These should be appropriate for the type of system being tested, the operations being conducted, as well as the size and level of development of the organization. They should be proportional to the inherent risks of the operation and should not create an unnecessary burden on the organization or slow down the development pace in a significant manner.

In the sheet 'CONOPS' in AWEurope CONOPS Guidelines and SORA Survey [Airborne Wind Europe (2019): Introduction to SORA for AWE.], an overview of the key elements which should be described in an AWE CONOPS has been given based on the template provided in SORA guidelines, Annex A [SORA guidelines (v2.0 package), JARUS]. For some elements of the CONOPS, a generalized description has been proposed which should be representative of the case for all AWEurope developers. For each section, a guideline that all AWEurope developers should be able to fulfill during the testing and demonstration phase, assuming a SAIL <= III, has been proposed. It is requested that each developer should confirm that the proposed CONOPS guidelines are relevant for their specific operations. If not, they should provide a short explanation as to why that is not the case.

3. Ground and Air Risk Mitigation

The basic principle behind the SORA process is to identify the hazards, threats and the relevant harm and threat barriers which are relevant for a given Unmanned Aerial System (UAS) operation. Threat barriers aim to reduce the chances that a hazard (i.e. UAS operation out of control) happens in the first place, and harm barriers aim to reduce the chances that a hazard will result in a harm. Three types of harm are considered:

1. Injuries or fatalities involving third parties on the ground
2. Injuries or fatalities involving third parties in the air
3. Damage or destruction of third party infrastructure

An example of a threat barrier would be a technical guideline like the ones now being developed by the WG Safety for the appropriate selection, handling, inspection and replacement of a tether, which would reduce the chance of a tether failure during operation. An example of a harm barrier would be to specify a large enough safety exclusion zone (danger area) around the operating AWE system so that in the event of a tether failure, the airborne part of the system will not leave a defined operational volume.

Considering that an AWE system in operation is essentially a tethered UAS operation, the SORA process as well as the division of risk mitigation procedures by ground and air risk are highly applicable and logical. In the SORA process, steps # 2 and 3 assess the initial and final ground risks inherent in the operation. The initial ground risk can be reduced through strategic mitigations, which are intended to both reduce the number of people at risk on the ground as well as reduce the effects of the ground impact once control of the operation is lost. Steps # 4 and 5 assess the initial and residual air risks inherent in the operation. The initial air risk can be reduced through strategic mitigations, some of which are under the operators control (operational restrictions) and others are not (common rules and structures). Depending on the residual air risk (after all strategic mitigations are applied) step # 6 applies tactical mitigations and assigns the associated performance requirements and robustness level in order to mitigate any residual risk of a mid-air collision.

Tactical mitigations are intended to provide a means of compliance with the ICAO Annex 2 section 3.2 'See & Avoid' requirement, which is referred to as 'Detect & Avoid' for UAS operations where the remote pilot is not within direct visual line of sight with the Unmanned Aircraft (UA). Although this requirement may eventually be waived by the NAA / CAA for large scale AWE operations where the system is treated as an obstruction and marked and lit accordingly, operations with small scale AWE systems during the testing and development phase will likely be required to comply with 'See & Avoid' unless the residual air risk is extremely low.

In order to support fruitful discussions between AWE developers on the topic of air and ground risk mitigation, the terminology to define the operational volume of an AWE system will now be defined with reference to Fehler: Referenz nicht gefunden below. In order to keep the terminology general to all AWE systems currently under development, the airborne part of the system (kite/plane/drone/…) will be referred to as the 'UA' for 'Unmanned Aircraft'.

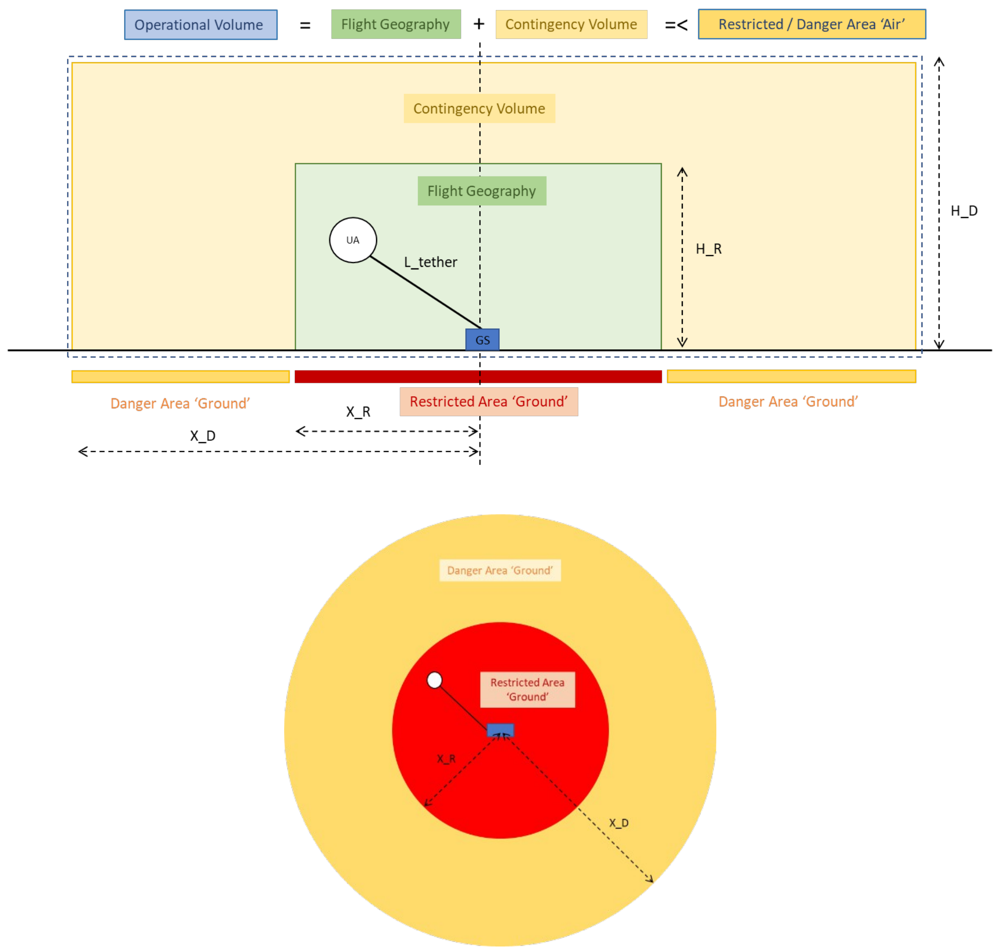

Figure 1: Definition and terminology to describe the AWE 'operational volume' (side and top view)

Definitions:

- **Flight Geography** – airspace in which the UA operates under 'normal' conditions, i.e. 'tethered' operation. Radius is defined by the maximum length of the tether. Maximum altitude is limited by the length of the tether or by a guidance software.
- **Contingency Volume** – airspace in which the UA (and all parts of it) will remain in case of 'abnormal' conditions, i.e. 'un-tethered' operation in case of tether failure or release, or a structural failure.
- **Operational Volume** – airspace in which the UA will remain in all but 'emergency' conditions, at which point emergency procedures as well as the Emergency Response Plan (ERP) are implemented.
- **Restricted / Danger Area 'Air'** – airspace defined as a 'restricted area' or 'danger area' and activated by NOTAM before flights. This should be at least as large as the 'operational volume' but may also be larger.
- **Restricted Area 'Ground'** – ground area around the Ground Station (GS) where the UA could crash on the tether under high load / speed. The radius of this area should be at least that of the tether length. No third parties allowed in this area during active operations. No active buildings or streets should be located within this area.

- **Danger Area 'Ground'** – ground area under the contingency volume but not under the flight geography. As a minimum, third parties entering this area during active test operations should be made aware of the potential danger and the remote pilot should be aware of their presence. For certain operations, the danger area may be considered as a restricted area.

Ground Risk Mitigations

Ground risk is assessed by determining an initial Ground Risk Class (GRC) of the operation based on the UA characteristic dimension as well as the operational scenario. Table 2 of the SORA guidelines [SORA guidelines (v2.0 package), JARUS], which has been included in Fehler: Referenz nicht gefunden below, provides a template for the process. **Although there may be cases where an assessment based on kinetic energy results in a lower initial GRC than that based on the maximum characteristic dimension (for a soft kite system for example), the characteristic dimension is taken to be more important as it defines the area of the impact zone in case of a crash landing.** Lethality is assumed in the analysis in order to maintain a conservative approach.

Intrinsic UAS Ground Risk Class				
Max UAS characteristics dimension	1 m / approx. 3ft	3 m / approx. 10ft	8 m / approx. 25ft	>8 m / approx. 25ft
Typical kinetic energy expected	*< 700 J (approx. 529 Ft Lb)*	*< 34 KJ (approx. 25000 Ft Lb)*	*< 1084 KJ (approx. 800000 Ft Lb)*	*> 1084 KJ (approx. 800000 Ft Lb)*
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 gathering of people	8			

Table 2 – Intrinsic Ground Risk Classes (GRC) Determination

Figure 2: Initial GRC table from the SORA guidelines [SORA guidelines (v2.0 package), JARUS].

It is assumed that most AWE developers are currently operating VLOS or BVLOS over either a sparsely populated environment or over a controlled ground area. However, due to the reduction in GRC that can be achieved through the use of a tether, the initial GRC assessment is actually not so important as the final GRC will typically end up at the lowest value in the column. Once the initial GRC has been assessed, it is then adapted through the use of mitigations as per table 3 of the SORA guidelines, shown in Fehler: Referenz nicht gefunden below.

		Robustness		
Mitigation Sequence	**Mitigations for ground risk**	Low/None	Medium	High
1	M1 - Strategic mitigations for ground risk[e]	**0: None -1: Low**	**-2**	**-4**
2	M2 - Effects of ground impact are reduced[f]	**0**	**-1**	**-2**
3	M3 - An Emergency Response Plan (ERP) is in place, operator validated and effective	**1**	**0**	**-1**

Table 3 – Mitigations for Final GRC determination

Figure 3: Ground Risk Mitigations from SORA guidelines [SORA guidelines (v2.0 package), JARUS]

The details regarding how the robustness levels of the various mitigations can be achieved are available in SORA guidelines Annex B [SORA guidelines (v2.0 package), JARUS]. **In the latest version (2.0) the guidelines now include a specific guidance for strategic ground risk mitigation through the use of a tether.** For AWE operations in the testing and development phase, a medium robustness for the tether should be possible to justify. In order to achieve a high level of robustness, validation of the claimed level of integrity through a competent third party would be required. Eventually this should be possible but in practice does not reduce the final GRC as it's not possible to be reduced through a strategic mitigation below the lowest value in the appropriate column. The reasoning behind this is that **the use of a tether is essentially a way to 'geofence' the UA operation over a very well defined area, which can then be controlled as a 'restricted area' as described in** Fehler: Referenz nicht gefunden**.**

Although further reduction of the initial GRC is possible by reducing the effects of a ground impact (i.e. through the use of a parachute) is theoretically possible, in practice this is very difficult to achieve for an AWE system. The key question is if the deployment of a parachute during tethered operation in windy conditions will actually reduce the effects of the ground impact to any significant degree. For untethered operation (in the case of a tether failure or an emergency release) the case for a parachute could indeed be argued. In any case, the impact of a parachute in terms of ground risk mitigation should be assessed based on the specific system configuration and agreed upon with the competent authority.

The final opportunity to reduce the initial GRC is through an Emergency Response Plan (ERP). This is a set of procedures defined to reduce the escalating effects of an operation being out of control. As a minimum, the following scenarios should be covered: crash inside the operational zone, landing / crash outside of the operational zone, collision with a manned aircraft. For AWE developers in the testing and demonstration phase it is assumed that achieving a medium level of robustness for the ERP is feasible so it should have no impact on the final GRC.

In the sheet 'Ground Risk' in AWEurope Safe Testing Guidelines [Airborne Wind Europe (2019): Introduction to SORA for AWE.], a preliminary assessment of the initial and final GRCs of a number of AWEurope developers has been performed based on published information of their respective systems as well as the assumptions on the mitigations described above. It is requested that all developers should either confirm that this assessment is representative of their current test operations or should be modified to reflect them or filled out accordingly. Based on these assessments, a 'representative case' has been created which is intended to reflect the generalized ground risk considerations for an AWE system in the testing and demonstration phase.

Air Risk Mitigations

Initial air risk is determined based on the likelihood that other aircraft will be present in the airspace in which the operation is taking place. This assessment has been simplified into a flowchart in figure 4 of the SORA guidelines and has been included in Fehler: Referenz nicht gefunden below. For most AWE operations in the testing and demonstration phase will result in an initial ARC of ‘c’ assuming operations above 500 ft. (~150 m) in uncontrolled airspace over rural areas.

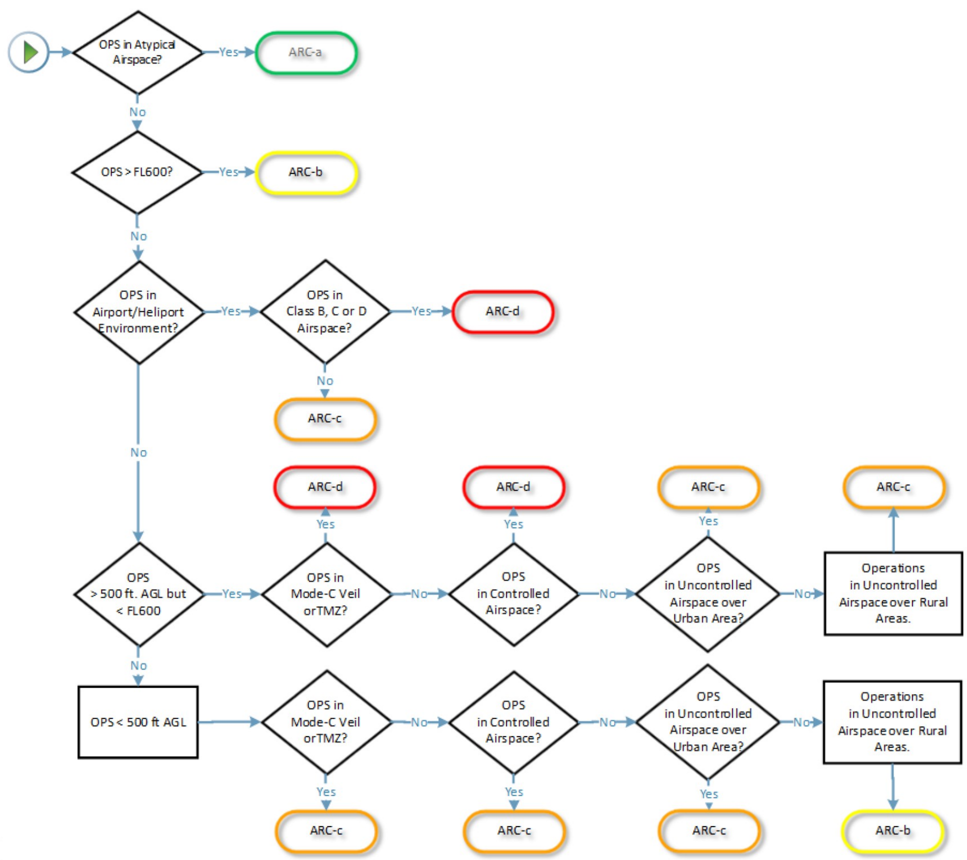

Figure 4 – ARC assignment process

Figure 4: Flowchart for determining initial ARC from SORA guidelines [SORA guidelines (v2.0 package), JARUS]

The initial ARC is then modified by the application of strategic mitigations to reduce the chances of a mid-air collision. **The best strategic mitigation in terms of air risk would be to obtain a restricted area around the operation, so that no other aircraft should enter the airspace. In practice however, it is often not possible to obtain a restricted airspace from the authorities, so a ‘danger area’ activated by Notice to Airmen (NOTAM) can be used.** This should make other airspace users aware that there is an operation taking place in the specific area which may pose a danger. However, as the responsibility to comply with 'see & avoid' is not waived, as would be the case for a restricted airspace, the operator may still have to implement tactical procedures to mitigate the residual air risk.

The other strategic mitigations which can be applied focus on making the AWE system as visible as possible to other airspace users, so they can easily identify it as a hazard and adjust their flight paths accordingly. This can be done through either visual means, like marking and lighting, or electronically through collision warning and avoidance devices. Additional strategic mitigations include 'time of use' or 'time of exposure' which can be claimed in cases where test flights are very short or where they will happen at times where air traffic density is very low, such as at night. The details of how strategic mitigations for air risk can be used to reduce the initial ARC are described in SORA guidelines Annex C [SORA guidelines (v2.0 package), JARUS].

Once all appropriate strategic mitigation have been considered, tactical mitigations are applied to mitigate any residual risk of a mid-air collision. Tactical mitigation takes the form of a dynamic 'mitigating feedback loop' and reduces the rate of collision by modifying the flight geometry and dynamics of aircraft in conflict, based on real time aircraft conflict information. An overview of the SORA Air-Conflict Mitigation Process, taken from SORA guidelines Annex C [SORA guidelines (v2.0 package), JARUS], is shown in Figure 5: SORA Air-Conflict Mitigation Process from SORA guidelines Annex C [SORA guidelines (v2.0 package), JARUS] below.

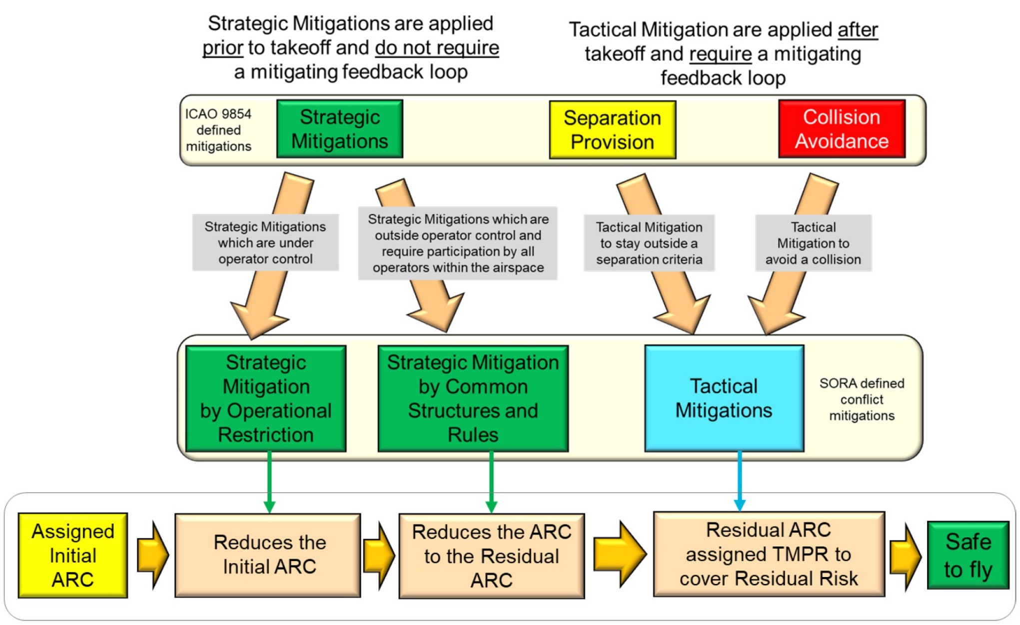

Figure 1; SORA Air-Conflict Mitigation Process

Figure 5: SORA Air-Conflict Mitigation Process from SORA guidelines Annex C [SORA guidelines (v2.0 package), JARUS]

If operations are VLOS, in which the remote pilot is in direct line of sight with the UA at all times and also has an oversight of the airspace around the operation, then the 'see & avoid' requirement is inherently met. It should noted that the range of sight of the remote pilot can be extended by an observer who is in constant radio contact, assuming the verification and communication latency between the pilot and the observer is less than 15 seconds. Such a configuration is referred to as 'extended' VLOS or EVLOS operations. For either VLOS or EVLOS, the operator should have a documented VLOS de-confliction scheme, in which the methods which will be used for detection, communication and the criteria which will be used to avoid incoming traffic.

Residual ARC	Tactical Mitigation Performance Requirements (TMPR)	TMPR Level of Robustness
ARC-d	High	High
ARC-c	Medium	Medium
ARC-b	Low	Low
ARC-a	No requirement	No requirement

Table 4 – Tactical Mitigation Performance Requirement (TMPR) and TMPR Level of Robustness Assignment

Figure 6: TMPR for ARC, SORA guidelines [SORA guidelines (v2.0 package), JARUS]

For BVLOS operations, the operator must meet the Tactical Mitigation Performance Requirements (TMPR) with an associated level of robustness based on the residual ARC, as determined by table 4 of the SORA guidelines, as seen in Fehler: Referenz nicht gefunden above. The SORA guidelines Annex D [SORA guidelines (v2.0 package), JARUS] gives details on the requirements for each step in the mitigating feedback loop which has the following steps:

Detect -> Decide -> Command -> Execute -> Feedback Loop

Considering just the 'detect' step for a low and medium TMPR level, the Detect And Avoid (DAA) system should be able to detect 50% and 90% of all aircraft in the detection volume respectively. For a high TMPR level associated with residual ARC-d, a system meeting TRCA SC-228 or EUROCAE WG-105 MOPS/MASPS (certification standards for DAA systems) is required.

In the sheet 'Air Risk' in AWEurope Safe Testing Guidelines [Airborne Wind Europe (2019): Introduction to SORA for AWE.], a preliminary assessment of the initial and residual ARC of a number of AWEurope developers has been performed based on published information of their respective systems as well as the assumptions on the mitigations described above. It is requested that all developers should either confirm that this assessment is representative of their current test operations or should be modified to reflect them or filled out accordingly. Based on these assessments, a 'representative case' has been created which is intended to reflect the generalized air risk considerations for an AWE system in the testing and demonstration phase.

4. SAIL Determination and OSO Compliance

The last steps in the SORA process are to determine the Specific Assurance and Integrity Level (SAIL) parameter for the operation and to assign the Operational Safety Objectives (OSO) to which the operator must comply. **The SAIL represents the level of confidence that the operation will stay under control** and is determined based on the final GRC and residual ARC using table 5 from the SORA guidelines, shown in Fehler: Referenz nicht gefunden below.

SAIL Determination				
	Residual ARC			
Final GRC	a	b	c	d
≤2	**I**	**II**	**IV**	**VI**
3	**II**	**II**	**IV**	**VI**
4	**III**	**III**	**IV**	**VI**
5	**IV**	**IV**	**IV**	**VI**
6	**V**	**V**	**V**	**VI**
7	**VI**	**VI**	**VI**	**VI**
>7	Category C operation			

Table 5 – SAIL determination

Figure 7: Table to determine SAIL, SORA Guidelines [SORA guidelines (v2.0 package), JARUS]

Depending on the SAIL, the operator must comply with a number of OSOs to some level of robustness. **The OSOs are the threat barriers that are intended to mitigate any residual risks in the operation which could not be covered by the harm barriers which have been applied.** There are 24 OSOs in total, however only 18 of them are unique. They are divided up into four categories, each of which focuses on a specific threat type which is to be mitigated. The SORA guidelines, Annex E [SORA guidelines (v2.0 package), JARUS] gives details on the OSOs and compliance criteria for each level of robustness. **The operator should ensure that the procedures, systems and documentation provided in their CONOPS is compliant with the OSO requirements as per the SAIL assessment of their specific operation.**

In the sheet 'SAIL' in AWEurope CONOPS Guidelines and SORA Survey [Airborne Wind Europe (2019): Introduction to SORA for AWE.], a preliminary assessment of the SAIL for the operations of a number of AWEurope developers has been performed based on the final GRC and residual ARC assessed in the previous. **Based on this preliminary assessment it is confirmed that a SAIL = II operation is the most appropriate 'representative case' for AWE operations in the testing and demonstration phase.**

In the sheet 'OSO', an overview of the OSO's and their associated level's of robustness for SAILs from I to III are given, along with a compliance statement for the SAIL = II case. It is requested that each developer confirm that the proposed OSO compliance statements are relevant for their specific operations. If not they should provide a short explanation.

The guidelines currently focus on operations with SAIL assessments <= III, assuming that this will cover all AWE operations in the testing and demonstration phase. The case for SAIL = II has been used to formulate the OSO compliance statements, as this was assessed as the most likely SAIL for an AWE operation in the testing and demonstration phase. **For developers who are performing operations with a lower or higher SAIL assessment, the OSO compliance statements should be adapted accordingly.**

5. References

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