Predefined Risk Assessment, PDRA-10 for Aerial Work operations:

- OVER SPARSELY POPULATED AREAS
- USING M1 MITIGATION AT LOW ROBUSTNESS
- UNCONTROLED AIRSPACE
- VLOS UP TO 200M AGL
- USING MULTIROTOR UNMANNED AIRCRAFT UP TO 3M CHARACTERISTIC DIMENSION
- WITH MANDATORY OBSERVER

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1. Overview of the PDRA

The development of this PDRA was triggered by the request from some states to facilitate operational authorisations of UAS operations to a maximum height of 200 m above ground level with a MR[1] UA of maximum characteristic dimension[2] up to 3 m, while maintaining the VLOS[3] flight condition.

The following PDRA is designed to enable UAS operations up to 200m AGL over sparsely populated area, while ensuring safety for other air traffic participants in uncontrolled airspace.

Flight above the altitude of 120m AGL entails an increased risk of a collision with a manned aircraft. The initial air risk class ARC-c can be lowered to ARC-b by keeping the operation under VLOS conditions where the operation has a limited boundaries and time horizon, which can be counted as a strategic mitigation by limiting operations by boundaries and chronology. With this strategic mitigation it is possible to reduce the initial ARC by one point. The operator must describe how the operation was limited in time. The proposed solution is subject to evaluation and acceptance by the competent authority (for guidelines check PDRA-10, SORA, step #4 to 6).

To maintain the lowered ARC, the operation must be supported by a mandatory observer who observes the UAS and detects the movement of other aircrafts when the pilot is not looking directly at the UAS.

The correct use of M1 mitigation in the case of PDRA-10 requires inspection just before and during the flight to ensure that the number of people at risk in operational area and ground risk buffer is reduced by factor 10 (-90% from the maximum limit for a sparsely populated area). Shelter is an allowable means to reduce population density. While operating the drone in VLOS conditions, the remote pilot can safely and unambiguously identify area(s) of less risk on the ground. The remote pilot is able to safely reduce the number of people at risk by flying at a safe distance from non-active participants. In an abnormal situation the remote pilot is able to command or maneuver the drone to a less populated area or to alert or notify people near the drone to get to safety.

As the UAS pilot maintains visual contact with his aircraft, the observer scans the surroundings to ensure that there are no events that increase the number of people exposed to the UAS operation within the operational area and ground risk buffer (M1 mitigation). If such an event occurs, the flight should be stopped in a way that does not endanger the persons exposed to the UAS operation.

The PDRA is based upon SORA version 2.0 and any future changes to this version of SORA may lead to changes of the provision in this PDRA.

The above limits and rules were created on the basis of domestic experience of flights of unmanned aerial systems performed in Poland in 2013-2020.

Summary of the main provisions:

[1] multirotor
[2] maximum distance between rotors.
[3] type of UAS operation in which, the remote pilot is able to maintain continuous unaided visual contact with the unmanned aircraft, allowing the remote pilot to control the flight path of the unmanned aircraft in relation to other aircraft, people and obstacles for the purpose of avoiding collisions.

- VLOS
- MR UA with maximum characteristic dimensions up to 3 m and typical kinetic energy up to 34 kJ
- Maximum height of the operational volume: 220 m AGL (200 m of flight geography and maximum 20 m of contingency volume)
- Mandatory observer

The required airspace observer's task is to:

- stand directly next to the UAS pilot or can communicate with no delay by cell phone or radio contact,

- scan the airspace to warn the UAS pilot about a potential threat,

- maintain eye contact with the UA in case the pilot needs temporarily look away from the UA,

- scan the environment to identify events that increase the number of people exposed to UAS operation.

Ground Risk:

- UA operated over sparsely populated area
- UA operated with a minimum 1:0,5 ground risk buffer
- All ground risk buffer must be cover by summary visual line of sight of pilot and observer
- Maximum UA ground speed alowed during the flight is 15m/s
- M1 mitigation - inspection just before and during the flight to ensure that the number of people at risk in operational area and ground risk buffer is reduced by factor 10 (-90% from the maximum limit for a sparsely populated area).

Air Risk:

- Operations in uncontrolled airspace
- Maximum initial ARC – ARC-c
- The adjacent airspace should not be ARC-d
- The operation may be performed in a reserved or restricted airspace that is established and approved for the other purpose than for the UAS operation.
- The strategic mitigation by operational limitation - restriction by boundary and chronology, must be used to reduce the air risk by one class.

PDRA characterisation and conditions				
Topic	**Method of proof**	**Condition**	**Integrity**	**Proof**
1. Operational characterization (scope and limitations)				
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.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		1.2 The remote pilot should only operate one UA at a time.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		1.3 The remote pilot should not operate from a moving vehicle.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		1.4 The remote pilot should not hand over the control of the UA to another command unit.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
UA range limit	Self declaration	1.5 VLOS operations: Within VLOS distance from the remote pilot. Note : depending on the dimensions of the UA, it may not be possible to reach a distance of 200 m from the remote pilot. VLOS condition has priority over the maximum reachable distance granted by the PDRA.	*Please include a reference to the relevant chapter of the OM or N/A*	I declare compliance or N/A.
Overflown areas	Declaration supported by data	1.6 UA operations should be conducted over sparsely populated area.	*Please include a reference to the relevant chapter of the OM in which you provide the procedures for ensuring sparsely populated area.*	I declare compliance. Supporting data is available.
UA Limitations	Self declaration	1.7 Maximum characteristic dimension (maximum distance between rotors): 3 m	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.

PDRA characterisation and conditions				
Topic	**Method of proof**	**Condition**	**Integrity**	**Proof**
		1.8 Typical kinetic energy (as defined in paragraph 2.3.1(k) of SORA) up to 34 kJ	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		1.9 Minimum descent speed is 3m/s.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
Flight height limit	Self declaration	1.10 The maximum height of the operational volume should not be higher than 220 m and the height of the flight geography 200 m above the overflown surface (or any other altitude reference defined by the state of operation). *Note: In addition to the vertical limit for the operational volume, an air risk buffer may be considered (see "Air Risk" under point 3.9 of this table).*	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
Visibility	Self declaration	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.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
Others	Self declaration	1.12 The UA should not be used to drop material or carry dangerous goods.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		1.13 Operation is limited by boundary and chronology – limited in time.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		1.14 The UA maximum ground speed during the flight should not exceed 15m/s.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.

PDRA characterisation and conditions						
Topic	**Method of proof**	**Condition**		**Integrity**		**Proof**
2. Operational risk classification (according to the classification defined in SORA)						
Final GRC	3	**Final ARC**	ARC-b	**SAIL**	II	
3. Operational mitigations						
Operational volume (see Figure 2 of SORA)	Self declaration	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).		*Please include a reference to the relevant chapter of the OM.*		I declare compliance.
		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.		*Please include a reference to the relevant chapter of the OM.*		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.		*Please include a reference to the relevant chapter of the OM.*		I declare compliance.
Ground Risk	Self declaration	3.4 The operational volume and the ground risk buffer should be within sight of the remote pilot and observer, to ensure that the number of people at risk in operational area and ground risk buffer is reduced by factor 10 (-90% from the maximum limit for a sparsely populated area). Shelter is an allowable means to reduce population density. Operation is entirely located in a sparsely populated area. The adjacent area should not		*Please include a reference to the relevant chapter of the OM.*		I declare compliance.

<table>
<tr><th colspan="5">PDRA characterisation and conditions</th></tr>
<tr><th>Topic</th><th>Method of proof</th><th>Condition</th><th>Integrity</th><th>Proof</th></tr>
<tr><td></td><td></td><td>contain assemblies of people.</td><td></td><td></td></tr>
<tr><td></td><td></td><td>3.5 The UA operator should establish a ground risk buffer to protect third parties on the ground outside the operational volume. The minimum criterion should be the use of the ‘1:0,5 rule’ (e.g. if the height of the operational volume is 150 m, the ground risk buffer should at least be 75 m).

Minimum criteria are:

<table>
<tr><th>Maximum height above ground</th><th>Minimum distance to be covered by the ground risk buffer for untethered MULTIROTOR UA</th></tr>
<tr><td>30 m</td><td>15 m</td></tr>
<tr><td>60 m</td><td>30 m</td></tr>
<tr><td>90 m</td><td>45 m</td></tr>
<tr><td>120 m</td><td>60 m</td></tr>
<tr><td>150 m</td><td>75 m</td></tr>
<tr><td>180 m</td><td>90 m</td></tr>
<tr><td>200 m</td><td>100 m</td></tr>
<tr><td>220 m</td><td>110 m</td></tr>
</table></td><td>Please include a reference to the relevant chapter of the OM.</td><td>I declare compliance.</td></tr>
<tr><td></td><td></td><td>3.6 The applicant should evaluate the area of operations typically by means of an on-site inspection or appraisal, and should be able to justify density of people at risk.</td><td>Please include a reference to the relevant chapter of the OM.</td><td>I declare compliance.</td></tr>
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PDRA characterisation and conditions				
Topic	**Method of proof**	**Condition**	**Integrity**	**Proof**
Air Risk	Declaration supported by data	3.7 The UA operation should be conducted:		
		3.7.1 In uncontrolled airspace (class F or G) with a coordination in reserved or segregated airspace if applicable.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		3.7.2 In an airspace classified by the competent authority as ARC-c or lower.. Operation in ARC-c must be reduced to ARC-b by time limit; or	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		3.7.3 In a reserved or restricted airspacethe operational volume should be entirely contained in that reserved or restricted airspace.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		3.8 The adjacent airspace should not be ARC-d.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		3.9 The UA operator should establish an air risk buffer to protect third parties in the air, outside the operational volume if:	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		3.9.1 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.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.

PDRA characterisation and conditions				
Topic	**Method of proof**	**Condition**	**Integrity**	**Proof**
		3.10 The air risk buffer as per point 3.9 should be contained in the 'airspace class F or G' (uncontrolled airspace). The air risk buffer should be over sparsely populated areas and in UA geographical zones defined by the state where the probability of encounter with manned aircraft and other airspace users is low.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		3.11 Prior to flight, the UA operator should assess the proximity of the planned UA operation to manned aircraft activity.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		3.12 The UA operator should establish a de-confliction scheme that allows the pilot to take efficient decisions in case of incoming traffic.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
Observers	Self declaration	3.13 Observer should: -stand directly next to the remote pilot or can communicate with no delay, -scan the airspace to warn the remote pilot about a potential threat, -maintain eye contact with the UA in case the remote pilot needs temporarily to look away from the aircraft -scan the environment to identify events that increase the number of people exposed to UAS operation.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.

PDRA characterisation and conditions				
Topic	**Method of proof**	**Condition**	**Integrity**	**Proof**
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);	*Please describe how you met this condition.*	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 3.10 above, and include them in the OM;	*Please include a reference to the relevant chapter of the OM.*	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.	*Please include a reference to the relevant chapter of the OM.*	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 include simulations or tests on the ground. The validation should be representative of the intended way to achieve containment according to the technical requirements, see chapter 6.14. (a) the procedures to recognize	*Please include a reference to the relevant chapter of the OM.*	I declare compliance and the OM is submitted to the NAA.

PDRA characterisation and conditions				
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		that the UA leaves the flight geography and the following execution of the contingency procedures; and (b) the procedures to recognize that the UA leaves the contingency volume, and the following execution of the emergency procedures. 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.		
		4.1.5 develop an emergency response plan (ERP) in accordance with the provisions for 'medium' level of robustness	*Please include a reference to the relevant chapter of the OM.*	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 UAS operation if needed;	*Please include a reference to the relevant chapter of the OM.*	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	*Please include a reference to the relevant chapter of the OM.*	I declare compliance and the OM is submitted to the NAA.

PDRA characterisation and conditions				
Topic	**Method of proof**	**Condition**	**Integrity**	**Proof**
		essential to the UAS operation can declare themselves fit to operate before conducting any operation.		
		4.1.8 ensure that before starting the operation is compliant with the conditions that are defined in points 3.4 and 3.7 above and, when required, coordination with the appropriate authorities has been established;	*Please include a reference to the relevant chapter of the OM.*	I declare compliance and the OM is submitted to the NAA.
		4.1.9 ensure that before starting the operation, M1 mitigation is effective and the number of people at risk in operational area and ground risk buffer is reduced by factor 10 (-90% from the maximum limit for a sparsely populated area).	*Please include a reference to the relevant chapter of the OM.*	I declare compliance and the OM is submitted to the NAA.
		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: (a) The method and means of communication with the authority or entity responsible for the	*Please include a reference to the relevant chapter of the OM.*	I declare compliance and the OM is submitted to the NAA.

PDRA characterisation and conditions				
Topic	**Method of proof**	**Condition**	**Integrity**	**Proof**
		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;		
		4.1.11 ensure that all operations effectively use and support the efficient use of radio spectrum in order to avoid harmful interference.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance and the OM is submitted to the NAA.
UA maintenance	Self declaration	4.2 In addition to the responsibilities that are defined in the provisions for UAS operators in previous points, the UAS operator should ensure that:		
		4.2.1 The UA maintenance instructions that are defined by the UA	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.

PDRA characterisation and conditions				
Topic	**Method of proof**	**Condition**	**Integrity**	**Proof**
		operator should be included in the OM and cover at least the UA manufacturer's instructions and requirements when applicable.		
		4.2.2 The maintenance staff should follow the UA maintenance instructions when performing maintenance.	*Please include a reference to the relevant chapter of the OM.*	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 UAS operator should declare that this level of performance is adequately achieved.	*Please include a reference to the relevant chapter of the OM.*	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.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
5. Conditions for the personnel in charge of duties essential to the UA operation				
General	Self declaration	5.1 The UAS operator should ensure that all personnel in charge of duties essential to the UAS 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 UAS	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.

PDRA characterisation and conditions				
Topic	**Method of proof**	**Condition**	**Integrity**	**Proof**
		operator should ensure the following:		
		5.1.1 The training programme should be documented (at least the training syllabus should be available).	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		5.1.2 Evidence of training should be presented for inspection upon request from the competent authority or authorized representative.	*Please include a reference to the relevant chapter of the OM.*	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:	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		5.2.1 the safety of persons is threatened; or	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		5.2.2 property on the ground is threatened; or	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		5.2.3 other airspace users are in jeopardy; or	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		5.2.4 there is a violation of the terms of the authorisation.	*Please include a reference to the relevant chapter of the OM.*	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	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.

PDRA characterisation and conditions				
Topic	**Method of proof**	**Condition**	**Integrity**	**Proof**
		to injury, fatigue, medication, sickness or other causes;		
		5.3.2 be familiar with manufacturer's instructions provided by the manufacturer of the UA;	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.sp
		5.3.3 ensure that the UA remains clear of clouds;	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		5.3.4 perform unaided visual scanning of the airspace, as required, to avoid any potential collision hazard;	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		5.3.5 obtain updated information relevant to the intended operation about anyflight restriction zones.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		5.3.6 ensure that the UA is in a safe condition to complete the intended flight safely.	*Please include a reference to the relevant chapter of the OM.*	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:	*Please include a reference to the relevant chapter of the OM, otherwise, N/A.*	I declare compliance or N/A.
		5.4.1 designate the remote pilot to be responsible for each flight;	*Please include a reference to the relevant chapter of the OM, otherwise, N/A.*	I declare compliance or N/A.
		5.4.2 include procedures to ensure coordination between the remote crew members with robust and effective	*Please include a reference to the relevant chapter of the OM, otherwise, N/A.*	I declare compliance or N/A.

PDRA characterisation and conditions				
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		communication channels. Those procedures should cover as a minimum the: (a) assignment of tasks to the remote crew members; and (b) establishment of step-by-step communication; and		
		5.4.3 ensure the training of the remote crew covers MCC	*Please include a reference to the relevant chapter of the OM, otherwise, N/A.*	I declare compliance or N/A.
Maintenance staff	Declaration supported by data	5.5 Any staff member authorised by the UAS operator to perform maintenance activities should have been duly trained regarding the documented maintenance procedures.	*Please include a reference to the relevant chapter of the OM*	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.	*Please include a reference to the relevant chapter of the OM*	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 or authorised representative.	*Please include a reference to the relevant chapter of the OM*	I declare compliance and the OM is submitted to the competent authority. Evidence of training is available at the request of the competent authority
Personnel in charge of duties	Self declaration	5.8 The UAS operator should have a policy defining how the personnel in charge of	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.

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

PDRA characterisation and conditions				
Topic	**Method of proof**	**Condition**	**Integrity**	**Proof**
		6.2 The UAS should be protected against potential electromagnetic interferences from the infrastructure / facilities in the overflown area.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
Human-machine-interface (HMI)	Self declaration	6.3 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.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance or N/A.
		6.4 The UAS operator should conduct an evaluation of the UAS considering and addressing human factors to determine whether the HMI is appropriate for the mission.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		6.5 The UAS operator should conduct a UA evaluation that considers and addresses human factors to determine whether the HMI is appropriate for the operation.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
C2 links and communication	Self declaration	6.6 The UAS should comply with the appropriate requirements for radio equipment and the use of the RF spectrum.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		6.7 Protection mechanisms against interference should be used, especially if unlicensed bands (e.g. ISM) are used for the C2 Link (mechanisms such as FHSS, DSSS or OFDM technologies, or	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.

PDRA characterisation and conditions				
Topic	**Method of proof**	**Condition**	**Integrity**	**Proof**
		frequency de-confliction by procedure)		
		6.8 The UAS should be equipped with a C2 Link protected against unauthorised access to the command and control functions.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		6.9 In case of a loss of C2 Link, the UAS should have a reliable and predictable method for the UAS 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.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
		6.10 In the event of an emergency, the remote pilot should have effective means to communicate with the relevant bodies.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.
Tactical mitigation	Self declaration	6.11 The UAS design must be adequate to ensure that the time required between a command given by the remote pilot and the UA executing it does not exceed 5 seconds	*Please include a reference to the relevant chapter of the OM.*	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 5 km and a maximum of 35 km.	*Please include a reference to the relevant chapter of the OM.*	I declare compliance.

PDRA characterisation and conditions				
Topic	**Method of proof**	**Condition**	**Integrity**	**Proof**
		6.13 This PDRA requires basic containment (enhanced containment is also acceptable) : 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. The operator should make a list of the failures that may lead to operation outside the operational volume and show that: (a) each failure is not probable; or (b) if a failure is probable, the UA can still be prevented from leaving the operational volume by procedural or other technical means. The operator should show that the combination of the probable failure and the intended countermeasures makes leaving the operational volume improbable. *Note1: The term 'probable' needs to be understood in its qualitative interpretation,*	*Please include a reference to the relevant chapter of the OM.*	I declare compliance. A design and installation appraisal is available and it covers at least: • the design and installation features (independence, separation, and redundancy) and • the particular risks (e.g. hail, ice, snow, electromagnetic interference, etc.) relevant to the type of operation

PDRA characterisation and conditions				
Topic	**Method of proof**	**Condition**	**Integrity**	**Proof**
		i.e. 'anticipated to occur one or more times during the entire system/operational life of an item.' *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.* *Note 3: Enhanced containment is required if operate in an area with an adjacent area of higher risk.*		
		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);	*Please include a reference to the relevant chapter of the OM.*	
		6.14.2 any relevant particular risks (e.g. hail, ice, snow, electro-magnetic interference, etc.) associated to the OM.	*Please include a reference to the relevant chapter of the OM.*	

Table PDRA-10.1 — Main limitations and provisions for PDRA-10

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

(a) The 'specific' category (category B) may cover a wide range of UA operations with different levels of risk. The UA operator is therefore required to identify the competency required for the remote pilot according to the outcome of the risk assessment. This appendix 1 to PDRA 10 covers the theoretical knowledge subjects while appendix 2 to PDRA 10 covers the practical knowledge subjects applicable to all operations in the 'specific' category (category B).

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

(1) Air safety:

- (i) remote pilot records;
- (ii) logbooks and associated documentation;
- (iii) good airmanship principles;
- (iv) aeronautical decision-making;
- (v) aviation safety;
- (vi) air proximity reporting; and
- (vii) advanced airmanship:
  - (A) manoeuvres and emergency procedures; and
  - (B) general information on unusual conditions (e.g. stalls, spins, vertical lift limitations, autorotation, vortex ring states);

(2) aviation regulations:

- (i) introduction to the UA regulation with focus on the 'specific' category (category B);
- (ii) risk assessment, introduction to SORA; and
- (iii) overview of PDRA;

(3) navigation:

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

(ii) reading maps and aeronautical charts (e.g. 1:500 000 and 1:250 000, interpretation, specialised charts, helicopter routes, U-space service areas, and understanding of basic terms); and

(iii) vertical navigation (e.g. reference altitudes and heights, altimetry);

(4) human performance limitations:

(i) perception; and

(ii) fatigue:

(A) flight durations within work hours;

(B) circadian rhythms;

(C) work stress; and

(D) commercial pressures;

(iii) attentiveness:

(A) eliminating distractions; and

(B) scan techniques;

(iv) medical fitness (health precautions, alcohol, drugs, medication etc.); and

(v) environmental factors such as vision changes from orientation to the sun;

(5) operational procedures:

(i) airspace classifications and operating principles;

(ii) U-Space/UTM;

(iii) procedures for airspace reservation;

(iv) aeronautical information publications;

(v) NOTAMs; and

(vi) mission planning, airspace considerations and site risk-assessment:

(A) measures to comply with the limitations and conditions applicable to the operational volume and the ground risk buffer for the intended operation; and

(6) UA general knowledge:

(i) loss of signal and system failure protocols — understanding the condition and planning for programmed responses such as returning to home, loiter, landing immediately;

(ii) flight termination systems; and

(iii) flight control modes;

(7) meteorology:

(i) obtaining and interpreting advanced weather information:

(A) weather reporting resources;

(B) reports;

(C) forecasts and meteorological conventions appropriate for typical UA flight operations;

(D) local weather assessments;

(E) low-level charts; and

(F) METAR, SPECI, TAF;

(ii) regional weather effects — standard weather patterns in coastal, mountain or desert terrains; and

(iii) weather effects on the UA (wind, storms, mist, variation of wind with altitude, wind shear etc.); and

(8) technical and operational mitigations for air risks.

(i) principles of DAA.

(c) The UA operator should provide competency-based theoretical training covering the emergency response plan (ERP) that includes the related proficiency requirements and recurrent training.

(d) The UA operator may define additional aspects from the subjects mentioned in point (b) based on the UA operations intended to be conducted:

(1) operational procedures;

(i) mission planning, airspace considerations and site risk-assessment — operations over sparsely populated area;

(ii) multi crew cooperation (MCC):

(A) coordination between the remote pilot and other personnel in charge of duties essential to the UA operation;

(B) crew resource management (CRM):

(a) effective leadership; and

(b) working with others;

(2) UA general knowledge:

(i) the means to monitor the UA (its position, height, speed, C2 Link, systems status, etc.);

(ii) the means to support air traffic awareness.

(3) Managing data sources regarding:

(i) Where to find the data

(ii) Security of the data

(iii) Quantity of the needed data

(iv) Impact on the storage of data

(e) The training and assessment should be appropriate to the level of automation of the operation

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

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

(1) Preparation of the UA operation:

(i) implement the necessary measures to comply with the limitations and conditions applicable to the operational volume and ground risk buffer for the intended operation in accordance with the operations manual procedures;

(ii) implement the necessary procedures to operate in controlled airspace, including a protocol to communicate with ATC and obtain clearance and instructions, if necessary;

(iii) confirm that all the necessary documents for the intended operation are on site; and

(iv) brief all participants about the planned operation.

(v) airspace scanning;

(2) Preparation for the flight:

(i) make sure that all the safety elements available on UA, including the height and speed limitation systems, the flight termination system and its triggering system are operational;

(ii) Knowledge of the basic actions to be taken in the event of an emergency situation, including issues with the UA, or if a mid-air collision hazard arises during the flight.

(3) Flight under abnormal conditions:

(i) manage a partial or complete power shortage of the unmanned aircraft propulsion system while ensuring the safety of third parties on the ground;

(ii) manage a situation of an incursion by a person not involved into the operational volume or the controlled ground area, and take appropriate measures to maintain safety;

(iii) react to, and take the appropriate corrective actions for a situations where the UA is likely to exceed the limit of the flight geography (contingency procedures) and from the operational volume (emergency procedures) as defined during the flight preparation;

(4) Emphasis should be placed on

(i) Normal, abnormal and emergency procedures;

(ii) Remote pilot incapacitation;

(iii) Skill test combined with periodic proficiency check;

(iv) Operating experience (with on the job training counting towards proficiency);

(v) Pre-flight, post-flight and documentation;

(vi) Recurrent training (UA/FTD).

(b) The practical skill training may be conducted on the actual UA or a flight training device (FTD). Emphasis should be placed on scenario based training (SBT) using highly structured scripts of real-world experiences for the specific operation to fortify learning in an operational environment and improving situation awareness. SBT should include realistic normal and emergencies scenarios that are written with specific learning objectives in mind.

(c) Practical skill training is checked during the assessment and can be done using the actual UA or on a flight training device appropriate to the specific operation.

(d) Initial and recurring training:

(1) The UA operator should ensure that specified minimum requirements with respect to time (e.g. programmed flying hours) for initial and recurrent training (e.g. duration and flying hours) are prescribed and provided in a manner that is acceptable and approved by the competent authority.

(2) Depending on the training course, each of the topics shown in Table 1 below may require an overview or in-depth training. In-depth training should be interactive and include discussions, 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	Overview	
Company safety culture, operational			In Depth	

procedures, organisation	In Depth	Not Required		Overview
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

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

2. Annex A: Risk assessment for PDRA-10

The following risk assessment has been conducted by applying SORA to the PDRA-10.

3.1 Step #1 – CONOPS description

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

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

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

The initial UA ground risk relates to the unmitigated risk of a person being struck by the UA (in case of loss of UA control) and can be represented by the Ground Risk Classes (GRC) derived from the intended 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
Typical kinetic energy expected	*< 700 J (approx. 529 Ft Lb)*	*< 34 KJ (approx. 25000 Ft Lb)*	*< 1084 KJ (approx. 800000 Ft Lb)*	*> 1084 KJ (approx. 800000 Ft Lb)*
Operational scenarios				
VLOS/BVLOS over controlled ground area	1	2	3	4
VLOS in sparsely populated environment	2	3	4	5
BVLOS in sparsely populated environment	3	4	5	6
VLOS in populated environment	4	5	6	8
BVLOS in populated environment	5	6	8	10
VLOS over gathering of people	7			
BVLOS over gathering of people	8			

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

From the limitations defining the proposed PDRA:

Operational scenarios: VLOS in sparsely populated environment

UA characteristics:

- Multirotor up to 3m of characteristic dimension

290 – Typical expected maximal kinetic energy of 34 kJ

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

292 **3.3 Step #3 — final GRC determination**

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

294 M1 - Inspection just before and during the flight to ensure that the number of people at risk in
295 operational area and ground risk buffer is reduced by factor 10 (-90% from the maximum limit for a
296 sparsely populated area)..

297 M3 – An Emergency Response Plan (ERP) is in place, operator validated and effective with a "medium"
298 level of robustness. As per point 4.1.5, the UA operator should develop an ERP in accordance with the
299 provisions for 'medium' level of robustness.

300 Consequently, as highlighted in Table A2, the **final GRC is 2**.

		Robustness			Correction
Mitigation Sequence	**Mitigations for ground risk**	**Low / None**	**Medium**	**High**	
1	M1 - Strategic mitigations for ground risk[4]	**0: None** **-1: Low**	**-2**	**-4**	**-1**
2	M2 - Effects of ground impact are reduced[5]	**0**	**-1**	**-2**	**0**
3	M3 - An Emergency Response Plan (ERP) is in place, operator validated and effective	**1**	**0**	**-1**	**0**
Total correction					**-1**

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

302 **3.4 Steps #4 to 6 — air risk assessment**

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

305 • Below 220 m AGL in an uncontrolled airspace over rural area where the initial ARC-c can be
306 lowered to ARC-b by keeping the operation under VLOS conditions where the operation has a
307 limited time horizon, which can be counted as a strategic mitigation by limiting operations by
308 boundaries and chronology and with a coordination with local airfields if applicable.

309 • An operation under this PDRA is also possible in a reserved or restricted airspace that is
310 established and approved for the **other purpose** than for the UAS operation. The flight is
311 possible only after coordination with the entity managing this airspace structure. The air risk
312 for such an airspace should be considered as ARC-b.

313 The **initial ARC is ARC-b or ARC-c – depends from airspace structure and flight altitude**.

[4] This mitigation is meant as a means to reduce the number of people at risk.
[5] This mitigation is meant as a means to reduce the energy absorbed by the people of the ground upon impact.

Limiting operations by boundaries and chronology is strategic mitigation to decrease the initial ARC-c. **The final ARC remains as ARC-b.**

> The proposed way of limiting operations in time (boundaries and chronology) is subject to assessment and acceptance by the competent authority. The correct use of time limit should include:
>
> - The start and end time of each flight; or,
>
> - The start and end time of the whole operation; or,
>
> - The rules of coordination with the entity managing the reserved or segregated space.
>
> Examples:
>
> - Flight in public, uncontrolled airspace. Estimated flight time: 20 minutes (12:45 - 13:05).
>
> - Under the coordination and with the permission of the airspace owner, each time announcing the take-off, the estimated flight time and the completion of the landing. Take-off only after permission. Two way communication required. Landing on demand of the airspace owner is possible.

VLOS condition and obligatory observer are tactical mitigations to maintain ARC-b. **The final ARC remains as ARC-b**.

The operation take place in Visual line of Sight of the pilot and visual observer.

For operations under PDRA-10, 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 UAS operator should use that service to plan UAS operations in an airspace that is characterised as ARC-b or ARC-c and only in uncontrolled airspace and over rural area.

3.5 Step #7 — final GRC determination

Ground risk: final GRC is 2.

Air risk: final ARC is ARC-b

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

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**

Table A3 SAIL determination

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

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

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

OSO Number (in line with SORA Annex E)		SAIL					
		I	**II**	**III**	**IV**	**V**	**VI**
	Technical issue with the UA						
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[6]	O	O	O	L	M	H
OSO#05	UA is designed considering system safety and reliability	O	O	L	M	H	H
OSO#06	C2 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

[6] 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
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
	Deterioration of external systems supporting UA operation						
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
	Human Error						
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
	Adverse operating conditions						
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)

3.7 Step #9 — adjacent area/airspace considerations

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

No probable failure of the UA or any external system supporting the operation should lead to operation outside of the operational volume. Compliance with this should be substantiated by a design and installation appraisal 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 ConOps.

The size of the adjacent area and airspace should be equal to the distance, which the UA can travel within 3 minutes of normal operational speed, with a minimum of 5 km and a maximum of 35 km.

3.8 Step #10 — comprehensive safety portfolio

This step addresses the satisfactory substantiation of mitigations and objectives required by the SORA process, ensuring also that any additional requirements to those identified by the SORA process (e.g. security, environmental protection, etc.) as well as the relative stakeholders (e.g. environmental protection agencies, national security bodies, etc.) are adequately addressed.

For the purpose of the assessment of this PDRA, under this step the compliance of proposed provisions for the PDRA against SORA criteria is performed as shown in:

For mitigations used to modify the intrinsic GRC: Table A5 in point 3.9 of this Annex.

For strategic mitigations for the initial ARC: Operation is limited by boundaries and chronology.

For tactical mitigations for the final ARC: VLOS conditions and mandytory observer.

For operational safety objectives: see Table A6 in point 3.10 of this Annex.

For adjacent area/airspace consideration: see Table A7 in point 3.11 of this Annex.

371 **3.9 Evaluation of mitigations means**

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Mitigations for the intrinsic GRC		Level of robustness	Criteria in SORA	Provisions for the PDRA
M1 - Strategic mitigations for ground risk	LEVEL of INTEGRITY	Low	Criterion #1 (Definition of the ground risk buffer) A ground risk buffer with at least a 1:1 rule or for rotary wing UA defined using a ballistic methodology approach acceptable to the competent authority.	Point 3.5 of the PDRA indicates that "1:0,5" rule is acceptable in case of MR UAS. Point 1.14 of the PDRA indicates that UA should not be operated with ground speed higher than 15m/s. Above came out from the ballistic methodology.
			Criterion #2 (Evaluation of people at risk) The applicant evaluates the area of operations by means of on-site inspections or appropriate appraisals to justify lowering the density of the people at risk (e.g. a residential area during daytime when some people may not be present or an industrial area at night time for the same	Points 3.4 and 3.6 of the PDRA indicates: The operational volume and the ground risk buffer should be all cover by summary vision line of sight of UAS pilot and observer, to ensure that the number of people at risk in operational area and ground risk buffer is reduced by factor 10 (-90% from the maximum limit for a sparsely populated area). Operation is entirely located in a sparsely populated area. The adjacent area should not contain assemblies of people. The applicant should evaluate the area of operations typically by means of an on-site inspection or appraisal, and should be able to justify density of people at risk. Shelter is an allowable means to reduce population density.
	LEVEL of ASSURANCE		Criterion #1 (Definition of the ground risk buffer) The applicant declares that the required level of integrity is achieved.	Declaration in point 3.5 of the PDRA Reference to the relevant chapter of the OM.

			Criterion #2 (Evaluation of people at risk) The applicant declares that the required level of integrity has been achieved.	Declaration in points 3.4 and 3.6 of the PDRA Reference to the relevant chapter of the OM.
M3 - An Emergency Response Plan (ERP) is in place, operator validated and effective	LEVEL of INTEGRITY	Medium	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: (a) the outcome of the situation highly relies on providence; or (b) could not be handled by a contingency procedure; or (c) when there is grave and imminent danger of fatalities The ERP proposed by an applicant is different from the emergency procedures. The ERP is expected to cover: (a) a plan to limit the escalating effect of an eminent crash (e.g. notify first responders), and (b) the conditions to alert ATM The ERP: (a) is suitable for the situation; (b) limits the escalating effects;	An ERP with medium levels of robustness is required

			(c) defines criteria to identify an emergency situation; (d) is practical to use; (e) clearly delineates Remote Crew member(s) duties.	
	LEVEL of ASSURANCE		Criterion #1 (Procedures) (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. (b) The ERP is validated through a representative tabletop exercise consistent with the ERP training syllabus.	An ERP with medium levels of robustness is required
			Criterion #2 (Training) (a) Training syllabus is available (b) Competency-based theoretical and practical training is organised by the operator	An ERP with medium levels of robustness is required

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

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3.10 Operational Safety Objectives (OSOs)

Please note that OSOs that are considered as 'optional' for SAIL II are not been 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	The UA maintenance instructions are defined and when applicable cover the UA designer instructions and requirements. when applicable. The maintenance staff is competent and has received an authorisation to carry out UA maintenance. The maintenance staff use the UA maintenance instructions while performing maintenance.	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. Point 4.2 of the PDRA indicates that the maintenance staff should use the UA maintenance instructions while performing maintenance.

Operational Safety Objectives (OSOs)		SAIL II level of robustness	Criteria in SORA for SAIL II	Provisions for the PDRA
	LEVEL of ASSURANCE		Criterion #1 (Procedure): – The maintenance instructions are documented. – The maintenance conducted on the UA is recorded in a maintenance log system[1/2]. – A list of maintenance staff authorised to carry out maintenance is established and kept up to date. [1] Objective is to record all the maintenance performed on the aircraft, and why it is performed (defects or malfunctions rectification, modification, scheduled maintenance etc.) [2] The maintenance log may be requested for inspection/audit by the approving authority or an authorised representative. Criterion #2 (Training): A record of all relevant qualifications, experience and/or trainings completed by the maintenance staff is established and kept up to date.	Criterion#1: – 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. – the UA operator should keep an up-to-date record of the maintenance activities conducted on the UA for a minimum of 3 years. – 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. 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.

OSO #06 – C2 link performance is appropriate for the operation	LEVEL of INTEGRITY	Low	The applicant determines that performance, RF spectrum usage[1] and environmental conditions for C2 links are adequate to safely conduct the intended operation. The UA remote pilot has the means to continuously monitor the C2 performance and ensure the performance continues to meet the operational requirements[2]. *[1] For a low level of integrity, unlicensed frequency bands might be acceptable under certain conditions, e.g.:* – 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 – the use of mechanisms to protect against interference (e.g. FHSS, frequency deconfliction by procedure). *[2] The remote pilot has continual and timely access to the relevant C2 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*	the UA operator should ensure that all operations effectively use and support the efficient use of radio spectrum in order to avoid harmful interference. Besides: – the remote pilot should 'ensure that the operating environment is compatible with the authorised or declared limitations and conditions' – 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. – 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) 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.) 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

Operational Safety Objectives (OSOs)		SAIL II level of robustness	Criteria in SORA for SAIL II	Provisions for the PDRA
			strength and receiving an alert from the UA HMI if the signal becomes too low.	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 [(1)] [(1)]*Supporting evidences may or may not be available*	This information should be included in the Operations Manual.
OSO #07 Inspection of the UA (product inspection) to ensure consistency to the ConOps	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		Criterion #1 (Procedure): – Product inspection is documented and accounts for the manufacturer's recommendations if available. Criterion #2 (Training): The remote crew is trained to perform the product inspection, and that training is self-declared (with evidence available).	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 Criterion #2: – 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'. – the training programme should be documented (at least the training syllabus should be available).

Operational procedures (OSO #08, OSO #11, OSO #14 and OSO #21)	LEVEL of INTEGRITY	Medium	Criterion #1 (Procedure definition): – Operational procedures[1] appropriate for the proposed operation are defined and as a minimum cover the following elements: Flight planning, Pre and post-flight inspections, Normal procedures, Procedures to evaluate environmental conditions before and during the mission (i.e. real-time evaluation), Procedures to cope with unintended adverse operating conditions (e.g. when ice is encountered during an operation not approved for icing conditions) Contingency procedures (to cope with abnormal situations), Emergency procedures (to cope with emergency situations), and Occurrence reporting procedures. – Normal, Abnormal, and Emergency procedures are compiled in an Operation Manual.	Criterion #1: – 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'. – 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. Criterion #2: – 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. Since taking manual control is still under JARUS discussion, it has not been considered in the assessment.Criterion #3: – Operational procedures should be developed to minimise human errors. To that aim it is important that:

Operational Safety Objectives (OSOs)		SAIL II level of robustness	Criteria in SORA for SAIL II	Provisions for the PDRA
			– The limitations of the external systems used to support UA safe operations are defined in an Operation Manual. 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. Criterion #3 (Consideration of Potential Human Error): Operational procedures take considerations of human errors. At a minimum, Operational procedures provide: – a clear distribution and assignment of tasks – an internal checklist to ensure staff are performing their assigned tasks.	– each of the tasks and the complete sequence of tasks of a procedure are clearly defined, designing them to be intuitive and unambiguous; – tasks are clearly distributed and assigned to the relevant roles and persons, ensuring a balanced workload; – 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..

Operational Safety Objectives (OSOs)		SAIL II level of robustness	Criteria in SORA for SAIL II	Provisions for the PDRA
	LEVEL of ASSURANCE		Operational procedures are validated against recognized standards. The adequacy of the Contingency and Emergency procedures are proved through: – Dedicated flight tests, or – Simulation provided the simulation is proven valid for the intended purpose with positive results.	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; 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: (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.

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: a) UA regulation b) UA airspace operating principles c) Airmanship and aviation safety d) Human performance limitations e) Meteorology f) Navigation/Charts g) UA knowledge h) Operating procedures and is adequate for the operation.	Appendices 1 and 2 lists the competencies required for remote pilots operating UA in the 'specific' category. the UA operator should ensure before conducting operations that the remote pilot has the appropriate competency. the remote pilot should have the appropriate remote pilot competency.
	LEVEL of ASSURANCE		Training is self-declared (with evidence available)	The remote pilot should carry a proof of competency while operating the UA. – the training programme should be documented (at least the training syllabus should be available); and – evidence of training should be presented for inspection upon request from the competent authority or authorised representative.

Safe Design: OSO #10 Safe recovery from technical issue & OSO #12 The UA is designed to manage the deterioration of external systems supporting UA operation	LEVEL of INTEGRITY	Low	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. External systems supporting the operation are defined as systems not already part of the UA but used to: 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). External systems activated/used after the loss of control of the operation are excluded from this definition. It is expected when operating over populous areas or gatherings of people, a fatality will not occur from any probable[1] failure[2] of the UA or any external system supporting the operation. [1] 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." [2] Some structural or mechanical failures may be excluded from the criterion if it can be shown that these mechanical parts were designed to aviation industry best practices.	N/A as operations are planned in sparsely populated area

Operational Safety Objectives (OSOs)		SAIL II level of robustness	Criteria in SORA for SAIL II	Provisions for the PDRA
	LEVEL of ASSURANCE		A design and installation appraisal is available. In particular, this appraisal shows that: the design and installation features (independence, separation and redundancy) satisfy the low integrity criterion; particular risks relevant to the Operations Manual (e.g. hail, ice, snow, electro-magnetic interference…) do not violate the independence claims, if any.	N/A as operations are planned in sparsely populated area
OSO #13 External services supporting UA operations are adequate to the operation	LEVEL of INTEGRITY	Low	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. Roles and responsibilities between the applicant and the external service provider are defined.	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. 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.
	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.

Operational Safety Objectives (OSOs)		SAIL II level of robustness	Criteria in SORA for SAIL II	Provisions for the PDRA
OSO #16 Multi crew coordination	LEVEL of INTEGRITY	Low	Criterion #1 (Procedures): – Procedure(s) to ensure coordination between the crew members and that robust and effective communication channels is (are) available and at a minimum cover: assignment of tasks to the crew, establishment of step-by-step communications. Criterion #2 (Training): Remote Crew training covers multi crew coordination.	Criterion #1: 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: – the assignment of tasks to the remote crew members; and – the establishment of step-by-step communication; and 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.

Operational Safety Objectives (OSOs)		SAIL II level of robustness	Criteria in SORA for SAIL II	Provisions for the PDRA
	LEVEL of ASSURANCE		Criterion #1 (Procedures): – Procedures are not required to be validated against a recognized standard. – The adequacy of the procedures and checklists is declarative. Criterion #2 (Training): – Training is self-declared (with evidence available)	Criterion #1 (Procedures): see the "level of assurance" for Operational procedures (OSO #08, OSO #11, OSO #14 and OSO #21) Criterion #2 (Training): see the "level of assurance" for Remote crew training (OSO #09, OSO #15 and OSO #22)
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 4.1.7 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 shall 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 6.4 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.

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	Criterion #1 (Definition) Environmental conditions for safe operations are defined and reflected in the flight manual or equivalent document. 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. Criterion #3 (Training): Training covers assessment of meteorological conditions.	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). Criterion #2: the OM should contain a point on environmental and weather conditions, including: – environmental and weather conditions adequate to conduct the UA operation; and – methods of obtaining weather forecasts Criterion #3: According to Appendix 1 to this PDRA 'meteorology' as one of the basic competencies from the competency framework that are necessary.

Operational Safety Objectives (OSOs)		SAIL II level of robustness	Criteria in SORA for SAIL II	Provisions for the PDRA
	LEVEL of ASSURANCE		• Criterion #1 (Definition): The applicant declares that the required level of integrity has been achieved[(1)]. [(1)] *Supporting evidences may or may not be available* • Criterion #2 (Procedures): See "level of assurance" for Operational procedures (OSO #08, OSO #11, OSO #14 and OSO #21)" • Criterion #3 (Training): see the "level of assurance" for Remote crew training (OSO #09, OSO #15 and OSO #22)"	Criterion #1 (Definition): This information should be included in the Operations Manual. Criterion #2 (Procedures): see the "level of assurance" for Operational procedures (OSO #08, OSO #11, OSO #14 and OSO #21)" Criterion #3 (Training): see the "level of assurance" for Remote crew training (OSO #09, OSO #15 and OSO #22)"

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

395 **3.11 Adjacent area/airspace consideration**

396

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 shall 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 shall be substantiated by a design and installation appraisal and shall 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.

397 **Table A7 Compliance check of PDRA-10 provisions against SORA criteria for mitigations used for containmen**