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## Predefined Risk Assessment, PDRA-06 for UA testing:

- VLOS OVER A CONTROLLED GROUND AREA
- MAXIMUM HEIGHT OF FLIGHT GEOGRAPHY 120m
- USING UNMANNED AIRCRAFT UP TO 8 M DIMENSION
- WITHIN THE RANGE OF THE DIRECT C2 LINK

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## 53 1. Overview of the PDRA

54 The development of this PDRA was triggered by the request from some states to facilitate  
55 operational authorisations for UAS with up to 8 m characteristic dimension<sup>1</sup> which have never flown  
56 before.

57 The PDRA should provide operators and manufacturers the possibility to perform UA test flights to  
58 develop technology, test components, or analyze specific procedures. It aims at granting enough  
59 flexibility for a variety of operations, while simultaneously ensuring a low-risk environment.

60 To provide flexibility, this PDRA considers operations that should be performed in Visual Line of Sight  
61 (VLOS) of the remote pilot. The operations should be conducted over controlled ground area that is  
62 entirely located in a sparsely populated environment. Operations over controlled ground  
63 automatically lead to a GRC appropriate for SAIL II operations, without the need to use mitigations  
64 that could reduce flexibility. It is also meaningful to require controlled ground, as this PDRA is  
65 designed for testing purposes, during which the likelihood for failures might be higher than usual.

66 A maximum height of 150 m above the overflown surface of the earth is considered for the  
67 operational volume. The operations take place in airspace considered as low encounter airspace  
68 (ARC-b). This can be uncontrolled airspace or controlled airspace with a coordination with the local  
69 ANSP.

70 In addition, the UA operator should establish an air risk buffer if the competent authority or the  
71 entity responsible for the airspace management considers necessary establishing such buffer.

72 The PDRA requires basic containment and provides suggestions, which may be used use to comply  
73 with the requirements considering the nature of the PDRA. These include an analysis of the UA  
74 system, a tether or a flight termination system.

75 Operators may perform automated flights, conducting the UA operation according to a  
76 preprogrammed path uploaded on the flight control system of the UA.

77 Summary of the main provisions:

- 78 • VLOS
- 79 • UA with maximum characteristic dimensions<sup>2</sup> up to 8 m and typical kinetic energy up to  
80 1084 kJ;
- 81 • Maximum height of the operational volume: 150 m AGL

82 Ground Risk:

- 83 • UA operated over controlled ground area that is entirely located in a sparsely populated  
84 area;
- 85 • UA operated with at least a 1:1 ground risk buffer

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<sup>1</sup> e.g. wingspan, rotor diameter/area or maximum distance between rotors in case of multirotor.

<sup>2</sup> e.g. wingspan, rotor diameter/area or maximum distance between rotors in case of multirotor.



86 Air Risk:

- 87 • Operations in airspace with low encounter rate (ARC-b);
- 88 • Uncontrolled or controlled airspace as established by the competent authority (with an
- 89 associated air risk that can be classified as not higher than ARC-b)

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PDRA characterisation and conditions				
Topic	Method of proof	Condition	Integrity	Proof
<b>1. Operational characterization (scope and limitations)</b>				
Level of human intervention	Self declaration	1.1 No autonomous operations: the remote pilot should have the ability to maintain control of the UA, except in case of a lost command and control (C2) link.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		1.2 The remote pilot should always be able to terminate the flight.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		1.3 The remote pilot should only operate one UA at a time.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		1.4 The remote pilot should not operate from a moving vehicle.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		1.5 The remote pilot should not hand over the control of the UA to another command unit.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
UA range limit	Self declaration	1.6 VLOS operations: Within VLOS distance from the remote pilot.	<i>Please include a reference to the relevant chapter of the OM or N/A</i>	I declare compliance or N/A.
Overflown areas	Declaration supported by data	1.7 UA operations should be conducted over controlled ground area.	<i>Please include a reference to the relevant chapter of the OM in which you provide the procedures for ensuring controlled ground area.</i>	I declare compliance. Supporting data is available.
UA Limitations	Self declaration	1.8 Maximum characteristic dimension (e.g. wingspan, rotor diameter/area or maximum distance between rotors in the case of a multicopter): 8 m	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		1.9 Typical kinetic energy (as defined in paragraph 2.3.1(k) of SORA) up to 1084 kJ	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.



PDRA characterisation and conditions					
Topic	Method of proof	Condition	Integrity	Proof	
Flight height limit	Self declaration	<p>1.10 The maximum height of the operational volume should not be higher than 150 m and the height of the flight geography 120 m above the overflow surface (or any other altitude reference defined by the state of operation).</p> <p><i>Note: In addition to the vertical limit for the operational volume, an air risk buffer may be considered (see "Air Risk" under point 3.10 of this table).</i></p>	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.	
Visibility	Self declaration	<p>1.11 The UA should be operated in an area where flight visibility is more than 5 km. The flight visibility should be understood as the distance from which manned aircraft can be visually detected from the position of the remote pilot. The remote pilot should stop the flight, in case the flight visibility degrades during the operation.</p>	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.	
Others	Self declaration	<p>1.12 The UA should not be used to drop material or carry dangerous goods.</p>	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.	
<b>2. Operational risk classification (according to the classification defined in SORA)</b>					
Final GRC	3	Final ARC	ARC-b	SAIL	II
<b>3. Operational mitigations</b>					
Operational volume (see Figure 2 of SORA)	Self declaration	<p>3.1 To determine the operational volume, the UA operator should consider the position-keeping capabilities of the UA in 4D space (latitude, longitude, height and time).</p>	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.	



PDRA characterisation and conditions				
Topic	Method of proof	Condition	Integrity	Proof
		3.2 In particular, the accuracy of the navigation solution, the flight technical error of the UA and the path definition error (e.g. map error) and latencies should be considered and addressed when determining the operational volume.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		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.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
Ground Risk	Self declaration	3.4 The operational volume and the ground risk buffer should be all contained in a controlled ground area that is entirely located in a sparsely populated area. The size of the adjacent area as computed in 6.12 should be considered when identifying a suitable location for the operation. The adjacent area should not contain assemblies of people.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		3.5 The UA operator should ensure the absence of uninvolved persons within the operational volume and the ground risk buffer prior to establishing the controlled ground area.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		3.6 The UA operator should ensure that no uninvolved persons can enter the controlled ground area during the operation or the operation can be	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.



PDRA characterisation and conditions				
Topic	Method of proof	Condition	Integrity	Proof
		suspended when uninvolved persons may be approaching the controlled ground area		
		3.7 The UA operator should establish a ground risk buffer to protect third parties on the ground outside the operational volume. The UA operator should make sure that the ground risk buffer is large enough to ensure that the UA impacts the ground within the limits of the ground risk buffer after flight termination at the most critical point. The ground risk buffer may be calculated using a ballistic methodology for rotary wing UA, but the minimum criterion should be the use of the '1:1 rule' (e.g. if the height of the operational volume is 150 m, the ground risk buffer should at least be 150 m).	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
Air Risk	Self declaration	3.8 The UA operation should be conducted:		
		3.8.1 below 150 m in uncontrolled airspace (class F or G) with a coordination with local airfields if applicable; or	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		3.8.2 below 150 m in controlled airspace with a coordination with the local ANSP; or	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance. Supporting evidence is available.





PDRA characterisation and conditions				
Topic	Method of proof	Condition	Integrity	Proof
		3.8.3 below 150 m in an airspace with a low encounter rate (ARC-b) which, for the purpose of this PDRA, is as defined by the competent authority; or	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		3.8.4 in a reserved or restricted airspace. The operational volume should be entirely contained in that reserved or restricted airspace.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		3.9 The adjacent airspace should not be ARC-d.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		3.10 The UA operator should establish an air risk buffer to protect third parties in the air, outside the operational volume if:	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		3.10.1 the competent authority or the entity responsible for the airspace management considers it necessary in order to ensure the protection of third parties in the air.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		3.11 The air risk buffer as per point 3.10 should be contained in the 'airspace class F or G' (uncontrolled airspace) unless the operation was coordinated with the local ANSP. The air risk buffer should be in an airspace with a low encounter rate (ARC-b) which, for the purpose of this PDRA, is as defined by	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.



PDRA characterisation and conditions				
Topic	Method of proof	Condition	Integrity	Proof
		the competent authority.		
		3.12 Prior to flight, the UA operator should assess the proximity of the planned UA operation to manned aircraft activity.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		3.13 The UA operator should establish a de-confliction scheme that allows the pilot to take efficient decisions in case of incoming traffic.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
4. UA operator and UA operations conditions				
UA operator and UA operations	Declaration supported by data	4.1 The UA operator should:		
		4.1.1 develop an operations manual (OM);	<i>Please describe how you met this condition.</i>	I declare compliance and the OM is submitted to the NAA.
		4.1.2 define the operational volume and ground risk buffer for the intended operation, as per points 3.1 to 3.11 above, and include them in the OM;	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance and the OM is submitted to the NAA.
		4.1.3 validate the operational procedures in accordance with the provisions for 'medium' level of robustness through a table top exercise or similar.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance and the OM is submitted to the NAA.
		4.1.4 validate the contingency and emergency procedures that are necessary to contain the UA within the operational volume. This validation is required before the first flight and should only		



PDRA characterisation and conditions				
Topic	Method of proof	Condition	Integrity	Proof
		<p>include simulations or tests on the ground.</p> <p>The validation should be representative of the intended way to achieve containment according to the technical requirements, see chapter 6.13.</p> <p>The simulations or tests should include at least:</p> <ul style="list-style-type: none"> <li>(a) the procedures to recognize that the UA leaves the flight geography and the following execution of the contingency procedures; and</li> <li>(b) the procedures to recognize that the UA leaves the contingency volume, and the following execution of the emergency procedures.</li> </ul> <p>The validation of the emergency procedures should include at least the execution of the ERP and a procedure to end the flight of the UA.</p>		



PDRA characterisation and conditions				
Topic	Method of proof	Condition	Integrity	Proof
		4.1.5 develop an emergency response plan (ERP) in accordance with the provisions for 'medium' level of robustness	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance and the OM is submitted to the NAA.
		4.1.6 designate for each flight a remote pilot with adequate competency and other personnel in charge of duties essential to the UA operation if needed;	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance and the OM is submitted to the NAA.
		4.1.7 have a policy that defines how the remote pilot and any other personnel in charge of duties essential to the UA operation can declare themselves fit to operate before conducting any operation.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance and the OM is submitted to the NAA.
		4.1.8 ensure that before starting the operation, the controlled ground area is in place, effective, and compliant with the minimum distance that is defined in points 3.4 and 3.7 above and, when required, coordination with the appropriate authorities has been established;	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance and the OM is submitted to the NAA.
		4.1.9 ensure that before starting the operation, all persons that are present in the controlled ground area:  (a) have been informed of the	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance and the OM is submitted to the NAA.



PDRA characterisation and conditions				
Topic	Method of proof	Condition	Integrity	Proof
		<p>risks of the operation;</p> <p>(b) have been briefed on or trained in, as appropriate, the safety precautions and measures that the UA operator has established for their protection; and</p> <p>(c) have explicitly agreed to participate in the operation;</p>		
		<p>4.1.10 in case the operation takes place in a reserved or restricted airspace, as part of the procedures that are contained in the OM (point 4.1.1 above), include the description of the following:</p> <p>(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.</p> <p><i>Note: The communication method should be published in the notice to airmen (NOTAM), which activates</i></p>	<p><i>Please include a reference to the relevant chapter of the OM.</i></p>	<p>I declare compliance and the OM is submitted to the NAA.</p>



PDRA characterisation and conditions				
Topic	Method of proof	Condition	Integrity	Proof
		<p><i>the reserved airspace to also allow coordination with manned aircraft.</i></p> <p>(b) The member(s) of personnel in charge of duties essential to the UA operation, who are responsible for establishing that communication;</p>		
		<p>4.1.11 ensure that all operations effectively use and support the efficient use of radio spectrum in order to avoid harmful interference.</p>	<p><i>Please include a reference to the relevant chapter of the OM.</i></p>	<p>I declare compliance and the OM is submitted to the NAA.</p>
UA maintenance	Self declaration	<p>4.2 In addition to the responsibilities that are defined in the provisions for UA operators in previous points, the UA operator should ensure that:</p>		
		<p>4.2.1 The UA maintenance instructions that are defined by the UA operator should be included in the OM and cover at least the UA manufacturer’s instructions and requirements when applicable. For development purposes of new UA, these maintenance instructions may be based on experiences made during the design process. The level of detail of these maintenance</p>	<p><i>Please include a reference to the relevant chapter of the OM.</i></p>	<p>I declare compliance.</p>



PDRA characterisation and conditions				
Topic	Method of proof	Condition	Integrity	Proof
		instructions may differ from the final product.		
		4.2.2 The maintenance staff should follow the UA maintenance instructions when performing maintenance.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
External services	Self declaration	4.3 The UA operator should ensure that the level of performance for any externally provided service necessary for the safety of the flight is adequate for the intended operation. The UA operator should declare that this level of performance is adequately achieved.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		4.4 The UA operator should define and allocate the roles and responsibilities between the UA operator and the external service provider(s), if applicable.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
5. Conditions for the personnel in charge of duties essential to the UA operation				
General	Self declaration	5.1 The UA operator should ensure that all personnel in charge of duties essential to the UA operation are provided with competency-based theoretical and practical training specific to their duties that consists of theoretical elements from Appendix 1 and practical elements from Appendix 2. In addition, the UA operator should ensure the following:	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.



PDRA characterisation and conditions				
Topic	Method of proof	Condition	Integrity	Proof
		5.1.1 The training programme should be documented (at least the training syllabus should be available).	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		5.1.2 Evidence of training should be presented for inspection upon request from the competent authority or authorized representative.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
Remote pilot	Self declaration	5.2 The remote pilot has the authority to cancel or delay any or all flight operations under the following conditions:	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		5.2.1 the safety of persons is threatened; or	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		5.2.2 property on the ground is threatened; or	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		5.2.3 other airspace users are in jeopardy; or	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		5.2.4 there is a violation of the terms of the authorisation.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		5.3 The remote pilot should:		
		5.3.1 not perform duties under the influence of psychoactive substances or alcohol or when it is unfit to perform its tasks due to injury, fatigue, medication,	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.





PDRA characterisation and conditions				
Topic	Method of proof	Condition	Integrity	Proof
		sickness or other causes;		
		5.3.2 when available, be familiar with manufacturer's instructions provided by the manufacturer of the UA;	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		5.3.3 ensure that the UA remains clear of clouds;	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		5.3.4 keep the UA in visual line of sight and perform unaided visual scanning of the airspace, as required, to avoid any potential collision hazard. The remote pilot can be assisted by airspace observers if desired.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		5.3.5 obtain updated information relevant to the intended operation about any flight restriction zones.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		5.3.6 ensure that the UA is in a safe condition to complete the intended flight safely.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
Multi-crew cooperation (MCC)	Self declaration	5.4 In applications where Multi-crew cooperation (MCC) might be required, the UA operator should:	<i>Please include a reference to the relevant chapter of the OM, otherwise, N/A.</i>	I declare compliance or N/A.
		5.4.1 designate the remote pilot to be responsible for each flight;	<i>Please include a reference to the relevant chapter of the OM, otherwise, N/A.</i>	I declare compliance or N/A.



PDRA characterisation and conditions				
Topic	Method of proof	Condition	Integrity	Proof
		5.4.2 include procedures to ensure coordination between the remote crew members with robust and effective communication channels. Those procedures should cover as a minimum the: <ul style="list-style-type: none"> <li>(a) assignment of tasks to the remote crew members; and</li> <li>(b) establishment of step-by-step communication; and</li> </ul>	<i>Please include a reference to the relevant chapter of the OM, otherwise, N/A.</i>	I declare compliance or N/A.
		5.4.3 ensure the training of the remote crew covers MCC	<i>Please include a reference to the relevant chapter of the OM, otherwise, N/A.</i>	I declare compliance or N/A.
Maintenance staff	Declaration supported by data	5.5 Any staff member authorised by the UA operator to perform maintenance activities should have been duly trained regarding the documented maintenance procedures.	<i>Please include a reference to the relevant chapter of the OM</i>	I declare compliance or N/A.
		5.6 Evidence of training should be presented for inspection upon request from the competent authority or authorised representative.	<i>Please include a reference to the relevant chapter of the OM</i>	I declare compliance and the OM is submitted to the competent authority. Evidence of training is available at the request of the competent authority
		5.7 The UA operator may declare that the maintenance team has received training regarding the documented maintenance procedures; however, evidence of this training should be made available upon request from the competent authority	<i>Please include a reference to the relevant chapter of the OM</i>	I declare compliance and the OM is submitted to the competent authority. Evidence of training is available at the request of the competent authority



PDRA characterisation and conditions				
Topic	Method of proof	Condition	Integrity	Proof
		or authorised representative.		
Personnel in charge of duties essential to the UA operation is fit to operate	Self declaration	5.8 The personnel in charge of duties essential to the UA operation should declare that they are fit to operate before conducting any operation based on the policy defined by the UA operator.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
<b>6. Technical provisions</b>				
General	Self declaration	6.1 The UA should be equipped with the means to monitor the critical parameters for a safe flight, in particular the:	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		6.1.1 UA position, height or altitude, ground speed or airspeed, attitude and trajectory;	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		6.1.2 UA energy status (fuel, battery charge, etc.); and	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		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.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		6.2 The UA should be protected against potential electromagnetic interferences	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.



PDRA characterisation and conditions				
Topic	Method of proof	Condition	Integrity	Proof
		from the infrastructure / facilities in the overflow area.		
Human-machine-interface (HMI)	Self declaration	6.3 The UA operator should carry out evaluations of the control unit in order to assess the workload of the remote pilot. The information and control interfaces should be clearly and succinctly presented and should not confuse, cause unreasonable fatigue, or contribute to remote crew errors that could adversely affect the safety of the operation.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance or N/A.
		6.4 The UA operator should conduct an evaluation of the UA considering and addressing human factors to determine whether the HMI is appropriate for the mission.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		6.5 The UA operator should conduct a UA evaluation that considers and addresses human factors to determine whether the HMI is appropriate for the operation.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
C2 links and communication	Self declaration	6.6 The UA should comply with the appropriate requirements for radio equipment and the use of the RF spectrum.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		6.7 Protection mechanisms against interference should be used, especially if unlicensed bands (e.g. ISM) are used	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.



PDRA characterisation and conditions				
Topic	Method of proof	Condition	Integrity	Proof
		for the C2 Link (mechanisms such as FHSS, DSSS or OFDM technologies, or frequency de-confliction by procedure)		
		6.8 The UA should be equipped with a C2 Link protected against unauthorised access to the command and control functions.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		6.9 In case of a loss of C2 Link, the UA should have a reliable and predictable method for the UA to recover the command and control link or terminate the flight in a way that reduces the effect on third parties in the air or on the ground.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
		6.10 In the event of an emergency, the remote pilot should have effective means to communicate with the relevant bodies.	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
Tactical mitigation	Self declaration	6.11 The UA design must be adequate to ensure that the time required between a command for an avoidance manoeuvre given by the remote pilot and the UA executing it does not exceed 5 seconds	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.
Containment	Declaration supported by data	6.12 The size of the adjacent area and airspace should be equal to the distance, which the UA can travel within 3 minutes during normal operational speed, with a minimum of 5km and a	<i>Please include a reference to the relevant chapter of the OM.</i>	I declare compliance.



PDRA characterisation and conditions				
Topic	Method of proof	Condition	Integrity	Proof
		<p>maximum of 35km.</p> <p>6.13 This PDRA requires basic containment: To ensure a safe recovery from a technical issue that involves the UA or an external system supporting the operation, the UA operator should ensure that no probable failure of the UA or any external system supporting the operation should lead to operation outside the operational volume.</p> <p>The operator should make a list of the failures that may lead to operation outside the operational volume and show that:</p> <ul style="list-style-type: none"> <li>(a) each failure is not probable; or</li> <li>(b) if a failure is probable, the UA can still be prevented from leaving the operational volume by procedural or other technical means.</li> </ul> <p>The operator should show that the combination of the probable failure and the intended countermeasures makes leaving the operational volume improbable.</p> <p><i>Note1: The term 'probable' needs to be</i></p>	<p><i>Please include a reference to the relevant chapter of the OM.</i></p>	<p>I declare compliance. A design and installation appraisal is available and it covers at least:</p> <ul style="list-style-type: none"> <li>• the design and installation features (independence, separation, and redundancy) and</li> <li>• the particular risks (e.g. hail, ice, snow, electromagnetic interference, etc.) relevant to the type of operation</li> </ul>



PDRA characterisation and conditions				
Topic	Method of proof	Condition	Integrity	Proof
		<p><i>understood in its qualitative interpretation, i.e. 'anticipated to occur one or more times during the entire system/operational life of an item.'</i></p> <p><i>Note 2: Applicants may make use of a simple Fault-Tree-Analysis to show compliance with the requirements or use other technical means like a tether or an independent flight termination system.</i></p> <p><i>Note 3: It is recommended that applicants use an independent flight termination system on their UA to increase safety during experimental flight testing.</i></p>		
		6.14 A design and installation appraisal should be made available and should include at least:		
		6.14.1 the design and installation features (independence, separation and redundancy);	<i>Please include a reference to the relevant chapter of the OM.</i>	
		6.14.2 any relevant particular risks (e.g. hail, ice, snow, electro-magnetic interference, etc.) associated to the OM.	<i>Please include a reference to the relevant chapter of the OM.</i>	

**Table PDRA-06.1 — Main limitations and provisions for PDRA-06**



92

93 **Appendix 1 THEORETICAL KNOWLEDGE SUBJECTS FOR THE TRAINING OF THE**  
94 **REMOTE PILOT AND ALL THE PERSONNEL IN CHARGE OF DUTIES ESSENTIAL TO**  
95 **THE UA OPERATION**

96 (a) The 'specific' category (category B) may cover a wide range of UA operations with different  
97 levels of risk. The UA operator is therefore required to identify the competency required for the  
98 remote pilot according to the outcome of the risk assessment. This appendix 1 to PDRA 6 covers  
99 the theoretical knowledge subjects while appendix 2 to PDRA 6 covers the practical knowledge  
100 subjects applicable to all operations in the 'specific' category (category B).

101 (b) The UA operator should propose to the competent authority, as part of the application, a  
102 theoretical knowledge training course for the remote pilot based on the elements defined for  
103 operations in the 'open' category (category A), complemented by the following elements, when  
104 relevant for the intended operation. The UA operator may use the same list of topics to propose  
105 also for the other personnel in charge of duties essential to the UA operation, a theoretical  
106 knowledge training course with competency-based theoretical training specific to their duties.

107 (1) Air safety:

108 (i) remote pilot records;

109 (ii) logbooks and associated documentation;

110 (iii) good airmanship principles;

111 (iv) aeronautical decision-making;

112 (v) aviation safety;

113 (vi) air proximity reporting; and

114 (vii) advanced airmanship:

115 (A) manoeuvres and emergency procedures; and

116 (B) general information on unusual conditions (e.g. stalls, spins, vertical lift  
117 limitations, autorotation, vortex ring states);

118 (2) aviation regulations:

119 (i) introduction to the UA regulation with focus on the 'specific' category (category  
120 B);

121 (ii) risk assessment, introduction to SORA; and

122 (iii) overview of PDRA;

123 (3) navigation:

124 (i) navigational aids and their limitations (e.g. GNSS)





- 125 (ii) reading maps and aeronautical charts (e.g. 1:500 000 and 1:250 000,  
126 interpretation, specialised charts, helicopter routes, U-space service areas, and  
127 understanding of basic terms); and
- 128 (iii) vertical navigation (e.g. reference altitudes and heights, altimetry);
- 129 (4) human performance limitations:
- 130 (i) perception; and
- 131 (ii) fatigue:
- 132 (A) flight durations within work hours;
- 133 (B) circadian rhythms;
- 134 (C) work stress; and
- 135 (D) commercial pressures;
- 136 (iii) attentiveness:
- 137 (A) eliminating distractions; and
- 138 (B) scan techniques;
- 139 (iv) medical fitness (health precautions, alcohol, drugs, medication etc.); and
- 140 (v) environmental factors such as vision changes from orientation to the sun;
- 141 (5) operational procedures:
- 142 (i) airspace classifications and operating principles;
- 143 (ii) U-Space/UTM;
- 144 (iii) procedures for airspace reservation;
- 145 (iv) aeronautical information publications;
- 146 (v) NOTAMs; and
- 147 (vi) mission planning, airspace considerations and site risk-assessment:
- 148 (A) measures to comply with the limitations and conditions applicable to the  
149 operational volume and the ground risk buffer for the intended operation;  
150 and
- 151 (6) UA general knowledge:
- 152 (i) loss of signal and system failure protocols — understanding the condition and  
153 planning for programmed responses such as returning to home, loiter, landing  
154 immediately;
- 155 (ii) flight termination systems; and
- 156 (iii) flight control modes;
- 157 (7) meteorology:



- 158 (i) obtaining and interpreting advanced weather information:
- 159 (A) weather reporting resources;
- 160 (B) reports;
- 161 (C) forecasts and meteorological conventions appropriate for typical UA flight
- 162 operations;
- 163 (D) local weather assessments;
- 164 (E) low-level charts; and
- 165 (F) METAR, SPECI, TAF;
- 166 (ii) regional weather effects — standard weather patterns in coastal, mountain or
- 167 desert terrains; and
- 168 (iii) weather effects on the UA (wind, storms, mist, variation of wind with altitude, wind
- 169 shear etc.); and
- 170 (8) technical and operational mitigations for air risks.
- 171 (i) principles of DAA.
- 172 (c) The UA operator should provide competency-based theoretical training covering the
- 173 emergency response plan (ERP) that includes the related proficiency requirements and
- 174 recurrent training.
- 175 (d) The UA operator may define additional aspects from the subjects mentioned in point (b) based on
- 176 the UA operations intended to be conducted:
- 177 (1) operational procedures;
- 178 (i) mission planning, airspace considerations and site risk-assessment — operations
- 179 over a controlled ground area;
- 180 (ii) multi crew cooperation (MCC):
- 181 (A) coordination between the remote pilot and other personnel in charge of
- 182 duties essential to the UA operation;
- 183 (B) crew resource management (CRM):
- 184 (a) effective leadership; and
- 185 (b) working with others;
- 186 (2) UA general knowledge:
- 187 (i) the means to monitor the UA (its position, height, speed, C2 Link, systems status,
- 188 etc.);
- 189 (ii) the means to support air traffic awareness.
- 190 (3) Managing data sources regarding:
- 191 (i) Where to find the data
- 192 (ii) Security of the data



- 193 (iii) Quantity of the needed data
- 194 (iv) Impact on the storage of data
- 195 (e) The training and assessment should be appropriate to the level of automation of the operation
- 196

197 **Appendix 2 PRACTICAL SKILL TRAINING OF THE REMOTE PILOT AND ALL THE**  
198 **PERSONNEL IN CHARGE OF DUTIES ESSENTIAL TO THE UA OPERATION**

199 (a) With regard to the practical skill training and assessment for the remote pilot, the UA operator should  
200 consider the competency defined for the 'open' category (category A) complemented by the following,  
201 when relevant for the intended operation. The UA operator should adapt the practical skill training based  
202 on the characteristics of the operation and the functions available on board of the UA. The UA operator  
203 may use the same list of topic to propose also for the personnel in charge of duties essential to the UA  
204 operation, other than remote pilot, a practical training.

- 205 (1) Preparation of the UA operation:
  - 206 (i) implement the necessary measures to comply with the limitations and conditions  
207 applicable to the operational volume and ground risk buffer for the intended  
208 operation in accordance with the operations manual procedures;
  - 209 (ii) implement the necessary procedures to operate in controlled airspace, including  
210 a protocol to communicate with ATC and obtain clearance and instructions, if  
211 necessary;
  - 212 (iii) confirm that all the necessary documents for the intended operation are on site;  
213 and
  - 214 (iv) brief all participants about the planned operation.
  - 215 (v) airspace scanning;
- 216 (2) Preparation for the flight:
  - 217 (i) make sure that all the safety elements available on UA, including the height and speed  
218 limitation systems, the flight termination system and its triggering system are  
219 operational;
  - 220 (ii) Knowledge of the basic actions to be taken in the event of an emergency situation,  
221 including issues with the UA, or if a mid-air collision hazard arises during the flight.
- 222 (3) Flight under abnormal conditions:
  - 223 (i) manage a partial or complete power shortage of the unmanned aircraft propulsion system  
224 while ensuring the safety of third parties on the ground;
  - 225 (ii) manage a situation of an incursion by a person not involved into the operational volume or  
226 the controlled ground area, and take appropriate measures to maintain safety;
  - 227 (iii) react to, and take the appropriate corrective actions for situations where the UA is likely to  
228 exceed the limit of the flight geography (contingency procedures) and from the operational  
229 volume (emergency procedures) as defined during the flight preparation;

- 230 (4) Emphasis should be placed on
- 231 (i) Normal, abnormal and emergency procedures;
- 232 (ii) Remote pilot incapacitation;
- 233 (iii) Skill test combined with periodic proficiency check;
- 234 (iv) Operating experience (with on the job training counting towards proficiency);
- 235 (v) Pre-flight, post-flight and documentation;
- 236 (vi) Recurrent training (UA/FTD).
- 237 (b) The practical skill training may be conducted on the actual UA or a flight training device (FTD). Emphasis
- 238 should be placed on scenario based training (SBT) using highly structured scripts of real-world
- 239 experiences for the specific operation to fortify learning in an operational environment and improving
- 240 situation awareness. SBT should include realistic normal and emergencies scenarios that are written with
- 241 specific learning objectives in mind.
- 242 (c) Practical skill training is checked during the assessment and can be done using the actual UA or on a flight
- 243 training device appropriate to the specific operation.
- 244 (d) Initial and recurring training:
- 245 (1) The UA operator should ensure that specified minimum requirements with respect to time (e.g.
- 246 programmed flying hours) for initial and recurrent training (e.g. duration and flying hours) are
- 247 prescribed and provided in a manner that is acceptable and approved by the competent authority.
- 248 (2) Depending on the training course, each of the topics shown in Table 1 below may require an
- 249 overview or in-depth training. In-depth training should be interactive and include discussions,
- 250 case study reviews and role-plays, as deemed necessary to enhance learning.

Topic	Initial	Change of UA	Change of remote pilot/crew	Recurrent Training
Situational awareness and error management	In Depth	In-depth	Overview	Overview
Company safety culture, operational procedures, organisation		Not Required	In Depth	
Stress management, fatigue and vigilance			Not Required	

Decision making		Overview		
Automation, philosophy of the use of automation	As Required	In-depth	In Depth	As Required
Specific UA type-related differences			Not Required (same UA type)	
Case based studies	In Depth		In Depth	As Required

251 **Table 1 — Level of practical skill training in several topics depending on initial training, recurring training or change of UA**  
 252 **/ UA operator**

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255 **2. Annex A: Risk assessment for PDRA-06**

256 The following risk assessment has been conducted by applying SORA to the PDRA-06.

257 **3.1 Step #1 – CONOPS description**

258 UA operators that intend to perform a UA operation under this PDRA should elaborate a concept of  
 259 operations (ConOps) which includes an Operational and Technical Manual. This ConOps needs to fit  
 260 the operational limitations defined in this PDRA.

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

263 **3.2 Step #2 — determination of the intrinsic UA ground risk class**

264 The initial UA ground risk relates to the unmitigated risk of a person being struck by the UA (in case of  
 265 loss of UA control) and can be represented by the Ground Risk Classes (GRC) derived from the intended  
 266 operation and the UA lethal area, as shown in Table A1 below.

Intrinsic UA Ground Risk Class				
Max UA characteristics dimension	1 m / approx. 3ft	3 m / approx. 10ft	8 m / approx. 25ft	>8 m / approx. 25ft
<i>Typical kinetic energy expected</i>	< 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			

267 **Table A1 Determination of the intrinsic UA Ground Risk Class (GRC)**

268 From the limitations defining the proposed PDRA:

269 Operational scenarios: VLOS over controlled ground areas. Because of the lack of in-service  
 270 experience and the fact that the UA may be a prototype with an increased risk of failure, maintaining  
 271 VLOS will offer an increased ability to control the flight.



272 UA characteristics:

- 273 – Up to 8m of characteristic dimension (e.g. wingspan or rotor diameter)
- 274 – Typical expected maximal kinetic energy of 1084 kJ

275 Thus, the maximum **intrinsic GRC = 3**

276 **3.3 Step #3 — final GRC determination**

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

278 M3 – An Emergency Response Plan (ERP) is in place, operator validated and effective with a  
 279 “medium” level of robustness. As per point 4.1.5, the UA operator should develop an ERP in  
 280 accordance with the provisions for ‘medium’ level of robustness.

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

Mitigation Sequence	Mitigations for ground risk	Robustness			Correction
		Low / None	Medium	High	
1	M1 - Strategic mitigations for ground risk <sup>3</sup>	0: None -1: Low	-2	-4	0
2	M2 - Effects of ground impact are reduced <sup>4</sup>	0	-1	-2	0
3	M3 - An Emergency Response Plan (ERP) is in place, operator validated and effective	1	0	-1	0
<b>Total correction</b>					<b>0</b>

282 **Table A2 Mitigations for Final GRC determination (GRC)**

283 **3.4 Steps #4 to 6 — air risk assessment**

284 This PDRA is intended for UA operations in airspace with a low encounter rate with manned aircraft  
 285 (ARC-b). ARC-b in the framework of this PDRA is understood as an airspace:

- 286 • below 150 m AGL in uncontrolled airspace (class F or G) over rural area, with a coordination with local  
 287 airfields if applicable;
- 288 • below 150 m AGL in controlled airspace with a coordination with the local ANSP; or
- 289 • below 150 m AGL in an airspace with a low encounter rate (ARC-b) which, for the purpose of this PDRA,  
 290 is as defined by the competent authority.

291 A competent authority may decide to create a specific area that is designated as a test site for UA  
 292 operations. Such a test site may have a restricted airspace that was specifically established to allow  
 293 safe operations of UA. To make this PDRA also applicable to such operations, the following is  
 294 considered:

<sup>3</sup> This mitigation is meant as a means to reduce the number of people at risk.

<sup>4</sup> This mitigation is meant as a means to reduce the energy absorbed by the people of the ground upon impact.



- An operation under this PDRA is also possible in a reserved or restricted airspace that is established and approved for the purpose of the UA operation. The air risk for such an airspace may be considered as ARC-a.

Therefore, this PDRA makes no specific difference between the operational requirements and procedures for flights in an ARC-b and ARC-a. This does not have an influence on the SAIL II classification. The final GRC is 3, which does not allow SAIL I.

The **initial ARC is ARC-b.**

No strategic mitigation to decrease the initial ARC is included, **the final ARC remains as ARC-b.**

The operation may take place in Visual line of Sight of the pilot.

For VLOS operations, the operator is required to have a deconfliction scheme to address the potential risk of collision with other airspace users.

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

311

**3.5 Step #7 — final GRC determination**

313

Ground risk: final GRC is 3.

Air risk: final ARC is ARC-b

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

317

318

319

320

SAIL Determination				
	Final ARC			
Final GRC	a	b	c	d
1	I	II	IV	VI
2	I	II	IV	VI
3	II	II	IV	VI
4	III	III	IV	VI
5	IV	IV	IV	VI
6	V	V	V	VI
7	VI	VI	VI	VI



321

**Table A3 SAIL determination**

322 **3.6 Step #8 — identification of Operational Safety Objectives (OSOs)**

323 The purpose of this step is to evaluate the defences within the UA operation in the form of OSOs and  
 324 the associated level of robustness depending on the SAIL. Table A4 provides a qualitative methodology  
 325 to make this determination. In this table, ‘O’ means optional, ‘L’ means recommended with low  
 326 robustness, ‘M’ means recommended with medium robustness, and ‘H’ means recommended with  
 327 high robustness.

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

OSO Number (in line with SORA Annex E)		SAIL					
		I	II	III	IV	V	VI
<b>Technical issue with the UA</b>							
OSO#01	Ensure the operator is competent and/or proven	O	L	M	H	H	H
OSO#02	UA manufactured by competent and/or proven entity	O	O	L	M	H	H
OSO#03	UA maintained by competent and/or proven entity	L	L	M	M	H	H
OSO#04	UA developed to authority recognized design standards <sup>5</sup>	O	O	O	L	M	H
OSO#05	UA is designed considering system safety and reliability	O	O	L	M	H	H
OSO#06	C3 link performance is appropriate for the operation	O	L	L	M	H	H
OSO#07	Inspection of the UA (product inspection) to ensure consistency to the ConOps	L	L	M	M	H	H
OSO#08	Operational procedures are defined, validated and adhered to	L	M	H	H	H	H
OSO#09	Remote crew trained and current and able to control the abnormal situation	L	L	M	M	H	H
OSO#10	Safe recovery from technical issue	L	L	M	M	H	H
<b>Deterioration of external systems supporting UA operation</b>							
OSO#11	Procedures are in-place to handle the deterioration of external systems supporting UA operation	L	M	H	H	H	H
OSO#12	The UA is designed to manage the deterioration of external systems supporting UA operation	L	L	M	M	H	H
OSO#13	External services supporting UA operations are adequate to the operation	L	L	M	H	H	H

<sup>5</sup> The robustness level does not apply to mitigations for which credit has been taken to derive the risk classes. This is further detailed in para. 3.2.11(a).

OSO Number (in line with SORA Annex E)		SAIL					
		I	II	III	IV	V	VI
<b>Human Error</b>							
OSO#14	Operational procedures are defined, validated and adhered to	L	M	H	H	H	H
OSO#15	Remote crew trained and current and able to control the abnormal situation	L	L	M	M	H	H
OSO#16	Multi crew coordination	L	L	M	M	H	H
OSO#17	Remote crew is fit to operate	L	L	M	M	H	H
OSO#18	Automatic protection of the flight envelope from Human Error	O	O	L	M	H	H
OSO#19	Safe recovery from Human Error	O	O	L	M	M	H
OSO#20	A Human Factors evaluation has been performed and the HMI found appropriate for the mission	O	L	L	M	M	H
<b>Adverse operating conditions</b>							
OSO#21	Operational procedures are defined, validated and adhered to	L	M	H	H	H	H
OSO#22	The remote crew is trained to identify critical environmental conditions and to avoid them	L	L	M	M	M	H
OSO#23	Environmental conditions for safe operations defined, measurable and adhered to	L	L	M	M	H	H
OSO#24	UA designed and qualified for adverse environmental conditions	O	O	M	H	H	H

**Table A4 Recommended operational safety objectives (OSOs)**

330  
331

332 **3.7 Step #9 — adjacent area/airspace considerations**

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

334 No probable failure of the UA or any external system supporting the operation should lead to  
335 operation outside of the operational volume. Compliance with this should be substantiated by a  
336 design and installation appraisal and include at least:

- 337 • design and installation features (independence, separation and redundancy);
- 338 • particular risks (e.g. hail, ice, snow, electro-magnetic interference, etc.) relevant to the  
339 ConOps.

340

341 **3.8 Step #10 — comprehensive safety portfolio**

342 This step addresses the satisfactory substantiation of mitigations and objectives required by the  
343 SORA process, ensuring also that any additional requirements to those identified by the SORA



- 344 process (e.g. security, environmental protection, etc.) as well as the relative stakeholders (e.g.  
345 environmental protection agencies, national security bodies, etc.) are adequately addressed.
- 346 For the purpose of the assessment of this PDRA, under this step the compliance of proposed  
347 provisions for the PDRA against SORA criteria is performed as shown in:
- 348 For mitigations used to modify the intrinsic GRC: Table A5 in point 3.9 of this Annex.
- 349 For strategic mitigations for the initial ARC: Not applicable.
- 350 For tactical mitigations for the final ARC: Not applicable.
- 351 For operational safety objectives: see Table A6 in point 3.10 of this Annex.
- 352 For adjacent area/airspace consideration: see Table A7 in point 3.11 of this Annex.

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353 3.9 Evaluation of mitigations means

354

Mitigations for the intrinsic GRC		Level of robustness	Criteria in SORA	Provisions for the PDRA
<p><b>M3 - An Emergency Response Plan (ERP) is in place, operator validated and effective</b></p>	<p>LEVEL of INTEGRITY</p>	<p>Medium</p>	<p>An ERP should be defined by the applicant in the event of a loss of control of the operation. These are emergency situations where the operation could result in an unrecoverable state and in which:</p> <ul style="list-style-type: none"> <li>(a) the outcome of the situation highly relies on providence; or</li> <li>(b) could not be handled by a contingency procedure; or</li> <li>(c) when there is grave and imminent danger of fatalities</li> </ul> <p>The ERP proposed by an applicant is different from the emergency procedures. The ERP is expected to cover:</p> <ul style="list-style-type: none"> <li>(a) a plan to limit the escalating effect of an eminent crash (e.g. notify first responders), and</li> <li>(b) the conditions to alert ATM</li> </ul> <p>The ERP:</p> <ul style="list-style-type: none"> <li>(a) is suitable for the situation;</li> <li>(b) limits the escalating effects;</li> </ul>	<p>An ERP with medium levels of robustness is required</p>



			<ul style="list-style-type: none"> <li>(c) defines criteria to identify an emergency situation;</li> <li>(d) is practical to use;</li> <li>(e) clearly delineates Remote Crew member(s) duties.</li> </ul>	
	LEVEL of ASSURANCE		<p>Criterion #1 (Procedures)</p> <ul style="list-style-type: none"> <li>(a) The ERP is developed to standards considered adequate by the competent authority and/or in accordance with means of compliance acceptable to that authority.</li> <li>(b) The ERP is validated through a representative tabletop exercise consistent with the ERP training syllabus.</li> </ul>	An ERP with medium levels of robustness is required
			<p>Criterion #2 (Training)</p> <ul style="list-style-type: none"> <li>(a) Training syllabus is available</li> <li>(b) Competency-based theoretical and practical training is organised by the operator</li> </ul>	An ERP with medium levels of robustness is required

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

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356  
357  
358  
359



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362

363 **3.10 Operational Safety Objectives (OSOs)**

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

Operational Safety Objectives (OSOs)		SAIL II level of robustness	Criteria in SORA for SAIL II	Provisions for the PDRA
OSO #01 – Ensure the operator is competent and/or proven	LEVEL of INTEGRITY	Low	The applicant is knowledgeable of the UA being used and as a minimum has the following relevant operational procedures: checklists, maintenance, training, responsibilities, and associated duties.	The UA operator should establish procedures and limitations adapted to the type of the intended operation and the risk involved’, which implies knowledge on the UA intended to be used and relevant operational procedures. Furthermore, point 4.1.1 indicates that the UA operator should develop an Operations Manual (OM).
	LEVEL of ASSURANCE		The elements requested for the level of integrity are addressed in the OPERATIONS MANUAL.	Point 4.1.1 of the PDRA indicates that the UA operator should develop an Operations Manual (OM).



Operational Safety Objectives (OSOs)		SAIL II level of robustness	Criteria in SORA for SAIL II	Provisions for the PDRA
OSO #03 – UA maintained by competent and/or proven entity (e.g. industry standards)	LEVEL of INTEGRITY	Low	<p>The UA maintenance instructions are defined and when applicable cover the UA designer instructions and requirements. when applicable.</p> <p>The maintenance staff is competent and has received an authorisation to carry out UA maintenance.</p> <p>The maintenance staff use the UA maintenance instructions while performing maintenance.</p>	<p>The UA operator should maintain the UA in a suitable condition for safe operation by, as a minimum, defining maintenance instructions and employing an adequately trained and qualified maintenance staff. Besides, point 4.2 of the PDRA indicates that UA maintenance instructions defined by the UA operator should cover at least the UA manufacturer’s instructions and requirements when applicable.</p> <p>Point 4.2 of the PDRA indicates that the maintenance staff should use the UA maintenance instructions while performing maintenance.</p>



Operational Safety Objectives (OSOs)		SAIL II level of robustness	Criteria in SORA for SAIL II	Provisions for the PDRA
	LEVEL of ASSURANCE		<p>Criterion #1 (Procedure):</p> <ul style="list-style-type: none"> <li>– The maintenance instructions are documented.</li> <li>– The maintenance conducted on the UA is recorded in a maintenance log system<sup>1/2</sup>.</li> <li>– A list of maintenance staff authorised to carry out maintenance is established and kept up to date.</li> </ul> <p><sup>1</sup> Objective is to record all the maintenance performed on the aircraft, and why it is performed (defects or malfunctions rectification, modification, scheduled maintenance etc.)</p> <p><sup>2</sup> The maintenance log may be requested for inspection/audit by the approving authority or an authorised representative.</p> <p>Criterion #2 (Training):</p> <p>A record of all relevant qualifications, experience and/or trainings completed by the maintenance staff is established and kept up to date.</p>	<p>Criterion#1:</p> <ul style="list-style-type: none"> <li>– Point 4.2 of the PDRA indicates that UA maintenance instructions defined by the UA operator should be included in the OM together with the maintenance instructions required to keep the UA in safe condition.</li> <li>– the UA operator should keep an up-to-date record of the maintenance activities conducted on the UA for a minimum of 3 years.</li> <li>– the UA operator should establish and keep an up-to-date list of the maintenance staff employed by the operator to carry out maintenance activities.</li> </ul> <p>Criterion #2: the UA operator should keep and maintain an up-to-date record of all the relevant qualifications training courses completed by the maintenance staff, for at least 3 years after those persons have ceased employment with the organisation or have changed their position in the organisation.</p>





<p><b>OSO #06 – C3 link performance is appropriate for the operation</b></p>	<p>LEVEL of INTEGRITY</p>	<p>Low</p>	<p>The applicant determines that performance, RF spectrum usage<sup>1</sup> and environmental conditions for C3 links are adequate to safely conduct the intended operation.</p> <p>The UA remote pilot has the means to continuously monitor the C3 performance and ensure the performance continues to meet the operational requirements<sup>2</sup>.</p> <p><i><sup>1</sup> For a low level of integrity, unlicensed frequency bands might be acceptable under certain conditions, e.g.:</i></p> <ul style="list-style-type: none"> <li>– the applicant demonstrates compliance with other RF spectrum usage requirements (e.g. for EU: Directive 2014/53/EU, for US: CFR Title 47 Part 15 Federal Communication Commission (FCC) rules), by showing the UA equipment is compliant with these requirements (e.g. FCC marking), and</li> <li>– the use of mechanisms to protect against interference (e.g. FHSS, frequency deconfliction by procedure).</li> </ul> <p><i><sup>2</sup> The remote pilot has continual and timely access to the relevant C3 information that could effect the safety of flight. For operations with a low level of integrity for this OSO, this could be achieved by monitoring the C2 link signal</i></p>	<p>the UA operator should ensure that all operations effectively use and support the efficient use of radio spectrum in order to avoid harmful interference.</p> <p>Besides:</p> <ul style="list-style-type: none"> <li>– the remote pilot should ‘ensure that the operating environment is compatible with the authorised or declared limitations and conditions’</li> <li>– Point 6.7 of the PDRA indicates The UA should comply with the appropriate requirements for radio equipment and the use of the RF spectrum.</li> <li>– Point 6.8 of the PDRA indicates that protection mechanisms against interference should be used, especially if unlicensed bands (e.g. ISM) are used for the C2 Link (mechanisms such as such as FHSS, DSSS or OFDM technologies, or frequency de-confliction by procedure)</li> </ul> <p>Point 6.1 of the PDRA indicates that means to monitor critical parameters for a safe flight should be available, and point 6.1.3 includes status of critical functions and systems; as a minimum, for services based on RF signals (e.g. C2 Link, GNSS, etc.)</p> <p>Point 6.10 of the PDRA indicates that in case of a loss of C2 Link, the UA should have a reliable and predictable method for the UA to recover the command and control</p>
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Operational Safety Objectives (OSOs)		SAIL II level of robustness	Criteria in SORA for SAIL II	Provisions for the PDRA
			<i>strength and receiving an alert from the UA HMI if the signal becomes too low.</i>	link or terminate the flight in a way that reduces the effect on third parties in the air or on the ground.  Point 6.11 of the PDRA indicates that In the event of an emergency, the remote pilot should have effective means to communicate with the relevant bodies.
	LEVEL of ASSURANCE		The applicant declares that the required level of integrity has been achieved <sup>(1)</sup> <i>(1)Supporting evidences may or may not be available</i>	This information should be included in the Operations Manual.
<b>OSO #07 Inspection of the UA (product inspection) to ensure consistency to the ConOps</b>	LEVEL of INTEGRITY	Low	The remote crew ensures that the UA is in a condition for safe operation and conforms to the approved Operations Manual.	the remote pilot should ‘ensure that the UA is in a safe condition to complete the intended flight safely’.  Pre-flight inspection is included in the Operations Manual



Operational Safety Objectives (OSOs)		SAIL II level of robustness	Criteria in SORA for SAIL II	Provisions for the PDRA
	LEVEL of ASSURANCE		<p>Criterion #1 (Procedure):</p> <ul style="list-style-type: none"> <li>– Product inspection is documented and accounts for the manufacturer’s recommendations if available.</li> </ul> <p>Criterion #2 (Training): The remote crew is trained to perform the product inspection, and that training is self-declared (with evidence available).</p>	<p>Criterion #1: The verification that the UA is in safe condition for the intended operation is included as one of the aspects to be documented in the OM</p> <p>Criterion #2:</p> <ul style="list-style-type: none"> <li>– the UA operator should ensure that remote pilots ‘have been informed about the UA operator’s operations manual’ and that personnel in charge of duties essential to the UA operation, other than the remote pilots, ‘have completed the on-the-job-training developed by the operator, and have been informed about the UA operator’s operations manual’.</li> <li>– the training programme should be documented (at least the training syllabus should be available).</li> </ul>



<p><b>Operational procedures (OSO #08, OSO #11, OSO #14 and OSO #21)</b></p>	<p>LEVEL of INTEGRITY</p>	<p>Medium</p>	<p>Criterion #1 (Procedure definition):</p> <ul style="list-style-type: none"> <li>– Operational procedures<sup>1</sup> appropriate for the proposed operation are defined and as a minimum cover the following elements:</li> </ul> <p>Flight planning,</p> <p>Pre and post-flight inspections,</p> <p>Normal procedures,</p> <p>Procedures to evaluate environmental conditions before and during the mission (i.e. real-time evaluation),</p> <p>Procedures to cope with unintended adverse operating conditions (e.g. when ice is encountered during an operation not approved for icing conditions)</p> <p>Contingency procedures (to cope with abnormal situations),</p> <p>Emergency procedures (to cope with emergency situations), and</p> <p>Occurrence reporting procedures.</p> <ul style="list-style-type: none"> <li>– Normal, Abnormal, and Emergency procedures are compiled in an Operation Manual.</li> </ul>	<p>Criterion #1:</p> <ul style="list-style-type: none"> <li>– the UA operator should ‘establish procedures and limitations adapted to the type of the intended operation and the risk involved, including operational procedures to ensure the safety of the operations’.</li> <li>– Point 4.1.1 of the PDRA indicates that the UA operator should develop an Operations Manual (OM) which should include all the elements indicated in SORA criterion #1.</li> </ul> <p>Criterion #2:</p> <ul style="list-style-type: none"> <li>– The UA operator should reduce the level of complexity avoiding raising the workload and/or the interactions with other entities (e.g. ATM, etc.) of remote pilots and/or other personnel in charge of duties essential to the UA operation to a level that may jeopardise their ability to perform adequately the procedures.</li> </ul> <p>Since taking manual control is still under JARUS discussion, it has not been considered in the assessment.</p> <p>Criterion #3:</p> <ul style="list-style-type: none"> <li>– Operational procedures should be developed to minimise human errors. To that aim it is important that:</li> </ul>
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Operational Safety Objectives (OSOs)		SAIL II level of robustness	Criteria in SORA for SAIL II	Provisions for the PDRA
			<ul style="list-style-type: none"> <li>– The limitations of the external systems used to support UA safe operations are defined in an Operation Manual.</li> </ul> <p>Criterion #2 (Procedure complexity which could jeopardize adherence to): Operational procedures involve the remote pilot to take manual control when the UA is usually automatically controlled.</p> <p>Criterion #3 (Consideration of Potential Human Error): Operational procedures take considerations of human errors.</p> <p>At a minimum, Operational procedures provide:</p> <ul style="list-style-type: none"> <li>– a clear distribution and assignment of tasks</li> <li>– an internal checklist to ensure staff are performing their assigned tasks.</li> </ul>	<ul style="list-style-type: none"> <li>– each of the tasks and the complete sequence of tasks of a procedure are clearly defined, designing them to be intuitive and unambiguous;</li> <li>– tasks are clearly distributed and assigned to the relevant roles and persons, ensuring a balanced workload;</li> <li>– procedures address adequately fatigue and stress, considering among other aspects: duty times, regular breaks, rest periods, the applicable health and safety requirements on the operational environment, handover/takeover procedures, responsibilities and workload..</li> </ul>



Operational Safety Objectives (OSOs)		SAIL II level of robustness	Criteria in SORA for SAIL II	Provisions for the PDRA
	LEVEL of ASSURANCE		<p>Operational procedures are validated against recognized standards.</p> <p>The adequacy of the Contingency and Emergency procedures are proved through:</p> <ul style="list-style-type: none"> <li>– Simulation provided the simulation is proven valid for the intended purpose with positive results.</li> </ul>	<p>Point 4.1.3 of the PDRA indicates that the UA operator should validate the operational procedures in accordance with the provisions for 'medium' level of robustness;</p> <p>Point 4.1.4 of the PDRA indicates that the UA operator should ensure the adequacy of the contingency and emergency procedures and prove it through any of the following:</p> <ul style="list-style-type: none"> <li>simulations, provided that the representativeness of the simulation means is proven for the intended purpose with positive results; or</li> <li>any other means acceptable to the competent authority.</li> </ul>



Operational Safety Objectives (OSOs)		SAIL II level of robustness	Criteria in SORA for SAIL II	Provisions for the PDRA
Remote crew training (OSO #09, OSO #15 and OSO #22)	LEVEL of INTEGRITY	Low	The competency-based theoretical and practical training ensures knowledge of: <ul style="list-style-type: none"> <li>a) UA regulation</li> <li>b) UA airspace operating principles</li> <li>c) Airmanship and aviation safety</li> <li>d) Human performance limitations</li> <li>e) Meteorology</li> <li>f) Navigation/Charts</li> <li>g) UA knowledge</li> <li>h) Operating procedures</li> </ul> and is adequate for the operation.	<p>Appendices 1 and 2 lists the competencies required for remote pilots operating UA in the ‘specific’ category.</p> <p>the UA operator should ensure before conducting operations that the remote pilot has the appropriate competency.</p> <p>the remote pilot should have the appropriate remote pilot competency for the intended operation.</p>
	LEVEL of ASSURANCE		Training is self-declared (with evidence available)	<p>The remote pilot should carry a proof of competency while operating the UA.</p> <ul style="list-style-type: none"> <li>– the training programme should be documented (at least the training syllabus should be available); and</li> <li>– evidence of training should be presented for inspection upon request from the competent authority or authorised representative.</li> </ul>



<p><b>Safe Design: OSO #10 Safe recovery from technical issue &amp; OSO #12 The UA is designed to manage the deterioration of external systems supporting UA operation</b></p>	<p>LEVEL of INTEGRITY</p>	<p>Low</p>	<p>The objective of these OSOs is to complement the technical containment safety requirements by addressing the risk of a fatality occurring while operating over populous areas or gatherings of people.</p> <p>External systems supporting the operation are defined as systems not already part of the UA but used to:</p> <p>launch / take-off the UA, make pre-flight checks, keep the UA within its operational volume (e.g. GNSS, Satellite Systems, Air Traffic Management, UTM).</p> <p>External systems activated/used after the loss of control of the operation are excluded from this definition.</p> <p>It is expected when operating over populous areas or gatherings of people, a fatality will not occur from any probable<sup>1</sup> failure<sup>2</sup> of the UA or any external system supporting the operation.</p> <p><sup>1</sup> The term “probable” needs to be understood in its qualitative interpretation, i.e. “Anticipated to occur one or more times during the entire system/operational life of an item.”</p> <p><sup>2</sup> Some structural or mechanical failures may be excluded from the criterion if it can be shown that</p>	<p>N/A as operations are planned in controlled ground area</p>
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Operational Safety Objectives (OSOs)		SAIL II level of robustness	Criteria in SORA for SAIL II	Provisions for the PDRA
			these mechanical parts were designed to aviation industry best practices.	
	LEVEL of ASSURANCE		<p>A design and installation appraisal is available. In particular, this appraisal shows that:</p> <p>the design and installation features (independence, separation and redundancy) satisfy the low integrity criterion;</p> <p>particular risks relevant to the Operations Manual (e.g. hail, ice, snow, electro-magnetic interference...) do not violate the independence claims, if any.</p>	N/A as operations are planned in controlled ground area
<b>OSO #13 External services supporting UA operations are adequate to the operation</b>	LEVEL of INTEGRITY	Low	<p>The applicant ensures that the level of performance for any externally provided service necessary for the safety of the flight is adequate for the intended operation.</p> <p>Roles and responsibilities between the applicant and the external service provider are defined.</p>	<p>Point 4.3 of the PDRA indicates that the UA operator should ensure that the level of performance for any externally provided service necessary for the safety of the flight is adequate for the intended operation. The UA operator should declare that this adequate level of performance is achieved.</p> <p>Point 4.4 of the PDRA indicates that the UA operator should define the allocation of the roles and responsibilities between the operator and the external service provider(s), if applicable.</p>



Operational Safety Objectives (OSOs)		SAIL II level of robustness	Criteria in SORA for SAIL II	Provisions for the PDRA
	LEVEL of ASSURANCE		The applicant declares that the requested level of performance for any externally provided service necessary for the safety of the flight is achieved (without evidence being necessarily available)	This information should be included in the Operations Manual.
<b>OSO #16 Multi crew coordination</b>	LEVEL of INTEGRITY	Low	<p>Criterion #1 (Procedures):</p> <ul style="list-style-type: none"> <li>– Procedure(s) to ensure coordination between the crew members and that robust and effective communication channels is (are) available and at a minimum cover:</li> </ul> <p>assignment of tasks to the crew, establishment of step-by-step communications.</p> <p>Criterion #2 (Training): Remote Crew training covers multi crew coordination.</p>	<p>Criterion #1:</p> <p>In applications where multi-crew cooperation (MCC) might be required, the UA operator should include procedures to ensure coordination between the remote crew members with robust and effective communication channels. Those procedures should cover as a minimum:</p> <ul style="list-style-type: none"> <li>– the assignment of tasks to the remote crew members; and</li> <li>– the establishment of step-by-step communication; and</li> </ul> <p>Criterion #2: According to point 5.7 of the PDRA, in applications where MCC might be required, the UA operator should ensure that the training of the remote crew covers MCC.</p>



Operational Safety Objectives (OSOs)		SAIL II level of robustness	Criteria in SORA for SAIL II	Provisions for the PDRA
	LEVEL of ASSURANCE		<p>Criterion #1 (Procedures):</p> <ul style="list-style-type: none"> <li>– Procedures are not required to be validated against a recognized standard.</li> <li>– The adequacy of the procedures and checklists is declarative.</li> </ul> <p>Criterion #2 (Training):</p> <ul style="list-style-type: none"> <li>– Training is self-declared (with evidence available)</li> </ul>	<p>Criterion #1 (Procedures): see the “level of assurance” for Operational procedures (OSO #08, OSO #11, OSO #14 and OSO #21)</p> <p>Criterion #2 (Training): see the “level of assurance” for Remote crew training (OSO #09, OSO #15 and OSO #22)</p>
OSO #17 Remote crew is fit to operate	LEVEL of INTEGRITY	Low	The applicant has a policy defining how the remote crew can declare themselves fit to operate before conducting any operation.	Point 4.1.5 of the PDRA indicates that the UA operator should have a policy that defines how the remote pilot and any other personnel in charge of duties essential to the UA operation can declare themselves fit to operate before conducting any operation.
	LEVEL of ASSURANCE		The remote crew declare they are fit to operate before conducting any operation based on the policy defined by the applicant.	The remote crew should declare that they are fit to operate before conducting any operation based on the policy defined by the UA operator.
OSO #20 A Human Factors evaluation has been performed and the HMI found appropriate for the mission	LEVEL of INTEGRITY	Low	The UA information and control interfaces are clearly and succinctly presented and do not confuse, cause unreasonable fatigue, or contribute to remote crew error that could adversely affect the safety of the operation.	Point 6.5 of the PDRA indicates that the UA 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 UA operation such that this could adversely affect the safety of the operation.



Operational Safety Objectives (OSOs)		SAIL II level of robustness	Criteria in SORA for SAIL II	Provisions for the PDRA
	LEVEL of ASSURANCE		The applicant conducts an evaluation of the UA considering and addressing human factors to determine the HMI is appropriate for the mission. The Human-Machine Interface evaluation is based on Engineering Evaluations or Analyses.	Point 6.6 of the PDRA indicates that the UA operator should conduct an evaluation of the UA considering and addressing human factors to determine whether the HMI is appropriate for the mission.

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Operational Safety Objectives (OSOs)		SAIL II level of robustness	Criteria in SORA for SAIL II	Provisions for the PDRA
OSO #23 Environmental conditions for safe operations defined, measurable and adhered to	LEVEL of INTEGRITY	Low	<p>Criterion #1 (Definition) Environmental conditions for safe operations are defined and reflected in the flight manual or equivalent document.</p> <p>Criterion #2 (Procedures) Procedures to evaluate environmental conditions before and during the mission (i.e. real-time evaluation) are available and include assessment of meteorological conditions (METAR, TAFOR, etc.) with a simple record system.</p> <p>Criterion #3 (Training): Training covers assessment of meteorological conditions.</p>	<p>Criterion #1: the OM should include a paragraph on the operational environment and geographical area for the intended operations (in general terms, describe the characteristics of the area to be overflown, its topography, obstacles etc., and the characteristics of the airspace to be used, and the environmental conditions (i.e. the weather and electromagnetic environment); the definition of the required operation volume and risk buffers to address the ground and air risks).</p> <p>Criterion #2: the OM should contain a point on environmental and weather conditions, including:</p> <ul style="list-style-type: none"> <li>– environmental and weather conditions adequate to conduct the UA operation; and</li> <li>– methods of obtaining weather forecasts</li> </ul> <p>Criterion #3:</p> <p>According to Appendix 1 to this PDRA ‘meteorology’ as one of the basic competencies from the competency framework that are necessary for the intended operation.</p>



Operational Safety Objectives (OSOs)		SAIL II level of robustness	Criteria in SORA for SAIL II	Provisions for the PDRA
	LEVEL of ASSURANCE		<ul style="list-style-type: none"> <li>• Criterion #1 (Definition): The applicant declares that the required level of integrity has been achieved<sup>(1)</sup>. <i>(1) Supporting evidences may or may not be available</i></li> <li>• Criterion #2 (Procedures): See “level of assurance” for Operational procedures (OSO #08, OSO #11, OSO #14 and OSO #21)”</li> <li>• Criterion #3 (Training): see the “level of assurance” for Remote crew training (OSO #09, OSO #15 and OSO #22)”</li> </ul>	<p>Criterion #1 (Definition): This information should be included in the Operations Manual.</p> <p>Criterion #2 (Procedures): see the “level of assurance” for Operational procedures (OSO #08, OSO #11, OSO #14 and OSO #21)”</p> <p>Criterion #3 (Training): see the “level of assurance” for Remote crew training (OSO #09, OSO #15 and OSO #22)”</p>

**Table A6 Compliance check of PDRA provisions against SORA criteria for Operational Safety Objectives (OSOs)**

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377 3.11 Adjacent area/airspace consideration

Mitigations used for containment		Level of robustness	Criteria in SORA	Provisions for the PDRA
	LEVEL of INTEGRITY	Medium	No probable failure of the UA or any external system supporting the operation should lead to operation outside of the operational volume.	Point 6.13 of the PDRA requires that for a safe recovery from a technical issue involving the UA or an external system supporting the operation, the UA operator should ensure: that no probable failure of the UA or any external system supporting the operation should lead to operation outside the operational volume,
	LEVEL of ASSURANCE		Compliance with the requirement above should be substantiated by a design and installation appraisal and should include at least:  design and installation features (independence, separation and redundancy);  particular risks (e.g. hail, ice, snow, electro-magnetic interference...) relevant to the Operations Manual.	Point 6.14 of the PDRA indicates that a design and installation appraisal should be made available and include at least:  design and installation features (independence, separation and redundancy);  particular risks (e.g. hail, ice, snow, electro-magnetic interference, etc.) relevant to the Operations Manual.



Mitigations used for containment		Level of robustness	Criteria in SORA	Provisions for the PDRA
	LEVEL of INTEGRITY		<ul style="list-style-type: none"> <li>– Following additional requirements should apply if adjacent area/airspace are gathering of people or ARC-d:</li> <li>– The probability of leaving the operational volume should be less than 10<sup>-4</sup>/FH.</li> </ul> <p>No single failure of the UAS or any external system supporting the operation should lead to operation outside of the ground risk buffer.</p>	Not applicable, point 3.4 and 3.11 of the PDRA requires adjacent area/airspace does not include gathering of people or ARC-d.
	LEVEL of ASSURANCE		Compliance with the requirements above should be substantiated by analysis and/or test data with supporting evidence.	Not applicable





Mitigations used for containment		Level of robustness	Criteria in SORA	Provisions for the PDRA
	LEVEL of INTEGRITY		<p>Software (SW) and airborne electronic hardware (AEH) whose development error(s) could directly<sup>1</sup> lead to operations outside the ground risk buffer should be developed to an industry standard or methodology that is recognised as being adequate by the competent authority.</p> <p><sup>2</sup><i>This does not imply a systematic need to develop the SW and AEH according to an industry standard or methodology recognised as adequate by the competent authority. The use of the term ‘directly’ means that a development error in a software or an airborne electronic hardware would lead the UA outside the ground risk buffer without the possibility for another system to prevent the UA from exiting the operational volume.</i></p>	Not applicable, point 3.4 and 3.11 of the PDRA requires adjacent area/airspace does not include gathering of people or ARC-d.
	LEVEL of ASSURANCE		[Not explicitly indicated in SORA] Evidence exist of compliance with an industry standard or methodology that is recognised as being adequate by the competent authority.	Not applicable

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**Table A7 Compliance check of PDRA-06 provisions against SORA criteria for mitigations used for containment**