

## Operational Risk Analysis Overview for Operations in the Specific Category PDRA – G01 Version 1.0: AMC 2 to Article 11 IR (EU) 2019/947

Data of authorised UAS and operation	
<b>1. Manufacturer or Type Certificate holder</b>	
<b>2. Model name</b>	
<b>3. Type of UAS configuration</b>	<input type="checkbox"/> Conventional Airplane <input type="checkbox"/> Helicopter <input type="checkbox"/> Multirotor <input type="checkbox"/> Hybrid/VTOL <input type="checkbox"/> Lighter than air <input type="checkbox"/> Other, please specify:
<b>4. Is the UAS tethered during the operation?</b>	<input type="checkbox"/> Yes <input type="checkbox"/> No
<b>5. Maximum characteristic dimensions (including propellers)</b>	
<b>6. Maximum take-off mass</b>	
<b>7. Maximum speed</b>	
<b>8. Type of propulsion system</b>	<input type="checkbox"/> Electric <input type="checkbox"/> Combustion <input type="checkbox"/> Hybrid, specify type: <input type="checkbox"/> Other, please specify:
<b>9. Number of type certificate or design verification report (if available)</b>	
<b>10. Certificate of airworthiness (if available)</b>	
<b>11. Number of noise certificate (if available)</b>	
<b>12. Manufacturer or Type Certificate holder</b>	
<b>13. Short description of proposed operations including the locations</b>	Please provide the GPS coordinates for the operational volume (flight geography and contingency volume), the ground risk buffer and the air risk buffer (if available) as a separate file using either .txt; .kmz or .kml. Give reference to the file name: _____
<b>Short description of proposed operations</b>	
<b>Place, Date</b>	<b>Name and Signature</b>

## Compliance Matrix for PDRA – G01 Version 1.0

Operational characterisation (scope and limitations)		
	PDRA requirements	Reference to documentation
<b>Level of human intervention</b>	1.1 No autonomous operations: the remote pilot should have the ability to maintain control of the UA, except in case of loss of the command and control (C2) link.	Document name: Chapter number: Page number:
	1.2 The remote pilot should operate only one UA at a time.	Document name: Chapter number: Page number:
	1.3 The remote pilot should not operate from a moving vehicle.	Document name: Chapter number: Page number:
	1.4 The remote pilot should not hand over the control of the UA to another command unit.	Document name: Chapter number: Page number:
<b>UA range limit</b>	1.5 Launch/recovery: at VLOS distance from the remote pilot, if not operating from a safe prepared area. <i>Note: 'safe prepared area' means a controlled ground area that is suitable for the safe launch/recovery of the UA.</i>	Document name: Chapter number: Page number:
	1.6 In flight: 1.6.1 If no AOs are employed: the UA is not operated further than 1 km (or other distance defined by the competent authority) from the remote pilot. <i>Note: The remote pilot's workload should allow the remote pilot to continuously scan the airspace.</i> 1.6.2 If AOs are employed: the range is not limited as long as the UA is not operated further than 1 km (unless a different distance is defined by the competent authority) from the AO who is nearest to the UA.	Document name: Chapter number: Page number:
<b>Areas overflown</b>	1.7 UAS operations should be conducted over sparsely populated areas.	Document name: Chapter number: Page number:

Operational characterisation (scope and limitations)		
	PDRA requirements	Reference to documentation
<b>UA limitations</b>	1.8 Maximum characteristic dimension (e.g. wingspan, rotor diameter/area or maximum distance between rotors in case of a multirotor): 3 m	Document name: Chapter number: Page number:
	1.9 Typical kinetic energy (as defined in paragraph 2.3.1(k) of AMC1 Article 11 of the UAS Regulation: up to 34 kJ	Document name: Chapter number: Page number:
<b>Flight height limit</b>	1.10 The maximum height of the operational volume should not be greater than 150 m (500 ft) above the overflow surface (or any other altitude reference defined by the Member State). <i>Note: In addition to the vertical limit of the operational volume, an air risk buffer is to be considered (see 'Air risk' under point 3 of this table).</i>	Document name: Chapter number: Page number:
<b>Airspace</b>	1.11 The UA should be operated: 1.11.1 in uncontrolled airspace (Class F or G) (corresponding to an air risk that can be classified as ARC-b); or 1.11.2 in a segregated area (corresponding to an air risk that can be classified as ARC-a); or 1.11.3 as otherwise established by the Member States in accordance with Article 15 (with an associated air risk that can be classified as not higher than ARC-b).	Document name: Chapter number: Page number:
<b>Visibility</b>	1.12 The UA should be operated in an area where flight visibility is more than 5 km. <i>Note: This flight visibility should be understood as the distance from which a UA can be visually detected by the remote crew.</i>	Document name: Chapter number: Page number:
<b>Others</b>	1.13 The UA should not be used to carry dangerous goods, except for dropping items in connection with agricultural, horticultural or forestry activities in which the carriage of the items does not contravene any other applicable regulations.	Document name: Chapter number: Page number:

Operational mitigations		
	PDRA requirements	Reference to documentation
<b>Operational volume</b>	3.1 To determine the operational volume, the applicant should consider the position-keeping capabilities of the UAS in 4D space (latitude, longitude, height, and time).	Document name: Chapter number: Page number:
	3.2 In particular, the accuracy of the navigation solution, the flight technical error of the UAS, as well as the flight path definition error (e.g. map error) and latencies should be considered and addressed when determining the operational volume.	Document name: Chapter number: Page number:
	3.3 The remote pilot should apply emergency procedures as soon as there is an indication that the UA may exceed the limits of the operational volume.	Document name: Chapter number: Page number:
<b>Ground risk</b>	3.4 The UAS operator should establish a ground risk buffer to protect third parties on the ground outside the operational volume. 3.4.1 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 150 m, the ground risk buffer should at least be 150 m).	Document name: Chapter number: Page number:
	3.5 The operational volume and the ground risk buffer should be all contained in a sparsely populated area.	Document name: Chapter number: Page number:
	3.6 The applicant 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.	Document name: Chapter number: Page number:
<b>Air risk</b>	3.7 The UAS operator should establish an air risk buffer to protect third parties in the air outside the operational volume.	Document name: Chapter number: Page number:
	3.8 This air risk buffer should be contained in the 'airspace class F or G' (uncontrolled airspace) over sparsely populated areas and in UAS geographical zones defined by the MSs where the probability of encounter with manned aircraft and other airspace users is not low.	Document name: Chapter number: Page number:
	3.9 The operational volume should be outside any geographical zone corresponding to a flight restriction zone, as defined by the responsible authority, unless the UAS operator has been granted an appropriate permission.	Document name: Chapter number: Page number:

Operational mitigations		
	PDRA requirements	Reference to documentation
	3.10 Prior to the flight, the remote pilot should assess the proximity of the planned operation to manned aircraft activity.	Document name: Chapter number: Page number:
<b>Observers</b>	3.11 If the UAS operator decides to employ one or more airspace observers (AOs), the remote pilot may operate the UA up to the distance that is specified in point 1.6.2.	Document name: Chapter number: Page number:
	3.12 The UAS operator should ensure the correct placement and number of AOs along the intended flight path. Prior to each flight, the UAS operator should verify that:	
	3.12.1 visibility and the planned distance of the AO are within acceptable limits that are defined in the operations manual (OM);	Document name: Chapter number: Page number:
	3.12.2 there are no potential terrain obstructions for each AO;	Document name: Chapter number: Page number:
	3.12.3 that there are no gaps between the zones that are covered by each of the AOs;	Document name: Chapter number: Page number:
	3.12.4 communication with each AO is established and effective; and	Document name: Chapter number: Page number:
	3.12.5 if means are used by the AOs to determine the position of the UA, those means are functioning and effective. <i>Note: Instead of an AO, the remote pilot may perform the visual scan of the airspace, provided that the workload allows the remote pilot to perform their duties.</i>	Document name: Chapter number: Page number:

UAS operator and UAS operations provisions		
	PDRA requirements	Reference to documentation
<b>UAS operator and UAS operations</b>	4.1 In addition to the responsibilities that are defined in point UAS.SPEC.050 of the Annex to the UAS Regulation and the provisions for UAS operators in previous points of this AMC, the UAS operator should:	
	4.1.1 develop an operations manual (OM) (for the template, refer to AMC1 UAS.SPEC.030(3)(e) and to the complementary information in GM1 UAS.SPEC.030(3)(e));	Document name: Chapter number: Page number:
	4.1.2 develop an emergency response plan (ERP) (see point 7 of GM1 UAS.SPEC.030(3)(e));	Document name: Chapter number: Page number:
	4.1.3 validate the operational procedures against standards that are recognised by the competent authority and/or in accordance with a means of compliance acceptable to that authority;	Document name: Chapter number: Page number:
	4.1.4 ensure the adequacy of the contingency and emergency procedures and prove them through any of the following: (a) dedicated flight tests; or (b) simulations, provided that the representativeness of the simulation means is proven for the intended purpose with positive results; or (c) any other means acceptable to the competent authority; and	Document name: Chapter number: Page number:
	4.1.5 have a policy that defines how the remote pilot and all other personnel in charge of duties essential to the UAS operation can declare themselves fit to operate before conducting any operation.	Document name: Chapter number: Page number:
<b>UAS maintenance</b>	4.2 The UAS maintenance instructions that are defined by the UAS operator should be included in the OM and should cover at least the UAS manufacturer's instructions and requirements, when applicable.	Document name: Chapter number: Page number:
	4.3 The maintenance staff should follow the UAS maintenance instructions when performing maintenance.	Document name: Chapter number: Page number:

UAS operator and UAS operations provisions		
	PDRA requirements	Reference to documentation
External services	4.4 The UAS operator should ensure that the level of performance for any externally provided service that is necessary for the safety of the flight is adequate for the intended operation. The UAS operator should declare that this level of performance is adequately achieved.	Document name: Chapter number: Page number:
	4.5 The UAS operator should define and allocate the roles and responsibilities between the UAS operator and the external service provider(s), if applicable.	Document name: Chapter number: Page number:

Provisions for the personnel in charge of duties essential to the UAS operation		
	PDRA requirements	Reference to documentation
	Compliance with Appendix A to AMC2 Article 11 of RG (EU) 2019/947 <i>The personnel in charge of duties essential to the UAS operation</i>	Document name: Chapter number: Page number:

Technical provisions		
	PDRA requirements	Reference to documentation
General	6.1 The UAS should be equipped with means to monitor the critical parameters of a safe flight, in particular the:	
	6.1.1 UA position, height or altitude, ground speed or airspeed, attitude and trajectory;	Document name: Chapter number: Page number:
	6.1.2 UAS energy status (fuel, battery charge, etc.); and	Document name: Chapter number: Page number:
	6.1.3 status of critical functions and systems; as a minimum, for services based on RF signals (e.g. C2 Link, GNSS, etc.), means should be provided to monitor the adequate performance and trigger an alert if the level becomes too low.	Document name: Chapter number: Page number:

Technical provisions		
	PDRA requirements	Reference to documentation
	6.2 The UA should have the performance capability to descend safely from its operating altitude to a 'safe altitude' in less than 1 minute, or have a descent rate of at least 2.5 m/s (500 fpm).	Document name: Chapter number: Page number:
<b>Human-machine interface (HMI)</b>	6.3 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 in such a way that could adversely affect the safety of the operation.	Document name: Chapter number: Page number:
	6.4 If an electronic means is used to support AOs in their role of maintaining awareness of the position of the unmanned aircraft, its HMI should: <ul style="list-style-type: none"> <li>6.4.1 be sufficiently easy to understand to allow the AOs to determine the position of the UA during the operation; and</li> <li>6.4.2 not degrade the AOs' ability to: <ul style="list-style-type: none"> <li>6.4.2.1 perform unaided visual scanning of the airspace where the UA is operating for any potential collision hazard; and</li> <li>6.4.2.2 maintain effective communication with the remote pilot at all times.</li> </ul> </li> </ul>	Document name: Chapter number: Page number:
	6.5 The UAS operator should conduct a UAS evaluation that considers and addresses human factors to determine whether the HMI is appropriate for the operation.	Document name: Chapter number: Page number:
<b>C2 links and communication</b>	6.6 The UAS should comply with the applicable requirements for radio equipment and use of the RF spectrum.	Document name: Chapter number: Page number:
	6.7 Protection mechanisms against interference should be used, especially if unlicensed bands (e.g. ISM) are used for the C2 link (mechanisms such as FHSS, technology or frequency de-confliction by procedure).	Document name: Chapter number: Page number:
	6.8 Communication between the remote pilot and the AO(s) should allow the remote pilot to manoeuvre the UA with sufficient time to avoid any risk of collision with manned aircraft, in accordance with point UAS.SPEC.060(3)(b) of the UAS Regulation.	Document name: Chapter number: Page number:

Technical provisions		
	PDRA requirements	Reference to documentation
Tactical mitigation	6.9 The UAS design should be adequate to ensure that the time required between a command given by the remote pilot and the UA executing it does not exceed 5 seconds.	Document name: Chapter number: Page number:
	6.10 Where an electronic means is used to assist the remote pilot and/or AOs in being aware of the UA position in relation to potential 'airspace intruders', the information is provided with a latency and an update rate for intruder data (e.g. position, speed, altitude, track) that support the decision criteria.	Document name: Chapter number: Page number:
Containment	6.11 To ensure a safe recovery from a technical issue that involves the UAS or an external system supporting the operation, the UAS operator should ensure that: 6.11.1 no probable failure of the UAS or of any external system supporting the operation should lead to operation outside the operational volume; and 6.11.2 it is reasonably expected that a fatality will not occur due to any probable failure of the UAS or of any external system supporting the operation.	Document name: Chapter number: Page number:
	6.12 The vertical extension of the operational volume should be 150 m above the surface (or any other altitude reference defined by the Member State). <i>Note: The term 'probable' should be understood in its qualitative interpretation, i.e. 'anticipated to occur one or more times during the entire system/operational life of an item'.</i>	Document name: Chapter number: Page number:
	6.13 A design and installation appraisal should be made available and should cover at least: 6.13.1 the design and installation features (independence, separation, and redundancy); and 6.13.2 the particular risks (e.g. hail, ice, snow, electromagnetic interference, etc.) relevant to the ConOps.	Document name: Chapter number: Page number:
	6.14 The following additional provisions should apply if the adjacent area includes an assembly of people or if the adjacent airspace is classified as ARC-d (in accordance with AMC1 Article 11 of the UAS Regulation): 6.14.1 The UAS should be designed to standards that are considered adequate by the competent authority and/or in accordance with a means of compliance that is acceptable to that authority such that: 6.14.1.1 the probability of the UA leaving the operational volume should be less than $10^{-4}$ /FH; and	Document name: Chapter number: Page number:

Technical provisions		
	PDRA requirements	Reference to documentation
	<p>6.14.1.2 no single failure of the UAS or of any external system supporting the operation should lead to operation outside the ground risk buffer.</p> <p><i>Note: The term 'failure' should be understood as an occurrence that affects the operation of a component, part, or element in such a way that it can no longer function as intended. Errors may cause failures but are not considered to be failures. Some structural or mechanical failures may be excluded from this criterion if it can be shown that these mechanical parts were designed according to aviation industry best practices.</i></p> <p>6.14.2 SW and AEH whose development error(s) could directly lead to operations outside the ground risk buffer should be developed according to an industry standard or methodology that are recognised as adequate by the competent authority.</p> <p><i>Note 1: The proposed additional safety provisions cover both the integrity and assurance levels.</i></p> <p><i>Note 2: The proposed additional safety provisions do not imply a systematic need to develop the SW and AEH according to an industry standard or methodology that are recognised as adequate by the competent authority. For instance, if the UA design includes an independent engine shutdown function that systematically prevents the UA from exiting the ground risk buffer due to single failures or a SW/AEH error of the flight controls, the intent of the provisions of point 6.14.1 above could be considered to be met.</i></p>	
	6.15 Compliance with the provisions of points 6.14.1 and 6.14.2 above should be substantiated by analysis and/or test data with supporting evidence.	
<b>Place, Date</b>	<b>Name and Signature</b>	