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| *This template for an Operations Manual (OM) is based on AMC1 and GM1 UAS.SPEC.030(3)(e). Additionally it comprises subchapters of AMC1 Article 11 Annex A and draft AMC3 UAS.SPEC.030(3)(e), AMC1,2,3 UAS.SPEC.050(1)(d) and UAS.SPEC.050(1)(e) of NPA 2021-09 for the ERP and Training Syllabi as well as elements resulting from the operational safety objectives (OSO’s).**The OM should enable the applicant to describe to the Competent Authority the intended operation(s) to a level of detail that effectively enables the identification of GRC, ARC, associated mitigations, and SAIL determination as well as the compliance with the required OSOs, mitigations and containment.**Operators may use this template for application of an operational authorisation and for further guidance on which subjects have to be addressed within the OM. The template has to be used in a modular manner, depending on the operational characteristics and depending on the SAIL-Level leading to OSO-requirements for the integrity and assurance level. This template is not to be understood as binding, but rather as a common thread.**This document must be original work completed and understood by the operator. Operators must take responsibility for their own safety cases, whether the material originates from this template or otherwise.**All information used can be found on* [*www.easa.europa.eu*](http://www.easa.europa.eu) *and especially within the easy access rules Easy Access Rules for Unmanned Aircraft Systems on https://www.easa.europa.eu/document-library/easy-access-rules/easy-access-rules-unmanned-aircraft-systems-regulation-eu*  |

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| Template Operations Manual (OM) |
| Cover and contact |
| Name, Surname or Company with contact details |
|  |
|  |
| **Operator-ID:***The UAS operator should not share with anybody the three ‘secret digits’ that are used to enhance the protection of the UAS operator registration number from being illegally uploaded into a UA.* |
|  |
| **author** |
| **Revision number and date** |

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*Figures should be used wherever an illustration could help to get a better understanding, e.g. for the operational volume and ground risk buffer, UAS airframe, systems and interface etc.*

# Definitions, acronyms and abbreviations

*You may use the list of abbreviations of the Easy Access Rules for Unmanned Aircraft Systems as an aid.*

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| AMC | Acceptable means of compliance |
| GM | Guidance material |
| OM | Operations Manual |
| UAS | Unmanned aircraft system |
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# References and attachments

*You may add relevant attachments such as checklists for complying with the defined operating procedures, complete / elements of the UAS-manual or evidence for complying with OSO’s such as log files etc.*

# System for amendment and revision of the OM

*The competent authority will authorise an operational authorisation based on a specific revision number of the OM, which is submitted with the application. Any change of the OM may has an effect on the operational authorisation. Therefore, the history of revisions must be transparent.*

1. *list the changes that require prior approval and the changes to be notified to the competent authority (UAS.SPEC.030).*
2. *description of the system for indicating changes and of the methodology for recording effective pages and effectivity dates.*
3. *details of the person(s) responsible for the revisions and their publication.*

# Record of revisions

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| Rev-No. | Date | Chapter(s) | Reason | Amended by | Released by |
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# Purpose and scope

*Purpose and scope of the OM with a brief description of the different parts of the documents. You may indicate whether this OM deals with a single or a couple of different missions.*

# Safety statement/policy

*Include a statement that the OM complies with the relevant requirements of Regulation (EU) 2019/947 and with the authorisation or the terms of approval of the light UAS operator certificate (LUC), in the case of a LUC holder, and contains instructions that are to be complied with by the personnel involved in flight operations.*

*For high risk, large-scaled operations, a safety policy might be more reasonable.*

*The safety policy is the means whereby an organisation states its intention to maintain and, where practicable, improve safety levels in all its activities and to minimise its contribution to the risk of an accident or serious incident as far as is reasonably practicable. It reflects the management’s commitment to safety, and should reflect the organisation’s philosophy of safety management, as well as be the foundation on which the organisation’s safety management system is built. It serves as a reminder of ‘how we do business here’. The creation of a positive safety culture begins with the issuance of a clear, unequivocal direction.*

*The commitment to apply ‘just culture’ principles forms the basis for the organisation’s internal rules that describe how ‘just culture’ principles are guaranteed and implemented.*

*For organisations that have their principal place of business in a MS, Regulation (EU) No 376/2014 defines the ‘just culture’ principles to be applied (refer in particular to Article 16(11) thereof).*

*The safety policy should:*

1. *be endorsed by the accountable manager;*
2. *reflect organisational commitments regarding safety, and its proactive and systematic management;*
3. *be communicated, with visible endorsement, throughout the organisation;*
4. *include internal reporting principles, and encourage personnel to report errors related to UAS operations, incidents and hazards; and*
5. *recognise the need for all personnel to cooperate with compliance monitoring and safety investigations.*

*The safety policy should include a commitment to:*

1. *improve towards the highest safety standards;*
2. *comply with all applicable legislation, meet all applicable standards, and consider best practices;*
3. *provide appropriate resources;*
4. *apply the human factors principles;*
5. *enforce safety as a primary responsibility of all managers; and*
6. *apply ‘just culture’ principles and, in particular, not to make available or use the information on occurrences:*
7. *to attribute blame or liability to someone for reporting something which would not have been otherwise detected; or*
8. *for any purpose other than the improvement of safety.*

*The senior management of the UAS operator should:*

1. *continually promote the UAS operator’s safety policy to all personnel, and demonstrate their commitment to it;*
2. *provide the necessary human and financial resources for the implementation of the safety policy; and*
3. *establish safety objectives and associated performance standards.*

*The accountable manager must sign this statement*

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| --- | --- |
| Date and approval signature of accountable manager |  |

*The template below provides section headings detailing the subject areas that should be addressed when producing the operations manual (OM). The template layouts as presented are not prescriptive, but the subject areas detailed should be included in the OM documentation as required for the particular operation(s), in order to provide the minimum required information and evidence for the SORA-process (GRC, ARC, associated mitigations, and SAIL determination) and especially to comply with the required OSO’s,* *mitigations and containment.*

*If an operator uses more than one type of operation, each type should have its own ConOps, but the general operator information should be put in a separate top-level document, that is referenced by each ConOps.*

*If an operator intends to operate in multiple locations, with location specific mitigations, the ConOps should be structured such that each location specific information set is organised in a sub-chapter.*

*The applicant may need to consult with the Competent Authority to discuss the individually appropriate document modularisation for complex organisations.*

***Behind each section heading, you may find further information presented in italics in brackets. This information may be used to put the information, needed by the authorities for checking compliance, in the correct section.***

***OSO#01*** *cannot be assigned to a single section but is addressed through the whole OM. Showing compliance with OSO#01 therefore depends on the OM itself:*

*LOW: “The applicant is knowledgeable of the UAS being used and as a minimum has the following relevant operational procedures: checklists, maintenance, training, responsibilities, and associated duties.”*

*MEDIUM: “Same as low. In addition, the applicant has an organisation appropriate for the intended operation. Also, the applicant has a method to identify, assess, and mitigate the risks associated with flight operations. These should be consistent with the nature and extent of the operations specified.”*

# Organisation

*Description of the UAS operator’s organisation related to UAS operations. This section should include the following:*

1. *A brief description of the organisation and its activities.*
2. *Include the organigram and a brief description thereof:
The organisational structure and designated individuals. Description of the operator’s organisational structure, including an organisational chart showing the different departments, if any (e.g. flight/ground operations, operational safety, maintenance, training, etc.) and the head of each department;*
3. *Duties and responsibilities of the management personnel (not directly involved in UAS operations):*

## Accountable Manager (AM)

*The accountable manager should have the authority to ensure that all activities are carried out in accordance with the requirements of the UAS Regulation.*

*The operator can be the accountable manager.*

## Other management personnel

*Operations manager, maintenance manager, training manager etc.*

## Design and production organisation (*OSO#02, OSO#04*)

1. *If the organisation is responsible for the design and/or production of the UAS (manufacturer), this section should describe the design and/or the production organisation.*
2. *The manufacturing procedures are developed to a standard considered adequate by the competent authority:*
	1. *the specification of materials,*
	2. *the suitability and durability of materials used,*
	3. *the processes necessary to allow for repeatability in manufacturing, and conformity within acceptable tolerances,*
	4. *configuration control;*
	5. *the verification of incoming products, parts, materials, and equipment;*
	6. *identification and traceability;*
	7. *in-process and final inspections & testing;*
	8. *the control and calibration of tools;*
	9. *handling and storage; and*
	10. *the control of non-conforming items.*
3. *The UAS is designed to standards.*

*Otherwise, if not responsible, use section 2.3 for providing information of the following:*

1. *It should provide information on the manufacturer of the UAS to be used if the UAS is not manufactured or produced by the operator, i.e. by a third-party manufacturer.*
2. *If required, information on the production organisation of the third‑party organisation should be provided as evidence.*

# Concept of operations (ConOps)

*The template below provides section headings detailing the subject areas that should be addressed when producing the ConOps, for the purposes of demonstrating that a UAS operation can be conducted safely. Please provide information for every single operation. If you have more than one operation, you may provide individual ConOps-chapters for each operation (e.g. ConOps for inspections flights of wind power stations and ConOps for surveying).*

*If you use the same UAS and/or procedures for several operations (within different ConOps), you can describe these elements in a general chapter outside of the specific ConOps.*

*For each operation, please describe the following:*

## Nature of the operation and associated risks

*Describe the general nature of the activities performed and the associated risks.*

1. *The applicant should describe what types of operations (e.g. surveying of power lines, inspection of wind power stations, agriculture flights, etc.) the UAS operator intends to carry out. The description should contain all the information needed to obtain a general understanding of how, where and under which conditions the operations shall be performed.*
2. *Diagrams and/or illustrations may be included to support the explanation.*

## Operational environment *(information substantiating the initial GRC and ARC, M1 as well as SORA STEP#9 have to be found within this section)*

*This section is essential for getting an impression of where the operation will take place. The geographical area and operational environment for the intended operation(s) are presented. The reader should get a detailed impression of each operating environment of a single operation applied for (for generic authorisations please ask your competent authority prior to application). In particular, the reader must get information for a correct understanding of the determined initial GRC and ARC scores within the application form as well as for SORA STEP#9 (adjacent area), if applicable.*

1. *The applicant should provide specific details on the type of operations (e.g. VLOS, BVLOS), seasons and time, the population density to be overflown (e.g. away from people, sparsely populated, assemblies of people, people per km²), the type of airspace to be used (e.g. a segregated area, fully integrated, airspace class), operating height and affected aerodromes close to the operation area.*
2. *In general terms, describe the characteristics of the area to be overflown, its topography, obstacles etc., and the environmental conditions (i.e. the climate and electromagnetic environment); Visualisation through maps could help to understand described characteristics of the environment.*
3. *The definition of the required operation volume and risk buffers to address the ground and air risks.
The operational volume, including the ground and air risk buffers, needs to be clearly defined. Relevant charts/diagrams (incl. detailed visualisation and calculation basis of the flight geography, contingency volume and ground risk buffer), and any other information helpful to visualise and understand the intended operation(s) should be included in this section (e.g. Google Earth / Google Maps / QGIS).*

## Technical specifications (OSO#02; OSO#04; OSO#*05; OSO#06; OSO#10; OSO#12; OSO#18; OSO#19; OSO#23; OSO#24; information substantiating the initial GRC*)

*Technical means used: in general terms, describe their main characteristics, performance and limitations in the following.*

*This section should show that the equipment, systems, and installations are designed to minimise hazards in the event of a probable malfunction or failure of the UAS. A strategy for detection, alerting and management of any malfunction, failure or combination thereof, which would lead to a hazard, may be available.*

### Unmanned aircraft

*If there is more than one specific type of UA used, an individual chapter for each UA-type may be necessary.*

#### Airframe

*This section should include the following:*

1. *A detailed description of the physical characteristics of the UA (mass, centre‑of-mass, dimensions, etc.), including photos, diagrams and schematics, if appropriate to support the description of the UA.*
2. *Dimensions: for fixed-wing UA, the wingspan, fuselage length, body diameter etc.; for a rotorcraft, the length, width and height, propeller diameter, etc.;*
3. *Mass: all the relevant masses such as the empty mass, MTOM, etc.; and*
4. *Centre of gravity: the centre of gravity and limits if necessary.*
5. *Materials: the main materials used and where they are used in the UA, highlighting in particular any new materials (new metal alloys or composites) or combinations of materials (composites ‘tailored’ to designs).*
6. *Load limits: the capability of the airframe structure to withstand expected flight load limits.*
7. *Sub-systems: any sub-systems such as a hydraulic system, environmental control system, parachute, brakes, etc.*

#### Unmanned aircraft performance characteristics (OSO#23;OSO#24)

*This section should include the following:*

1. *the performance of the UA within the proposed flight envelope, specifically addressing at least the following items (use tables or a lists rather than continuous text for presentation):*
2. *Performance*
3. *maximum altitude;*
4. *maximum endurance;*
5. *maximum range;*
6. *maximum rate of climb;*
7. *maximum rate of descent;*
8. *maximum bank angle; and*
9. *turn rate limits.*
10. *Airspeeds*
11. *slowest speed attainable;*
12. *stall speed (if applicable);*
13. *nominal cruise speed;max cruise speed; and*
14. *never-exceed airspeed.*
15. *Any performance limitations due to environmental and meteorological conditions, specifically addressing the following items:*
16. *wind speed limitations (headwind, crosswind, gusts);*
17. *turbulence restrictions;*
18. *rain, hail, snow, ash resistance or sensitivities;*
19. *the minimum visibility conditions, if applicable;*
20. *outside air temperature (OAT) limits; and*
21. *in-flight icing:*
22. *whether the proposed operating environment includes operations in icing conditions;*
23. *whether the system has an icing detection capability, and if so, what indications, if any, the system provides to the remote pilot, and/or how the system responds; and*
24. *any icing protection capability of the UA, including any test data that demonstrates the performance of the icing protection system.*
25. *UAS is designed and qualified for adverse environmental conditions (if applicable)*

#### Propulsion system

*This section should include the following:*

* + - * 1. *Principle
				A description of the propulsion system and its ability to provide reliable and sufficient power to take off, climb, and maintain flight at the expected mission altitudes.*
				2. *Fuel-powered propulsion systems*
1. *The type (manufacturer organisation and model) of engine that is used;*
2. *How many engines are installed;*
3. *The type and the capacity of fuel that is used;*
4. *How the engine performance is monitored;*
5. *The status indicators, alerts (such as warning, caution and advisory), messages that are provided to the remote pilot;*
6. *A description of the most critical propulsion-related failure modes/conditions and their impact on the operation of the system;*
7. *How the UA responds, and the safeguards that are in place to mitigate the risk of a loss of engine power for each of the following:*
8. *fuel starvation;*
9. *fuel contamination;*
10. *failed signal input from the remote pilot station (RPS); and*
11. *engine controller failure;*
12. *The in-flight restart capabilities of the engine, if applicable, and if so, a description of the manual and/or automatic features of this capability;*
13. *The fuel system and how it allows for adequate control of the fuel delivery to the engine, and provides for aircrew determination of the fuel remaining. This includes a system level diagram showing the location of the system in the UA and the fuel flow path; and*
14. *How the fuel system is designed in terms of safety (fire detection and extinguishing, reduction of risk in case of impact, leak prevention, etc.).*
	* + - 1. *Electric-powered propulsion systems*
15. *A high-level description of the electrical distribution architecture, including items such as regulators, switches, buses, and converters, as necessary;*
16. *The type of motor that is used;*
17. *The number of motors that are installed;*
18. *The maximum continuous power output of the motor in watts;*
19. *The maximum peak power output of the motor in watts;*
20. *The current range of the motor in amps;*
21. *Whether the propulsion system has a separate electrical source, and if not, how the power is managed with respect to the other systems of the UA;*
22. *A description of the electrical system and how it distributes adequate power to meet the requirements of the receiving systems. This should include a system level diagram showing the electrical power distribution throughout the UA;*
23. *How power is generated on board the UA (for example, generators, alternators, batteries).*
24. *If a limited life power source such as batteries is used, the useful life of the power source during normal and emergency conditions, and how this was determined;*
25. *How information on the battery status and the remaining battery capacity is provided to the remote pilot or the watchdog system;*
26. *If available, a description of the source(s) of backup power for use in the event of a loss of the primary power source. This should include:*
27. *the systems that are powered during backup power operation;*
28. *a description of any automatic or manual load shedding; and*
29. *how much operational time the backup power source provides, including the assumptions used to make this determination;*
30. *How the performance of the propulsion system is monitored;*
31. *The status indicators and alert (such as warning, caution and advisory) messages that are provided to the remote pilot;*
32. *A description of the most critical propulsion-related failure modes/conditions and their impact on system operation;*
33. *How the UA responds, and the safeguards that are in place to mitigate the risk of a propulsion system loss for each of the following:*
34. *Low battery charge;*
35. *A failed signal input from the RPS; and*
36. *A motor controller failure;*
37. *If the motor has in-flight reset capabilities, a description of the manual and/or automatic features of this capability.*
	* + - 1. *Other propulsion systems*

*A description of these systems to a level of detail equivalent to the fuel and electrical propulsions sections above.*

#### Flight control surfaces and actuators

*This section should include the following:*

1. *A description of the design and operation of the flight control surfaces and servos/actuators, including a diagram showing the location of the control surfaces and the servos/actuators;*
2. *A description of any potential failure modes and the corresponding mitigations;*
3. *How the system responds to a servo/actuator failure; and*
4. *How the remote-pilot or watchdog system is alerted of a servo/actuator malfunction.*

#### Sensors

*This section should describe the non-payload sensor equipment on board the UA and its role.*

#### Payloads

*This section should describe the payload equipment on board the UA, including all the payload configurations that significantly change the weight and balance, electrical loads, or flight dynamics.*

### Unmanned aircraft control segment (OSO#19; OSO#20)

*This section should include the following:*

#### General

*An overall system architecture diagram of the avionics architecture, including the location of all air data sensors, antennas, radios, and navigation equipment. A description of any redundant systems, if available.*

#### Navigation

1. *How the UAS determines its location;*
2. *How the UAS navigates to its intended destination;*
3. *How the remote pilot responds to instructions from:*
4. *air traffic control;*
5. *UA observers or VOs (if applicable); and*
6. *other crew members (if applicable);*
7. *The procedures to test the altimeter navigation system (position, altitude);*
8. *How the system identifies and responds to a loss of the primary means of navigation;*
9. *A description of any backup means of navigation; and*
10. *How the system responds to a loss of the secondary means of navigation, if available.*

#### Autopilot

1. *How the autopilot system was developed, and the industry or regulatory standards that were used in the development process.*
2. *If the autopilot is a commercial off-the-shelf (COTS) product, the type/design and the production organisation, with the criteria that were used in selecting the COTS autopilot.*
3. *The procedures used to install the autopilot and how its correct installation is verified, with references to any documents or procedures provided by the manufacturer’s organisation and/or developed by the UAS operator’s organisation.*
4. *If the autopilot employs input limit parameters to keep the aircraft within defined limits (structural, performance, flight envelope, etc.), a list of those limits and a description of how these limits were defined and validated.*
5. *The type of testing and validation that was performed (software-in-the-loop (SITL) and hardware-in-the-loop (HITL) simulations).*

#### Flight control system (OSO#18)

1. *If there are any auxiliary controls, how the flight control computer interfaces with the auxiliary controls, and how they are protected against unintended activation.*
2. *A description of the flight control computer interfaces required to determine the flight status and to issue appropriate commands.*
3. *The operating system on which the flight controls are based.*
4. *The UAS flight control system incorporates automatic protection of the flight envelope to prevent the remote pilot from making any single input under normal operating conditions that would cause the UA to exceed its flight envelope or prevent it from recovering in a timely fashion.*
5. *Each UA is designed with a flight envelope that describes its safe performance limits with regard to minimum and maximum operating speeds, and its operating structural strength;*
6. *Automatic protection of the flight envelope is intended to prevent the remote pilot from operating the UA outside its flight envelope. If the operator demonstrates that the remote-pilot is not in the loop, this is not applicable;*
7. *A UAS implementing such an automatic protection function will ensure that the UA is operated within an acceptable flight envelope margin even in the case of incorrect remote-pilot control inputs (human errors).*
8. *UAS without automatic protection functions are susceptible to incorrect remote-pilot control inputs (human errors), which can result in the loss of the UA if the designed performance limits of the aircraft are exceeded.*

#### Remote pilot station (RPS) (OSO#20, TMPR)

1. *A description or a diagram of the RPS configuration, including screen captures of the control station displays.*
2. *How accurately the remote pilot can determine the attitude, altitude (or height) and position of the UA.*
3. *The accuracy of the transmission of critical parameters to other airspace users/air traffic control (ATC).*
4. *The critical commands that are safeguarded from inadvertent activation and how that is achieved (for example, is there a two-step process to command ‘switch the engine off’). The kinds of inadvertent input that the remote pilot could enter to cause an undesirable outcome (for example, accidentally hitting the ‘kill engine’ control in flight).*
5. *Any other programmes that run concurrently on the ground control computer, and if there are any, the precautionary measures that are used to ensure that flight‑critical processing will not be adversely affected.*
6. *The provisions that are made against an RPS display or interface lock‑up.*
7. *The alerts (such as warning, caution and advisory) that the system provides to the remote pilot (e.g. low fuel or battery level, failure of critical systems, or operation out of control).*
8. *A description of the means to provide power to the RPS, and redundancies, if any.*
9. *The UAS information and control interfaces are clearly and succinctly presented and do not confuse, cause unreasonable fatigue, or contribute to remote crew errors that could adversely affect the safety of the operation.*

#### Detect and avoid (DAA) system (information substantiating residual ARC and TMPR can be found within this section)

1. *Aircraft conflict avoidance*
2. *A description of the system/equipment that is installed for collaborative conflict avoidance (e.g. SSR, TCAS, ADS-B, FLARM, etc.).*
3. *If the equipment is qualified, details of the detailed qualification to the respective standard.*
4. *If the equipment is not qualified, the criteria that were used in selecting the system.*
5. *Non-collaborative conflict avoidance:
A description of the equipment that is installed (e.g. vision-based, PSR data, LIDAR, etc.).*
6. *Obstacle conflict avoidance
A description of the system/equipment that is installed, if any, for obstacle collision avoidance.*
7. *Avoidance of adverse weather conditions
A description of the system/equipment that is installed, if any, for the avoidance of adverse weather conditions.*
8. *Standard*
9. *If the equipment is qualified, a list of the detailed qualification to the respective standard.*
10. *If the equipment is not qualified, the criteria that were used in selecting the system.*
11. *A description of any interface between the conflict avoidance system and the flight control computer.*
12. *A description of the principles that govern the installed DAA system*
13. *A description of the role of the remote pilot or any other remote crew in the DAA system.*
14. *A description of the known limitations of the DAA system.*

### Command and control (C2) link segment *(OSO#06, TMPR)*

Provide the C2-Link related information in the following.

1. *The main parameters associated with the performance of the Link include, but are not limited to the following:*
2. *the transaction expiration time;*
3. *the availability;*
4. *the continuity; and*
5. *the integrity.*

**C2**

**C2**

**C3**

1. *The standard(s) with which the system is compliant.*
2. *the applicant demonstrates compliance with other RF spectrum usage requirements (e.g. Directive 2014/53/EU), by showing that the UAS equipment is compliant with these requirements; and*
3. *the use of mechanisms to protect against interference (e.g. FHSS, frequency de-confliction by procedure).*
4. *A detailed diagram that shows the system architecture of the C2 link, including informational or data flows and the performance of the subsystem, and values for the data rates and latencies, if known.*
5. *A description of the control link(s) connecting the UA to the RPS and any other ground systems or infrastructures, if applicable, specifically addressing the following items:*
6. *The spectrum that will be used for the control link and how the use of this spectrum has been coordinated. If approval of the spectrum is not required, the regulation that was used to authorise the frequency.*
7. *The type of signal processing and/or link security (i.e. encryption) that is employed.*
8. *The datalink margin in terms of the overall link bandwidth at the maximum anticipated distance from the RPS, and how it was determined.*
9. *If there is a radio signal strength and/or health indicator or similar display to the remote pilot, how the signal strength and health values were determined, and the threshold values that represent a critically degraded signal.*
10. *If the system employs redundant and/or independent control links, how different the design is, and the likely common failure modes.*
11. *For satellite links, an estimate of the latencies associated with using the satellite link for aircraft control and for air traffic control communications.*
12. *The design characteristics that prevent or mitigate the loss of the datalink due to the following:*
13. *(RF or other interference;*
14. *flight beyond the communications range;*
15. *antenna masking (during turns and/or at high attitude angles);*
16. *a loss of functionality of the RPS;*
17. *a loss of functionality of the UA; and*
18. *atmospheric attenuation, including precipitation.*

#### C2 link degradation

*A description of the system functions in case of a C2 link degradation:*

1. *Whether the C2 link degradation status is available and in what form (e.g. degraded, critical, automatic messages).*
2. *How the status of the C2 link degradation is announced to the remote pilot (e.g. visual, haptic, or sound). A description of the associated contingency procedures.*
3. *Other.*

#### C2 link loss

1. *The conditions that could lead to a loss of the C2 link.*
2. *The measures in case of a loss of the C2 link.*
3. *A description of the clear and distinct aural and visual alerts to the remote pilot for any case of a lost link.*
4. *A description of the established lost link strategy presented in the UAS operating manual, taking into account the emergency recovery capability.*
5. *A description of how the geo-awareness or geo-fencing system is used in this case, if available.*

*The lost link strategy, and, if incorporated, the re-acquisition process in order to try to re-establish the link in a reasonably short time.*

### Safety features and containment system *(OSO#10; OSO#12; information substantiating the residual GRC and ARC, M2, TMPR as well as SORA STEP#9 can be found within this section)*

*When operating over populated areas or assemblies of people, it can be reasonably expected that a fatality will not occur from any probable failure of the UAS or any external system supporting the operation.*

#### Safety features

1. *A description of the single failure modes and their recovery mode(s), if any.*
2. *A description of the emergency recovery capability to prevent risks to third-parties. This typically consists of:*
3. *a flight termination system (FTS), procedure or function that aims to immediately end the flight; or*
4. *an automatic recovery system (ARS) that is implemented through UAS crew command or by the on board systems. This may include an automatic pre‑programmed course of action to reach a predefined and unpopulated forced landing area; or*
5. *any combination of the above, or other methods.*
6. *The applicant should provide both a functional and physical diagram of the global UA system with a clear depiction of its constituent components, and, where applicable, an indication of its peculiar features (e.g. independent power supplies, redundancies, etc.)*

#### Containment system

1. *A description of the principles of the system/equipment used to perform containment functions for:*
2. *avoidance of specific area(s) or volume(s); or*
3. *confinement in a given area or volume.*
4. *The system information and, if applicable, supporting evidence that demonstrates the reliability of the containment system.*

### Ground equipment segment (GSE)

1. *A description of all the support equipment that is used on the ground, such as launch or recovery systems, generators, and power supplies.*
2. *(b) A description of the standard equipment available, and the backup or emergency equipment.*
3. *(c) A description of how the UAS is transported on the ground.*

## Maintenance *(OSO#03)*

*Provide maintenance instructions required to keep the UAS in a safe condition, covering the UAS manufacturer’s maintenance instructions and requirements when applicable). If third party organisations are used, refer to chapter 2.6 and just describe the maintenance performed on your own.*

*This section should describe:*

1. *The UAS maintenance instructions are defined, and, when applicable, cover the UAS designer’s instructions and requirements.*
2. *The maintenance staff use the documented UAS maintenance instructions while performing maintenance.*
3. *Scheduled maintenance of each UAS is organised and in accordance with a maintenance programme.*
4. *The maintenance conducted on the UAS is recorded in a maintenance log system.*
5. *Objective is to record all the maintenance performed on the aircraft, and why it is performed (rectification of defects or malfunctions, modifications, scheduled maintenance, etc.). The maintenance log may be requested for inspection/audit by the approving authority or an authorised representative.*
6. *the maintenance log system is used to record all the maintenance conducted on the UAS, including releases. A maintenance release can only be accomplished by a staff member who has received a maintenance release authorisation for that particular UAS model/family.*
7. *the maintenance organisation, if required.*

## Personnel *(OSO#07; OSO#09; OSO#15; OSO#17; OSO#19; OSO#22; OSO#23)*

*This section comprises competency, duties and responsibilities of personnel involved in the operations such as the remote pilot, UA observer, visual observer (VO), supervisor, controller, operations manager, etc. (initial qualifications; experience in operating UAS; experience in the particular operation; training and checking; compliance with the applicable regulations and guidance to crew members concerning health, fitness for duty and fatigue;).*

### Competency, duties and responsibilities

*This section should describe:*

1. *the responsibilities and duties of personnel, including all the positions and people involved, for functions such as:*
2. *the remote pilot (including the composition of the flight team (crew) according to the nature of the operation, its complexity, the type of UAS, etc.); and*
3. *support personnel (e.g. visual observers (VOs), launch crew, and recovery crew, payload operator, ground assistant, maintenance technician, etc.);*
4. *Name the personnel involved in UAS-operation and their qualifications:*

#### Safety Manager (SM) (if applicable)

*The safety manager should:*

1. *facilitate hazard identification, risk analysis, and risk management;*
2. *monitor the implementation of risk mitigation measures;*
3. *provide periodic reports on safety performance;*
4. *ensure maintenance of the safety management documentation;*
5. *ensure that there is safety management training available and that it meets acceptable standards;*
6. *provide all the personnel involved with advice on safety matters; and*
7. *ensure the initiation and follow-up of internal occurrence investigations.*

#### Compliance Monitoring Manager (CM) (if applicable)

*The primary objective of the compliance monitoring function is to enable the UAS operator to ensure a safe operation and to remain in compliance with the UAS Regulation.*

*An external organisation may be contracted to perform compliance monitoring functions. In such cases, that organisation should designate the compliance monitoring manager.*

*The compliance monitoring manager may use one or more auditors to carry out compliance audits and inspections of the operator under their own responsibility.*

*The tasks of the compliance monitoring manager may be performed by the safety manager.*

*The compliance monitoring function should include audits and inspections.*

*The accountable manager should designate a manager to monitor the compliance with:*

1. *the terms of approval, the privileges, the risk assessment and the resulting mitigation measures;*
2. *all operator’s manuals and procedures; and*
3. *training standards.*

*The compliance monitoring manager should:*

1. *have knowledge of, and experience in, compliance monitoring;*
2. *have direct access to the accountable manager to ensure that findings are addressed, as necessary;*

*A report should be raised each time an audit is carried out, describing what was checked and the resulting findings against applicable requirements and procedures.*

#### Head of Training (HT) (if applicable)

#### Chief Theoretical Knowledge Instructor (CTKI)) (if applicable)

#### Remote Pilots/Crew

#### Visual Observers and Assistants (if applicable)

#### Maintenance personnel (OSO#03) (if applicable)

1. *A list of maintenance staff with maintenance release authorisation is established and kept up to date.*
2. *The maintenance staff is competent and has received an authorisation to carry out UAS maintenance.*
3. *A record of all the relevant qualifications, experience and/or training completed by the maintenance staff is established and kept up to date.*
4. *All maintenance staff have undergone initial training.*
5. *The initial training syllabus and training standard including theoretical/practical elements, duration, etc. is defined and is commensurate with the authorisation held by the maintenance staff.*
6. *For staff that hold a maintenance release authorisation, the initial training is specific to that particular UAS model/family.*

### Health policy *(OSO#17)*

*The operator has a policy defining how the remote crew can declare themselves fit to operate before conducting any operation and how it is documented.*

*Precautions and guidelines involving the health of the personnel, including precautions pertaining to environmental conditions in the area of operation (policy on consumption of alcohol, narcotics and drugs, sleep aids and anti-depressants, medication and vaccination, fatigue, flight and duty period limitations, stress and rest, etc.). Procedures, guidance or references to ensure that the flight team are appropriately fit, capable and able to conduct the planned operations.*

1. *duty, flight duty and resting times for the remote crew are defined;*
2. *remote crew duty, flight duty and the resting times policy are documented;*
3. *requirements appropriate for the remote crew to operate the UAS;*

### Training of personnel *(OSO#07, OSO#09, OSO#15, OSO#19; OSO#22; OSO#23)*

*The training should be competency-based and adequate for the operation and ensures in general knowledge of:*

1. *the UAS Regulation;*
2. *airspace operating principles;*
3. *airmanship and aviation safety;*
4. *human performance limitations;*
5. *meteorology;*
6. *navigation/charts;*
7. *the UAS; and*
8. *operating procedures.*

*Furthermore, the training considers following:*

1. *Theoretical, practical (and medical) requirements for operating UAS in compliance with the applicable regulation;*
2. *Training and check programme for the personnel in charge of the preparation and/or performance of the UAS operations, as well as for the VOs, when applicable; the operation of different types of UAS, including details of any limitations to the types of UAS that a remote pilot may operate, if appropriate; and*
3. *for multi-crew coordination if more than one person is directly involved in the flight operations*
4. *Training and refresher training records;*

#### Remote pilot and crew training

*For the training the UAS 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 that are listed in AMC1 UAS.OPEN.020(4)(b) and UAS.OPEN.040(3), which are relevant for the intended operation, complemented by the elements listed below. The UAS operator may use the same listed topics to propose also for the other personnel in charge of duties essential to the UAS operation a theoretical knowledge training course with competency-based theoretical training specific to the duties of such personnel.*

*The UAS operator should provide its personnel with competency-based theoretical training covering the ERP that includes the related proficiency requirements and recurrent training.*

*The training and assessment should be appropriate to the level of automation of the UAS operation.*

##### Theoretical training elements

1. *Air safety:*
2. *remote pilot records;*
3. *logbooks and associated documentation;*
4. *good airmanship principles;*
5. *aeronautical decision-making;*
6. *aviation safety;*
7. *air proximity reporting; and*
8. *advanced airmanship:*
9. *manoeuvres and emergency procedures; and*
10. *general information on unusual conditions (e.g. stalls, spins, vertical lift limitations, autorotation, vortex ring states);*
11. *Aviation regulations:*
12. *introduction to the UAS Regulation with focus on the ‘specific’ category;*
13. *risk assessment, introduction to SORA; and*
14. *overview of STSs and the PDRA;.*
15. *Navigation:*
16. *navigational aids (e.g. GNSS) and their limitations;*
17. *reading maps and aeronautical charts (e.g. 1:500 000 and 1:250 000, interpretation, specialised charts, helicopter routes, U-space service areas, understanding of basic terms); and*
18. *vertical navigation (e.g. reference altitudes and heights, altimetry);.*
19. *Human performance limitations:*
20. *perception (situational awareness in BVLOS operations); and*
21. *fatigue:*
22. *flight durations within work hours;*
23. *circadian rhythm;*
24. *work stress; and*
25. *commercial pressure; and*
26. *attentiveness:*
27. *eliminating distractions; and*
28. *scan techniques;*
29. *medical fitness (health precautions, alcohol, drugs, medication, etc.); and*
30. *environmental factors such as vision changes from orientation to the sun.;*
31. *Airspace operating principles:*
32. *airspace classifications and operating principles;*
33. *U-space;*
34. *procedures for airspace reservation;*
35. *aeronautical information publications; and*
36. *NOTAM.*
37. *UAS general knowledge:*
38. *loss of signal and system failure protocols — understanding the condition and planning for programmed responses such as returning to home, loiter, landing immediately*
39. *(ii) flight termination systems;*
40. *(iii) flight control modes;*
41. *(iv) the means to monitor the UA (its position, height, speed, C2 Link, systems status, etc.);*
42. *(v) the means of communication with the VOs; and*
43. *(vi) the means to support air traffic awareness.*
44. *Meteorology:*
45. *obtaining and interpreting advanced weather information:*
46. *weather reporting resources;*
47. *reports;*
48. *forecasts and meteorological conventions appropriate for typical UAS flight operations;*
49. *local weather assessments;*
50. *low-level charts; and*
51. *METAR, SPECI, TAF;*
52. *regional weather effects — standard weather patterns in coastal, mountain or desert terrains; and*
53. *weather effects on the UA (wind, storms, mist, variation of wind with altitude, wind shear, etc.).;*
54. *Technical and operational mitigation measures for air risks:*
55. *EVLOS by employing airspace observers (AOs); and*
56. *principles of detect and avoid (DAA).*
57. *Operational procedures:*
58. *mission planning, airspace considerations, and site risk assessment:*
59. *measures to comply with the limitations and conditions applicable to the operational volume and to the ground risk buffer for the intended UAS operation;*
60. *UAS operations over a controlled ground area;*
61. *BVLOS operations;*
62. *use of UA VOs;*
63. *multi-crew cooperation (MCC):*
64. *coordination between the remote pilot and other personnel (e.g. AOs) in charge of duties essential to the UAS operation;*
65. *crew resource management (CRM):*
	1. *effective leadership;*
	2. *working with others.*
66. *Managing data sources regarding:*
67. *where to obtain the data from;*
68. *the security of the data;*
69. *the quantity of the data needed; and*
70. *the impact on the storage of data.*

##### Practical skill training

*Regarding the practical skill training and assessment for the remote pilot, the UAS operator should consider the competencies that are defined in AMC2 UAS.OPEN.030(2)(b), complemented by the items listed below. The UAS operator should adapt the practical skill training to the characteristics of the UAS operation and to the functions available on board the UAS. The UAS operator may use the same listed topics to propose a practical training course also for the other personnel in charge of duties essential to the UAS operation.*

The practical skill training may be conducted on the UAS or on an FTD. Scenario-based training (SBT) with highly structured, real-world experience scripts for the specific UAS operation should be used to fortify personnel’s learning in an operational environment and improve situational awareness. SBT should include realistic normal, abnormal, and emergency scenarios that are drafted considering specific learning objectives.

The practicalskill training is checked during the assessment and can be provided using the actual UAS or an FTD appropriate to the specific UAS operation.

1. *Preparation of the UAS operation:*
2. *implement the necessary measures to comply with the limitations and conditions applicable to the operational volume and to the ground risk buffer for the intended UAS operation in accordance with the OM procedures;*
3. *apply the necessary procedures for UAS operations in controlled airspace, including a protocol to communicate with the ATC and obtain clearance and instructions, if necessary;*
4. *confirm that all necessary documents for the intended UAS operation are on-site;*
5. *brief all participants on the planned UAS operation;*
6. *perform airspace scanning; and*
7. *if AOs are employed, place them adequately and prepare a deconfliction scheme that includes phraseology.*
8. *Preparation for the flight:*
9. *ensure that all the safety systems and functions of the UAS, including its height and speed limitation systems, flight termination system, and triggering system, are operational; and*
10. *know the basic actions to be taken in the event of an emergency, including issues with the UAS, or a mid-air collision hazard arising during the flight.*
11. *Flight under abnormal conditions:*
12. *manage a partial or complete power shortage of the UA propulsion system, while ensuring the safety of third parties on the ground;*
13. *manage a situation of a non-involved person entering the operational volume or the controlled ground area, and take appropriate measures to maintain safety; and*
14. *react to, and take the appropriate corrective actions for, a situation where the UA is likely to exceed the limits of both the flight geography (contingency procedures) and of the operational volume (emergency procedures) as they were defined during the flight preparation.*
15. *In general, emphasis should be placed on the following:*
16. *normal, contingency, and emergency procedures;*
17. *skill tests combined with periodic proficiency checks;*
18. *operating experience (with on-the-job training counting towards proficiency);*
19. *pre-flight and post-flight procedures and documentation;*
20. *recurrent training (UAS / flight training device (FTD)); and*
21. *remote pilot incapacitation.*

***Initial and recurrent training***

*The UAS operator should ensure that specified minimum requirements regarding the time of the initial and recurrent training (e.g. duration and number of flight hours) are provided for in a manner that is acceptable and approved by the competent authority.*

*Depending on the training course, each of the topics shown in Table 1 below may require only overview training or in-depth training. In-depth training should be interactive and include discussions, case-study reviews, and role play, as deemed necessary to enhance learning*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Topic*** | ***Initial Training*** | ***Change of UAS*** | ***Change of remote pilot / crew*** | ***Recurrent Training*** |
| *Situational awareness and error management* | *In-depth* | *In-depth* | *Overview* | *Overview* |
| *Organisational safety culture, operational procedures, organisational structure* | *In-depth* | *Not required* | *In-depth* | *Overview* |
| *Stress management, fatigue, and vigilance* | *In-depth* | *Not required* | *Not required* | *Overview* |
| *Decision-making* | *In-depth* | *Overview* | *Not required* | *Overview* |
| *Automation, philosophy of the use of automation* | *As required* | *In-depth* | *In-depth* | *As required* |
| *Specific UAS type-related differences* | *As required* | *In-depth* | *Not required for the same UAS type* | *As required* |
| *Case-based studies* | *In-depth* | *In-depth* | *In-depth* | *As required* |

*Table - Level of practical skill training in several topics depending on initial training, recurrent training, or change of UAS / remote pilot / crew*

##### Operation-specific endorsement modules (OSO#07)

*Depending on the type and risk of the intended UAS operation, the UAS operator may propose, as part of the application for an operational authorisation, additional theoretical knowledge training in combination with the practical skill training that is specific to the intended UAS operation as described in the OM.*

*The practical skill training should at least contain the practical competencies that are described in AMC2 UAS.OPEN.030(2)(b) ‘UAS operations in subcategory A2’, which may include relevant emergency and contingency procedures. However, the UAS operator may adapt that training to the level of automation of the UAS.*

*During the practical skill training, the remote pilot should list the relevant emergency and contingency procedures, which are defined in the OM and are peculiar to flight over known populated areas or over assemblies of people in a given area of operation, and should describe the basic conditions for each kind of emergency as well as the related recovery techniques to be applied during flight for the emergencies that are defined in the OM. Depending on the criticality of the situation and on the available time to react, the remote pilot should memorise some procedures, while for other procedures, they may consult a checklist.*

*For the practical skill training, the remote pilot only needs to complete the relevant operation-specific endorsement modules that reflect the intended UAS operation. For example, in case of transport of cargo, the remote pilot should complete the related training module ‘Transport and/or dropping of cargo’; however, if that cargo contains dangerous goods, then the remote pilot should also complete the training module ‘Transport of dangerous goods’.*

*The assurance level of the operation-specific endorsement modules is determined by the related SAIL according to the respective specific operational risk assessment (SORA).*

*Relevant UAS operation-specific endorsements modules should be reflected in the documentation of the remote pilot’s competencies.*

*The following UAS operation-specific endorsement modules and the areas to be covered are recommended:*

1. *Product inspection - conformity of the UAS with the approved ConOps*
2. *Documentation of product inspection in line with manufacturer’s recommendations, if available;*
3. *The remote crew is trained to perform the product inspection;*
4. *Product inspection procedure incl. checklists;*
5. *The UAS operator provides competency-based, theoretical and practical training.*
6. *night operations;*
7. *General*
8. *Degradation of visual acuity*
9. *Night illusions*
10. *Altered visual-scanning techniques*
11. *Altered identification of obstacles*
12. *overflight (flight over known populated areas or over assemblies of people in a given area of operation that is located in urban environment);*
13. *Optimising flight paths to reduce risk of exposure*
14. *Likely operating sites and alternative sites*
15. *Adequate clearance for wind effects, especially in urban environment*
16. *Obstructions (wires, masts, buildings, etc.)*
17. *Avoiding third-party interference with the UA*
18. *Minimum separation distances from persons, vessels, vehicles, and structures*
19. *Command-and-control (C2) electromagnetic interference, i.e. high-intensity radio transmissions*
20. *Crowd control strategies and public access*
21. *Geographical zones according to Article 15 of the UAS Regulation*
22. *BVLOS operations;*
23. *Operation planning: airspace, terrain, obstacles, expected air traffic, and restricted areas*
24. *Sensor systems and their limitations*
25. *Cooperative and non-cooperative aircraft (airspace surveillance)*
26. *Roles and responsibilities of the remote pilot to remain clear of collision*
27. *Command, control and communication (C3) link performance and limitations*
28. *Signal or communications latency for the C2 link*
29. *Planning for the loss of signal or for system failure*
30. *Interpreting separate data sources*
31. *Crew resource management (CRM)*
32. *low-altitude (below 500 ft) controlled airspace (LACA);*
33. *Air traffic management (ATM) procedures*
34. *Radio communications and phraseology*
35. *Advanced aviation terminology*
36. *non-segregated flight;*
37. *Clear roles and responsibilities*
38. *Wake turbulence*
39. *transport and/or dropping of cargo;*
40. *Weight and balance*
41. *Load securing and awareness of dangerous goods*
42. *transport of dangerous goods;*
43. *operations with multiple UASs and UAS swarms;*
44. *Limitations related to human factors*
45. *CRM*
46. *Navigating multiple platforms*
47. *Recognising system failures*
48. *Emergency containment procedures*
49. *UA launch and recovery using special equipment;*
50. *Operating procedures*
51. *Recognising failures*
52. *flying over mountainous terrain.*
53. *Temperature inversions*
54. *Orographic lifting*
55. *Higher winds through passes*
56. *Mountain waves*
57. *High- and low-pressure patterns*
58. *Density altitude effects*

#### Maintenance staff training

*Tbd.*

## External systems, services and facilities and C3-Link *(OSO#06; OSO#12; OSO#13; information substantiating the residual GRC and ARC as well as TMPR can be found within this section)*

*Provide information regarding any third party services, which are essential for the UAS-operation - the way of communication, preventing failures or system errors and evidence for accuracy (e.g. using AIS-services, airspace surveillance, maintenance organisations, third party flight planning tools, etc.).*

*The operator ensures that the level of performance for any externally provided service necessary for the safety of the flight is adequate for the intended operation. If the externally provided service requires communication between the UAS operator and the service provider, the applicant ensures there is effective communication to support the service provision.*

*Roles and responsibilities between the applicant and the external service provider are defined.*

*This may take the form of a service-level agreement (SLA) or any official commitment that prevails between a service provider and the applicant on the relevant aspects of the service (including quality, availability, responsibilities). The applicant has a means to monitor externally provided services, which affect flight critical systems and take appropriate actions if real-time performance could lead to the loss of control of the operation.*

*In particular, provide information on the specific C3-Link for external services, if applicable.*

1. *Determination that the performance, RF spectrum usage and environmental conditions for C3 links are adequate to safely conduct the intended operation.*
2. *The remote pilot must have continual and timely access to the relevant C3 information that could affect the safety of flight. For operations requesting only a low level of integrity this could be achieved by monitoring the link signal strength and receiving an alert from the UAS HMI if the signal strength becomes too low.*
3. *Depending on the operation, the use of licensed frequency bands might be necessary. In some cases, the use of non‑aeronautical bands (e.g. licensed bands for cellular network) may be acceptable.*
4. *The main parameters associated with the performance of the Link include, but are not limited to the following:*
5. *the transaction expiration time;*
6. *the availability;*
7. *the continuity; and*
8. *the integrity.*

*In the scope of this section, external systems supporting UAS operation are defined as systems that are not already part of the UAS but are used to:*

1. *launch/take-off the UA;*
2. *make pre-flight checks; or*
3. *keep the UA within its operational volume (e.g. GNSS, satellite systems, air traffic management, U-Space).*
4. *Etc.*

# Operational procedures *(OSO#08, OSO#11, OSO#14, OSO#16; OSO#19; OSO#21; OSO#23; information substantiating the residual GRC and ARC, TMPR as well as SORA STEP#9 have to be found within this section)*

*Operational procedures (covering the deterioration of the UAS itself and any external system supporting UAS operation) appropriate for the proposed operation are defined and, as a minimum, cover the following elements:*

1. *Normal procedures;*
2. *Contingency procedures (to cope with abnormal situations);*
3. *Emergency procedures (to cope with emergency situations);*

*In particular, following procedures should be defined:*

1. *Flight planning;*
2. *Pre- and post-flight inspections;*
3. *Procedures to evaluate the environmental conditions before and during the mission (i.e. real-time evaluation);*
4. *Procedures to cope with unexpected adverse operating conditions (e.g. when ice is encountered during an operation not approved for icing conditions);*
5. *Procedures to evaluate environmental conditions before and during the mission (i.e. real-time evaluation) are available and include assessment of meteorological conditions (METAR, TAF, etc.) with a simple recording system.*

*At a minimum, operational procedures provide:*

1. *a clear distribution and assignment of tasks, and*
2. *an internal checklist to ensure staff are adequately performing their assigned tasks.*

*It should be considered, that operational procedures are complex and may potentially jeopardise the crew’s ability to respond by raising the remote crew’s workload and/or the interactions with other entities (e.g. ATM, etc.).*

*For a better understanding, it might be helpful to reference checklists within the annex.*

## Normal procedures

*(The UAS operator should complete the following paragraphs considering the elements listed below. The procedures applicable to all UAS operations may be listed in paragraph 3.1.1)*

1. *The normal operation strategy should contain all the safety measures, such as technical or procedural measures, etc. that are put in place to ensure that the UAS can fulfil the operation within the approved limitations, and so that the operation remains in control.*
2. *Within this section, it should be assumed that all systems are working normally and as intended.*
3. *The intent of this chapter is to provide a clear understanding of how the operation takes place within the approved technical, environmental, and procedural limitations.*

### General procedures valid for all operations

*This section should describe the normal operating procedures applicable to all operations for which an approval is requested. This section should be only applicable, if more than one peculiar mission is available. General procedures can be applicable for:*

1. *Site planning, survey and evaluation*
2. *Notification to relevant third parties*
3. *Weather briefing*
4. *Communication*

### Standard operating procedures (SOP) peculiar to a single operation

*Describe the standard operating procedures (SOP) applicable to a single operation (e.g SOP inspection of a wind power station or SOP surveying). For more than one operation applied, individual SOP-chapters should be in place. This session should include:*

1. *Multi-crew procedures, if applicable*
2. *assignment of tasks to the crew;*
3. *establishment of step-by-step communications;*
4. *Communication devices comply with standards;*
5. *Limitations, if not generally valid*
6. *Pre flight*
7. *Post flight*
8. *Debriefing*
9. *Flight planning*
10. *Briefing*
11. *Start / landing*
12. *In flight*
13. *Mission related objectives*

## **Contingency procedures**

*The UAS operator should complete the following paragraphs considering the elements listed below. The procedures applicable to all UAS operations may be listed in paragraph 3.2.1).*

### General procedures valid for all operations (if applicable)

1. *Consideration of the following to minimise human errors:*
2. *a clear distribution and assignment of tasks; and*
3. *an internal checklist to check that staff are properly performing their assigned tasks.*
4. *Consideration of the deterioration of external systems supporting the UAS operation; in order to assist in the identification of procedures related to the deterioration of external systems supporting the UAS operation, it is recommended to:*
5. *identify the external systems supporting the operation;*
6. *describe the deterioration modes of these external systems which would prevent the operator maintaining a safe operation of the UAS (e.g. complete loss of GNSS, drift of the GNSS, latency issues, etc.);*
7. *describe the means put in place to detect the deterioration modes of the external systems; and*
8. *describe the procedure(s) in place once a deterioration mode of one of the external systems is detected (e.g. activation of the emergency recovery capability, switch to manual control, etc.).*
9. *Coordination between the remote pilot(s) and other personnel;*
10. *Methods to exercise operational control; and*
11. *Pre-flight preparation and checklists. These include, but are not limited to, the following points:*
12. *The site of the operation:*
13. *the assessment of the area of operation and the surrounding area, including, for example, the terrain and potential obstacles and obstructions for keeping a VLOS of the UA, potential overflight of uninvolved persons, potential overflight of critical infrastructure (a risk assessment of the critical infrastructure should be performed in cooperation with the responsible organisation for the infrastructure, as they are most knowledgeable of the threats)*
14. *the assessment of the surrounding environment and airspace, including, for example, the proximity of restricted zones and potential activities by other airspace users;*
15. *when UA VOs are used, the assessment of the compliance between visibility and planned range, the potential terrain obstruction, and the potential gaps between the zones covered by each of the UA VOs; and*
16. *the class of airspace and other aircraft operations (local aerodromes or operating sites, restrictions, permissions).*
17. *Environmental and weather conditions:*
18. *environmental and weather conditions adequate to conduct the UAS operation; and*
19. *methods of obtaining weather forecasts.*
20. *Coordination with third parties, if applicable (e.g. requests for additional permits from various agencies and the military when operating, for example, in environmentally protected areas, areas restricted to photographic flights, near critical infrastructure, in urban areas, emergency situations, etc.);*
21. *the minimum number of crew members required to perform the operation, and their responsibilities;*
22. *the required communication procedures between the personnel in charge of duties essential to the UAS operation, and with external parties when needed;*
23. *compliance with any specific requirement from the relevant authorities in the intended area of operations, including those related to security, privacy, data and environmental protection, use of the RF spectrum; also considering cross-border operations (specific local requirements) when applicable;*
24. *the required risk mitigations put in place to ensure the operation is safely conducted (e.g. a controlled ground area, securing the controlled ground area to avoid third parties entering the area during the operation, and ensuring coordination with the local authorities when needed, etc.); and*
25. *procedures to verify that the UAS is in a condition to safely conduct the intended operation (e.g. update of geographical zones data for geo-awareness or geo-fencing systems; definition and upload of lost link contingency automatic procedures; battery status, loading and securing the payload;).*
26. *Launch and recovery procedures;*
27. *In-flight procedures (operating instructions for the UA (reference to or duplication of information from the manufacturer’s manual); instructions on how to keep the UA within the flight geography, how to determine the best flight route; obstacles in the area, height; congested environments, keeping the UA in the planned volume);*
28. *Post-flight procedures, including the inspections to verify the condition of the UAS;*
29. *Procedures for the detection of potentially conflicting aircraft by the remote pilot and, when required by the UAS operator, UA VOs; and*
30. *Dangerous goods (limitations on their nature, quantity and packaging; acceptance prior to loading, inspecting packages for any evidence of leakage or damage).*

### Contingency procedures peculiar to a single operation

1. *Procedures to cope with the UA leaving the desired ‘flight geography’;*
2. *Procedures to cope with the UA entering the ‘containment’ volume;*
3. *Procedures to cope with uninvolved persons entering the controlled ground area, if applicable;*
4. *Procedures to cope with adverse operating conditions (e.g. in case icing is encountered during the operation, if the operation is not approved for icing conditions);*
5. *Procedures to cope with the deterioration of external systems supporting the operation. In order to help properly identify the procedures related to the deterioration of external systems supporting the UAS operation, it is recommended to:*
6. *identify the external systems supporting the operation;*
7. *describe the deterioration modes of these external systems which would prevent the operator maintaining a safe operation of the UAS (e.g. complete loss of GNSS, drift of the GNSS, latency issues, etc.);*
8. *describe the means put in place to detect the deterioration modes of the external systems; and*
9. *describe the procedure(s) in place once a deterioration mode of one of the external systems is detected (e.g. activation of the emergency recovery capability, switch to manual control, etc.).*
10. *De-confliction scheme (i.e. the criteria that will be applied for the decision to avoid incoming traffic). In cases where the detection is performed by UA VOs, the phraseology to be used.*

## Emergency procedures

*The UAS operator should define procedures to cope with emergency situations.*

1. *Procedures to avoid or, at least minimise, harm to third parties in the air or on the ground. With regard to the air risk, an avoidance strategy to minimise the collision risk with another airspace user (in particular, an aircraft with people on board); and*
2. *Procedures for the emergency recovery of the UA (e.g. landing immediately, termination of the flight with FTS or a controlled crash/splash,* etc.).

# Emergency response plan (ERP) *(M3)*

***Purpose of the ERP***

*The UAS operator should, in cooperation with other stakeholders, if applicable, develop, coordinate, and maintain an ERP that ensures orderly and safe transition from normal operation to emergency and return to normal operation. The ERP should include the actions to be taken by the UAS operator or specified individuals in an emergency, and indicate the size, nature, and complexity of the activities to be performed by the UAS operator.*

1. *As for emergency procedures, an ERP is implemented by the UAS operator to address emergency situations. However, an ERP is specifically developed to:*
2. *limit any escalating effect of the emergency situation;*
3. *meet the conditions to alert the relevant authorities and entities.*
4. *The ERP should contain all the necessary information about the role of the relevant personnel in an emergency and about their response to it.*

***Effectiveness of the ERP***

*An effective ERP should:*

1. *be appropriate to the size, nature, and complexity of the UAS operation;*
2. *be readily accessible by all relevant personnel and by other entities, where applicable;*
3. *include procedures and checklists relevant to different or specific emergency situations;*
4. *clearly define the roles and responsibilities of the relevant personnel;*
5. *have quick-reference contact details of the relevant personnel;*
6. *be regularly tested through practical exercises involving the relevant personnel; and*
7. *be periodically reviewed and updated, when necessary, to maintain its effectiveness.*

**Emergencies, response activation, procedures, and checklists**

1. *The ERP should define the criteria for identifying emergency situations and identify the main emergency situations that are likely to increase the level of harm (escalating effect) if no action is taken.*
2. *The identified emergency situations should at least include those in which one or more UA are operated by the UAS operator and that have the potential to:*
3. *harm one or more persons;*
4. *hit a ground vehicle, building, or facility where there are one or more persons who*
5. *might be injured as a consequence of the UA impact;*
6. *harm critical infrastructure;*
7. *start a fire that might propagate;*
8. *release dangerous substances;*
9. *hit an aircraft that carries people and/or whose crash might lead to one or more of*
10. *the situations that are listed in (a) to (e); and*
11. *cause the UA to leave the operational volume and fly beyond the limits of:*
12. *the ground risk buffer; and/or*
13. *the air risk buffer (if existing) or enter an adjacent airspace where the risk of collision with manned aircraft is higher than within the operational volume.*
14. *The ERP should establish the criteria for the activation of the respective emergency response procedures to address the identified emergency situations.*
15. *As a minimum, the ERP should include procedures for:*
16. *an orderly transition from the normal phase to the emergency response phase;*
17. *the assignment of emergency responsibilities and roles;*
18. *coordinated action and interaction with other entities to respond to the emergency situation; and*
19. *return to normal operation, as soon as practicable.*
20. *The ERP should consider the following principles for prioritising the actions to respond to an emergency situation:*
21. *alert the relevant personnel and entities;*
22. *protect the life of those affected or in danger;*
23. *give first aid while awaiting the arrival of the emergency services, provided the*
24. *personnel employed by the UAS operator is qualified for that purpose;*
25. *ensure the safety of the emergency responders;*
26. *keep the emergency situation under control or contained;*
27. *protect property;*
28. *restore the normal situation, as soon as practicable;*
29. *record the emergency situation and the response to it, and preserve evidence for*
30. *further investigation;*
31. *remove damaged items, unless needed untouched for investigation, and restore*
32. *the location of the emergency;*
33. *debrief the relevant personnel;*
34. *prepare any required post-emergency report or notification; and*
35. *evaluate the effectiveness of the ERP and update it, if required.*
36. *The ERP should include a procedure for recording the information on the emergency situation and on the subsequent response. That procedure should also cover how to gather information from a third party that reports an emergency situation caused by a UA of the UAS operator.*
37. *The ERP should include procedures for handling hazardous materials in an emergency situation, if applicable.*
38. *The ERP should include checklists that:*
39. *are suitable for the identified emergency situations;*
40. *clearly indicate the sequence of actions and the personnel responsible to carry out those actions; and*
41. *provide the contact details of key stakeholders.*
42. *The content of the ERP should be kept up to date and reflect all organisational or operational changes that may affect it. Roles, responsibilities, and key contacts.*
43. *The UAS operator should nominate an emergency response manager (ERM) who has the overall responsibility for the emergency response.*
44. *If the UAS operator is not a one-person entity and/or manages external personnel in an emergency response, the UAS operator should establish an emergency response team (ERT) that:*
45. *is led by the ERM;*
46. *includes a core ERT that isformed by persons with a role that implies being directly affected by an emergency situation; and*
47. *includes, if applicable, a support ERT that is formed by ERT members who support the core ERT in responding to the emergency situation.*
48. *The ERP should provide a clear delineation of the responsibilities in an emergency response, including the duties of the remote pilot(s) and any other personnel in charge of duties essential to the UAS operation.*
49. *The ERP should establish a contact list(s) of key persons, relevant authorities, and entities involved in an emergency response, including:*
50. *the full names, roles, responsibilities, and contact details of the ERM and, if applicable, of the ERT members, including their alternates if the nominated persons are unavailable; and*
51. *the full names, roles, responsibilities, and contact details of the relevant authorities and entities outside the UAS operator to be contacted in case of emergency; in addition, the single European emergency call number ‘112’ should be indicated as an emergency contact number for UAS operations that are conducted in any of the EASA Member States and in any other State where that number is used.*
52. *The ERP should indicate the person(s) responsible for the emergency response means and their contact details. The responsible person(s) should ensure that those means are available and usable when needed.*
53. *To ensure a prompt response, the ERM and other ERT members, if applicable, should have direct access to:*
54. *the emergency response checklists; and*
55. *if not included in the checklists referred to in (a), the contact list(s)*

***Emergency response means***

1. *The ERP should indicate the means to be used by the UAS operator to respond to an emergency, which may include one or more of the following:*
2. *facilities, infrastructure, and equipment;*
3. *extinguishing means, e.g. fire extinguishers;*
4. *personal protective equipment, e.g. protective clothing, high-visibility clothing,*
5. *helmets, goggles, gloves;*
6. *medical means, including first-aid kits;*
7. *communication means, e.g. phones (landline and mobile), walkie-talkies, aviation*
8. *radios, internet; and*
9. *others.*
10. *The person(s) in charge of the emergency response means should have an updated record of the available means that are indicated in point Error! Reference source not found. including their number and status (e.g. expiry date of perishable means).*

***ERP validation***

1. *If the UAS operator is a one-person entity and does not manage external personnel in an emergency response, the UAS operator should at least ensure that:*
2. *the procedures cover all the identified emergency situations and that the necessary actions are reflected in the corresponding checklist(s);*
3. *the contact details are up to date; and*
4. *the availability of the emergency response means is checked before conducting any UAS operation, in particular, that the communication means to alert the relevant contacts (see point (b)) are operational.*
5. *If the UAS operator is not a one-person entity and/or manages external personnel in an emergency response, the UAS operator should conduct a tabletop exercise that:*
6. *is established in accordance with the criteria that are indicated in the ERP to be considered representative;*
7. *is consistent with the ERP training syllabus;*
8. *includes sessions where one or more scenarios of the identified emergency situations are discussed by the exercise participants, which should include the relevant ERT members for each of the sessions; all aspects of the ERP should be covered once all sessions of the tabletop exercise have been completed;*
9. *is guided by the ERM or any other person designated by the UAS operator to act as a facilitator;*
10. *may include the participation of third parties that are identified in the ERP; the participation conditions for those third parties should be indicated in the ERP; and*
11. *is performed with the periodicity that is indicated in the ERP.*

*However, if the UAS operator is a one-person entity and does not manage external personnel in an emergency response, a tabletop exercise may not be appropriate as the participation of third parties is not required. In such case, the conditions are deemed sufficient and proportionate to the level of simplicity of the operator and, in principle, of the UAS operations. For UAS operators with a more complex structure as well as for complex UAS operations, the tabletop exercises may need to be complemented with partial emergency exercises and/or full-scale exercises, including the corresponding drills. If the level of robustness that is required or claimed for the ERP is high, such exercises and drills are needed.*

1. *Depending on the level of risk of the UAS operation, the competent authority may require that:*
2. *the ERP and its effectiveness with respect to limiting the number of people at risk be validated by the competent authority itself or by an entity designated by the competent authority;*
3. *the UAS operator should coordinate and agree the ERP with all third parties that are identified in the plan; and*
4. *the representativeness of the tabletop exercise is validated by the competent authority of the EASA Member State of registration or by an entity that is designated by the competent authority.*
5. *After using the procedures that are described in the ERP in a real emergency situation, the UAS operator should conduct an analysis of the way the emergency was managed and verify the effectiveness of the ERP.*

***ERP training***

1. *The UAS operator should provide relevant personnel, and in particular ERT members, with ERP training.*
2. *The UAS operator should develop a training syllabus that covers all the elements of the ERP.*
3. *The UAS operator should compile and keep up to date a record of the ERP training that is completed by the relevant personnel.*
4. *The competent authority of the EASA Member State of registration or an entity that is designated by the competent authority should verify the competencies of the relevant personnel if the level of assurance that is required or claimed for the ERP is high.*

*When the UAS operator develops an ERP, the following should be considered:*

*it is expected to cover:*

1. *the plan to limit crash-escalating effects (e.g. notify the emergency services and other relevant authorities); and*
2. *he conditions to alert ATM.*
3. *(b) it is suitable for the situation;*
4. *it limits the escalating effects;*
5. *it defines criteria to identify an emergency situation;*
6. *it is practical to use;*
7. *it clearly delineates the responsibilities of the personnel in charge of duties essential to the UAS operation;*
8. *it is developed to standards considered adequate by the competent authority and/or in accordance with means of compliance acceptable to that authority; and*
9. *when considered appropriate by the competent authority, to be validated through a representative tabletop exercise53 consistent with the ERP training syllabus.*

# Occurrence reporting procedures according to Regulation (EU) No 376/2014. (OSO#08; OSO#11; OSO#14, OSO#21)

*This section should cover occurrence reporting procedures including:*

1. *Documentation and data logging*
2. *Reporting procedures and responsibilities*
3. *Data storage and availability*

*Art. 19 of Reg. (EU) 2019/947: Each UAS operator shall report to the competent authority on any safety-related occurrence and exchange information regarding its UAS in compliance with Regulation (EU) No 376/2014.*

*Art. 3 No. 2 of Reg (EU) No. 376/2014: This Regulation applies to occurrences and other safety-related information involving civil aircraft to which Regulation (EU) 2018/1139 of the European Parliament and of the Council applies. However, this Regulation shall not apply to occurrences and other safety-related information involving unmanned aircraft for which a certificate or declaration is not required pursuant to Article 56(1) and (5) of Regulation (EU) 2018/1139, unless the occurrence or other safety-related information involving such unmanned aircraft resulted in a fatal or serious injury to a person or it involved aircraft other than unmanned aircraft.*

# Cybersecurity

*Security procedures referred to in UAS.SPEC.050(a)(ii) and (iii); instructions, guidance, procedures, and responsibilities on how to implement security requirements and protect the UAS from unauthorised modification, interference, etc.*

*Further requirements will be developed by EASA in the near future.*

# Environmental impacts

*Guidelines to minimise nuisance and environmental impact referred to in UAS.SPEC.050(a)(v);*

# Record-keeping procedures (instructions on logs and records of pilots and other data considered useful for the tracking and monitoring of the activity).

1. *keep and maintain an up-to-date record of:*
2. *all the relevant qualifications and training courses completed by the remote pilot and the other personnel in charge of duties essential to the UAS operation and 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;*
3. *the maintenance activities conducted on the UAS for a minimum of 3 years;*
4. *the information on UAS operations, including any unusual technical or operational occurrences and other data as required by the declaration or by the operational authorisation for a minimum of 3 years;*
5. *establish and keep an up-to-date list of the designated remote pilots for each flight;*
6. *establish and keep an up-to-date list of the maintenance staff employed by the operator to carry out maintenance activities;*