AMC3 Article 11 Rules for conducting an operational risk assessment

PREDEFINED RISK ASSESSMENT **PDRA-G02** Version 1.0

EDITION December 2020

(a) Scope

This PDRA is the result of applying the methodology that is described in AMC1 Article 11 of the UAS Regulation to UAS operations that are conducted in the 'specific' category:

(1) with UA with maximum characteristic dimensions (e.g. wingspan, rotor diameter/area or maximum distance between rotors in case of multirotor) of up to 3 m and typical kinetic energy of up to 34 kJ;

(2) BVLOS of the remote pilot;

(3) over sparsely populated areas;

(4) in airspace that is reserved for the operation: either a danger area or a restricted area appropriate for UAS operations.

(b) PDRA characterisation and provisions

The characterisation and provisions for this PDRA are summarised in **Table PDRA-G02.1** below:

PDRA characterisation and provisions	
1. Operational characterisation (scope and limitations)	
Level of human intervention	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. 1.2 The remote pilot should operate only one UA at a time.
UA range limit	1.3 Launch/recovery: at VLOS distance from the remote pilot, if not operating from a safe prepared area. *Note: 'safe prepared area' means a controlled ground area that is suitable for the safe launch/recovery of the UA.* 1.4 In flight: The range limit should be within the C2 link coverage that ensures the safe conduct of the flight.
Areas overflown	1.5 UAS operations should be conducted over sparsely populated areas.
UA limitations	1.6 Maximum characteristic dimension (e.g. wingspan, rotor diameter/area or maximum distance between rotors in case of a multirotor): 3 m 1.7 Typical kinetic energy (as defined in paragraph 2.3.1(k) of AMC1 Article 11 of the UAS Regulation): up to 34 kJ
Flight height limit	1.8 The maximum height of the operation volume is limited by the size of the reserved airspace. *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).*
Airspace	1.9 Operations should only be conducted in airspace that is reserved for the operation (corresponding to an air risk that can be classified as ARC-a). *Note: 'Reserved airspace' means here either a danger area or a restricted area that is designated for UAS operations.*
Visibility	1.10 If take-off and landing are conducted in VLOS of the remote pilot, visibility should be sufficient to ensure that no people are in danger during the take-off/landing phase. The remote pilot should abort the take-off or landing in case people on the ground are in danger.
Others	1.11 The UA should not be used to drop material or 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.				
2. Operational risk classification (according to the classification defined in AMC1 Article 11 of the UAS Regulation)					
Final GRC	**3**	Final ARC	**ARC-a**	SAIL	**II**
3. Operational mitigations					
Operational volume (see Figure 2 of AMC1 Article 11)	3.1 To determine the operational volume, the UAS operator should consider the position-keeping capabilities of the UAS in 4D space (latitude, longitude, height, and time). 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. 3.3 The remote pilot should apply the emergency procedures as soon as there is an indication that the UA may exceed the limits of the operational volume.				
Ground risk	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). 3.5 The operational volume and the ground risk buffer should be all contained in a sparsely populated area. 3.6 The UAS operator should evaluate the area of operations typically by means of an on-site inspection or appraisal, and should be able to justify a lower density of people at risk.				
Air risk	3.7 The operational volume should be entirely contained in the reserved airspace. 3.8 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.				
Observers	N/A				

4. UAS operator and UAS operations provisions	
UAS operator and UAS operations	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)); 4.1.2 develop an emergency response plan (ERP) (see point 7 of GM2 UAS.SPEC.030(3)(e)); 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; 4.1.4 ensure the adequacy of the contingency and emergency procedures and prove it 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; 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. 4.1.6 as part of the procedures that are contained in the OM (point 4.1.1 above), include the description of the following: (a) The method and means of communication with the authority or entity responsible for the management of the airspace during the entire period of the reserved or restricted airspace being active, as mandated by the authorisation. *Note: The communication method should be published in the notice to airmen (NOTAM), which activates the reserved airspace to also allow coordination with manned aircraft.* (b) The member(s) of personnel in charge of duties essential to the UAS operation, who are responsible for establishing that communication.
UAS maintenance	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. 4.3 The maintenance staff should follow the UAS maintenance instructions when performing maintenance.

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. 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.
5. Provisions for the personnel in charge of duties essential to the UAS operation	
	As per Appendix A to AMC2 Article 11 *The personnel in charge of duties essential to the UAS operation*
6. Technical provisions	
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; 6.1.2 UAS energy status (fuel, battery charge, etc.); and 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 performance level becomes too low.
Human–machine interface (HMI)	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. 6.4 The UAS operator should conduct a UAS evaluation that considers and addresses human factors to determine whether the HMI is appropriate for the operation.
C2 links and communication	6.5 The UAS should comply with the applicable requirements for radio equipment and use of the RF spectrum. 6.6 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 deconfliction by procedure). 6.7 The UAS operator should ensure that reliable and continuous means of two-way communication for the purpose that is indicated in point 4.1.6(a) above are available.
Tactical mitigation	N/A
Containment	6.8 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: 6.8.1 no probable failure of the UAS or of any external system supporting the operation should lead to operation outside the operational volume; and 6.8.2 that 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. *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'.* 6.9 A design and installation appraisal should be made available and should cover at least: 6.9.1 the design and installation features (independence, separation, and redundancy); and 6.9.2 the particular risks (e.g. hail, ice, snow, electromagnetic interference, etc.) relevant to the ConOps. 6.10 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). 6.10.1 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: 6.10.1.1 the probability of the UA leaving the operational volume should be less than 10^{-4}/FH; and 6.10.1.2 no single failure of the UAS or of any external system supporting the operation should lead to operation outside the ground risk buffer. *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 the criterion if it can be shown that these mechanical parts were designed according to aviation industry best practices.* 6.10.2 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. *Note 1: The proposed additional safety provisions cover both the integrity and assurance levels.* *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 <u>independent</u> engine shutdown function that systematically prevents the UA from exiting the ground risk buffer due to single failures or an SW/AEH error of the flight controls, the intent of the provisions of point 6.10.1 above could be considered to be met.* 6.11 Compliance with the provisions of points 6.10.1 and 6.10.2 above should be substantiated by analysis and/or test data with supporting evidence.

Table PDRA-G02.1 — Main limitations and provisions for PDRA-G02