**PREDEFINED RISK ASSESSMENT**

**IT-PDRA-08: BVLOS flight with NOTAM over Urban area**

**(a) Scope**

This PDRA is the result of applying the SORA methodology to UAS operations performed in the 'specific' category with the following main attributes:

1) UA:
   a. With maximum characteristic dimensions (i.e. maximum distance between rotors for multicopters, wingspan for fixed-wing) up to 1 m;
   b. With a Take-Off Mass (including payload) up to 2 Kg.;
   c. Compliant with requirements defined in ENAC LG 2016/003-NAV Ed. 1 1/6/2016 for harmless UAS.
2) operated BVLOS of the remote pilot;
3) over populated areas;
4) in segregated airspace (through a NOTAM); and
5) in a volume of airspace where BVLOS is allowed referring to the geo-awareness maps on D-flight portal.

**(b) PDRA characterisation and provisions**

Characterisation and provisions for this PDRA are summarised in the following table:

| **PDRA characterisation and provisions** | | | |
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| ***Item*** | ***Requirement*** | ***Means of Evidence*** | ***Supporting Material*** |
| **1. Operational characterisation (scope and limitations)** | | | |
| Level of human intervention | 1.1. No autonomous operations: the remote pilot should have the ability to control the UA, except in case of a lost link.<br>1.2. The remote pilot only operates one UA at a time.<br>1.3. The remote pilot does not operate from a moving vehicle.<br>1.4. Handover between RPSs is not performed. | Operations Manual | The Operations Manual shall be developed in accordance with the template provided in Appendix D |
| UA range limit | 1.5. Launch/recovery: VLOS distance from the remote pilot<br>1.6. In flight:<br>1.6.1. For multicopters, UA is not operated at more than 2 km from the remote pilot. | | |

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| | 1.6.2. For fixed-wing, UA is not operated at more than 6 km from the remote pilot. | | |
| Overflown areas | 1.7. Populated areas. | | |
| UA limitations | 1.8. Maximum characteristic dimension (e.g. rotor diameter/area or maximum distance between rotors, wing-span): 1 m<br>1.9. Take off mass (including payload) up to 2 kg<br>1.10. Compliant with requirements defined in ENAC LG 2016/003-NAV Ed. 1 1/6/2016 for harmless UAS. | Harmless certification | |
| Flight height limit | 1.11. The maximum height of the operational volume is not greater than 120 m (400 ft) above the overflown surface .<br>*Note: In addition to the vertical limit for the operational volume, an air risk buffer is to be considered (see 'air risk' under point 3 of this table).* | | |
| Airspace | 1.12. Operated:<br>1.12.1 in operational volume within the volumes allowed by ATM-09, unless the UAS operator is in receipt of the appropriate permission, that is segregated through a NOTAM (corresponding to an air risk that can be classified as ARC-a); | | |
| Visibility | *N/A* | | |
| Others | 1.13. The UA should not be used to drop material or carry dangerous goods, except for dropping items in connection with agricultural, horticultural or forestry activities in which the carriage of the items does not contravene any other applicable regulations. | | |

| **2. Operational risk classification (according to SORA)** | | | | | |
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| Final GRC | **3** | Final ARC | **Arc-a** | SAIL | **II** |

| ***Item*** | ***Requirement*** | ***Means of Evidence*** | ***Supporting Material*** |
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| **3. Operational mitigations** | | | |
| Operational volume | 3.1. To determine the operational volume, the applicant considers the position-keeping capabilities of the UAS in 4D space (latitude, longitude, height and time).<br>3.2. In particular, the accuracy of the navigation solution, the flight | Operations Manual | The Operations Manual shall be developed in accordance with the |

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| | technical error of the UAS and the path definition error (e.g. map error) and latencies are considered and addressed in this determination.<br>3.3. If the UA leaves the operational volume, emergency procedures are activated immediately. | | template provided |
| Ground risk | 3.4. A ground risk buffer is established to protect third parties on the ground.<br>3.4.1. The minimum criterion should be the use of the '1:1 rule' (e.g. if the UA is planned to operate at a height of 120 m, the ground risk buffer should at least be 120 m).<br>3.5. The operational volume and the ground risk buffer is all contained in a non-populated environment. | Operations Manual<br><br>*Note: The applicant should evaluate the area of operations by means of an on-site inspection or appraisal, and should be able to determine that the area is non-populated. This procedure shall be included in the Operations Manual* | |
| Air risk | 3.6. The operational volume should be within the volumes allowed by ATM-09, unless the UAS operator is in receipt of the appropriate permission.<br>3.7. An appropriate air risk buffer is defined.<br>3.8. This air risk buffer is contained in the volume allowed by ATM-09<br>3.9. Prior to flight, the proximity of the planned operation to manned aircraft activity should be assessed. | Operations Manual | |
| VOs | N/A | | |
| **4. Operator provisions** | | | |
| Operator | 4.1. The UAS operator should:<br>4.1.1. have knowledge of the UAS being used; and<br>4.1.2. develop relevant procedures including at least the following as a minimum: operational procedures (e.g. checklists), maintenance, training, responsibilities, and duties. | Operations Manual | The Operations Manual shall be developed in accordance with the template provided |
| UAS operations | 4.2. The operational procedures should be validated against standards recognised by the competent authority and/or in accordance with a means of compliance acceptable to that authority.<br>4.3. The UAS operator should develop an Emergency Response Plan | Operations Manual<br>Emergency Response Plan (ERP)<br><br>*Notes:*<br>• *The adequacy of the contingency and emergency procedures should be* | The Operations Manual and the ERP shall be developed in accordance with the template provided |

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| | 4.4. The remote crew should be competent and be authorised by the UAS operator to carry out the intended operations.<br>4.5. A list of the remote crew members authorised to carry out UAS operations is established and kept up to date.<br>4.6. The applicant should have a policy that defines how the remote crew can declare themselves fit to operate before conducting any operation. | *proved through:*<br>• *dedicated flight tests; or*<br>• *simulations, provided that the representativeness of the simulation means is proven for the intended purpose with positive results;*<br>• *Operations Manual should include an up-to-date record of all the relevant qualifications, experience and/or training completed by the remote crew.* | |
| UAS maintenance | 4.7. The UAS maintenance instructions should be defined by the UAS operator, documented and cover at least the UAS manufacturer's instructions and requirements when applicable.<br>4.8. The maintenance staff should be competent and should have received an authorisation from the UAS operator to carry out maintenance.<br>4.9. The maintenance staff should use the UAS maintenance instructions while performing maintenance. | Operations Manual and/or Maintenance Manual<br><br>Notes:<br>• *The maintenance instructions should be documented in the Operations Manual*<br>• *The maintenance conducted on the UAS should be recorded in a maintenance log system.*<br>• *A list of the maintenance staff authorised to carry out maintenance should be established and kept up to date.*<br>• *A record of all the relevant qualifications, experience and/or training completed by the maintenance staff should be established and kept up to date.*<br>• *The maintenance log may be requested for inspection/audit by ENAC or an authorised representative.* | The Operations Manual shall be developed in accordance with the template provided |
| External services | 4.10. The applicant 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. | Operations Manual<br><br>*Note: The applicant should declare that this* | The Operations Manual shall be developed in |

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| | 4.11. The roles and responsibilities between the applicant and the external service provider should be defined in the Operations Manual. | *adequate level of performance is achieved.* | accordance with the template provided |
| **5. Provisions for the personnel in charge of duties essential to the UAS operation** | | | |
| | Ref. LG 2020/001-NAV para 6.4 | | |
| **6. Technical provisions** | | | |
| General | 6.1. Means to monitor critical parameters for a safe flight should be available, in particular the:<br>6.1.1. UA position, height or altitude, ground speed or airspeed, attitude and trajectory;<br>6.1.2. UAS energy status (fuel, battery charge, etc.); and the<br>6.1.3. status of critical functions and systems; as a minimum, for services based on RF signals (e.g. C2 Link, GNSS, etc.), means should be provided to monitor the adequate performance and trigger an alert if the level becomes too low.<br>6.2. The UA should have the performance capability to descend safely from its operating altitude to a 'safe altitude' in less than a minute, or have a descent rate of at least 2.5 m/s (500 fpm). | Flight Manual | |
| HMI | 6.3. The UAS information and control interfaces should be clearly and succinctly presented and should not confuse, cause unreasonable fatigue, or contribute to causing any disturbance to the personnel in charge of duties essential to the UAS operation such that this could adversely affect the safety of the operation.<br>6.4. The applicant should conduct an evaluation of the UAS considering and addressing human factors to determine whether the HMI is appropriate for the mission. | Flight Manual | |
| C2 links and communication | 6.5. The UAS should comply with the appropriate requirements for radio equipment and the use of the RF spectrum.<br>6.6. The Primary C2L shall operate in Radio Line of Sight<br>6.7. Protection mechanisms against interference should be used, especially if unlicensed bands (e.g. ISM) are used for the C2 Link (mechanisms such as FHSS, technology or frequency de-confliction by procedure). | Operations Manual | The Operations Manual shall be developed in accordance with the template provided |

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| | 6.8. The UAS shall be equipped with a C2 Link Recovery function in case of loss. | | |
| Tactical mitigation | 6.9. The UAS design should be adequate to ensure that the time required between a command given by the remote pilot and the UA executing it does not exceed 5 seconds.<br>6.10. Where an electronic means is used to assist the remote pilot in being aware of the UA position in relation to potential 'airspace intruders', the information is provided with a latency and an update rate for intruder data (e.g. position, speed, altitude, track) that support the decision criteria. | Flight Manual | |
| Containment | 6.11. To ensure a safe recovery from a technical issue involving the UAS or an external system supporting the operation, the UAS operator should ensure:<br>6.11.1. that no probable failure of the UAS or any external system supporting the operation should lead to operation outside the operational volume.<br>6.11.2. that it is reasonably expected that a fatality will not occur from any probable failure of the UAS, or any external system supporting the operation.<br>6.12. The vertical extension of the operational volume should be 120 m above the surface.<br>*Note: 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.'*<br><br>6.13. A design and installation appraisal should be made available and should minimally include:<br>6.13.1. design and installation features (independence, separation and redundancy);<br>6.13.2. particular risks (e.g. hail, ice, snow, electro-magnetic interference, etc.) relevant to the ConOps.<br>6.14. The following additional provisions should apply if the adjacent area includes an assembly of people or if the adjacent airspace is classified as ARC-d (in accordance with AMC1 to Article 11 of the UAS Regulation): | Compliance to all these requirements can be ensured by using both:<br>• a Flight Termination system that is independent and dissimilar from the Primary Control System<br>• a geo-fencing function<br><br>Evidence of analyses demonstrating the effectiveness of the containment measures shall be provide. | |

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| | 6.14.1. The probability of leaving the operational volume should be less than 10-4/FH.<br>6.14.2. No single failure of the UAS or any external system supporting the operation should lead to operation outside the ground risk buffer.<br><br>*Note: The term 'failure' needs to be understood as an occurrence, which affects the operation of a component, part, or element such that it can no longer function as intended. Errors may cause failures but are not considered to be failures. Some structural or mechanical failures may be excluded from the criterion if it can be shown that these mechanical parts were designed according to aviation industry best practices.*<br><br>6.14.3. SW and AEH whose development error(s) could directly lead to operations outside the ground risk buffer should be developed to an industry standard or methodology recognised as adequate by the competent authority.<br><br>*Note 1: The proposed additional safety provisions cover both the integrity and assurance levels.*<br>*Note 2: The proposed additional safety provisions do not imply a systematic need to develop the SW and AEH according to an industry standard or methodology recognised as adequate by the competent authority. For instance, if the UA design includes an independent engine shutdown function which systematically prevents the UA from exiting the ground risk buffer due to single failures or a SW/AEH error of the flight controls, the intent of provisions 6.16.2 and 6.16.3 could be considered to be met.* | | |