Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of the Environment,
Transport, Energy and Communications DETEC

Federal Office of Civil Aviation FOCA
Innovation and Digitalisation

FOCA GM

Guidance **M**aterial

OSO 8/11/14/21 Operational Procedures

On JARUS SORA Annex E

Scope	OSO 8/11/14/21 Operational Procedures
Applies to	Specific UAS Operations
Valid from	1 June 2021
Version	ISS 01 / REV 00

Business object	033.1-00001/00018 (to be changed manually)
Prepared by	Tristan Maitre & Nathanel Apter/ ID
Released by	ID / 26 May 2021
Distribution	External

Log of Revision (LoR)

Date	Issue	Revision	Highlight of Revision
12.05.2021	1	0	First Issue

Table of Contents (ToC)

0 Introduction

All Guidance Material (GM) is intended to assist the operator in administrative matters. The administrative requirements and processes facilitate liaising with the Federal Office of Civil Aviation (FOCA). GM is to be considered a tool for the operator in order to ease processes of obtaining required and defined approvals and authorisations issued by the FOCA.

0.1 Terms and Conditions

The use of the male gender should be understood to include male and female persons.

The most frequent abbreviations used by the EASA are listed here: easa.europa.eu/abbreviations.

The most frequent abbreviations used in the JARUS deliverables' documents are listed in JARUS glossary (V0.7 – 11/07/2018)

When used in the GM, modal verbs such as 'shall, must, will, may, should, could, etc.' have the meaning assigned to them in the English Style Guide of the European Commission.

Requirements extracted from JARUS SORA Annex E are given below the following header:

Requirements

Guidance issued by FOCA is given below the following header:

Guidance

Note that the guidance is by no means exhaustive and that other means to comply with the requirements than those described here might exist.

0.2 Purpose of this GM

The purpose of this GM is to provide guidance for operators to enable them to comply with Operational Safety Objectives (OSOs) 8, 11, 14 and 21 of the Specific Operational Risk Assessment Step 8.

0.3 Scope

This GM addresses compliance with the criteria of Integrity and Assurance set out in the JARUS SORA Annex E. Guidance is provided **only for low and medium robustness levels**. High robustness level requirements fall outside the scope of this specific GM.

0.4 Organisation / Operator Responsibilities

Devising the operational procedures specific to an operation is the operator's responsibility and the GM provided here should by no means affect the responsibility of the operator to devise his means of compliance.

0.5 References

ISO. (2019, 11). ISO 21384-3 Unmanned Aircraft Systems - Part 3: Operational Procedures. Genève, Switzerland.

1 Criterion #1 Procedure Definition

Requirements OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#1 – LOW, MEDIUM LEVELS OF INTEGRITY

Operational procedures[1] appropriate for the proposed operation are defined and as a minimum cover the following elements:

- *Flight planning,*
- *Pre and post-flight inspections,*
- *Procedures to evaluate environmental conditions before and during the mission (i.e. real-time evaluation),*
- *Procedures to cope with unintended adverse operating conditions (e.g. when ice is encountered during an operation not approved for icing conditions)*
- *Normal procedures,*
- *Contingency procedures (to cope with abnormal situations),*
- *Emergency procedures (to cope with emergency situations), and*
- *Occurrence reporting procedures.*

Normal, Contingency and Emergency procedures are compiled in an Operation Manual.

The limitations of the external systems supporting UAS operation[2] are defined in an operation manual.

1.1 Low Level of Robustness

Requirements OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#1 – LOW LEVEL OF ASSURANCE

Operational procedures do not require validation against either a standard or a means of compliance considered adequate by the competent authority.

The adequacy of the operational procedures is declared (note: by the applicant), *except for Emergency Procedures, which are tested.*

Guidance OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#1 – LOW LEVEL OF ROBUSTNESS – Flight Planning

Flight Planning should address the following:

- The evaluation of the site of the operation:

    1. The assessment of the area of operation and the surrounding area, including, for example, the terrain and potential obstacles and obstructions for keeping the UAS in VLOS (if applicable), potential for flying over uninvolved persons, potential for flying over critical infrastructure (a risk assessment of the critical infrastructure should be performed in cooperation with the organisation responsible for the infrastructure, as they know most about the risks). For the purpose of this assessment, the population density map and the obstacle database can be used, among other tools.
    2. The class of airspace, other aircraft operations on local aerodromes or operating sites, restrictions, permissions and potential activities by other airspace users. For the purpose of

[1] Operational procedures cover the deterioration of the UAS itself and any external system supporting UAS operation.

[2] In the scope of this assessment, external systems supporting UAS operation are defined as systems not already part of the UAS but used to:

- launch / take-off the UAS,
- make pre-flight checks,
- keep the UA within its operational volume (e.g. GNSS, Satellite Systems, Air Traffic Management, UTM). External systems activated/used after the loss of control of the operation are excluded from this definition.

this assesment, the ICAO map, the sailplanes map and the hospital heliports and mountain landing sites location map can be used, among other tools.

3. The assessment of the surrounding environment, including, for example, the location of restricted zones;
   For the purpose of this assessment, the RPAS Map should be used, since it is the official map regarding geozones.
4. When UAS Airspace Observers (AOs) 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 UAS AOs; and

- Provision of information to and/or coordination with all third parties involved as described in the ConOps, for example:
  - Aerodromes
  - HEMS
  - Military

- Emergency Response Plan (ERP) information/instructions available for the flight if applicable.

- Crew trained according to requirements defined in the ConOps (Training Manual if applicable). Crew self-declares itself fit to operate.

- Weather conditions are adequate to conduct the UAS operation within the ConOps defined limits. This includes as a minimum:

  - Temperature
  - Wind and Gusts
  - Precipitations
  - Icing
  - Visibility

- 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 radio frequency (RF) spectrum;
- Compliance with cross-border operations requirements (specific local requirements) when applicable

Guidance OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#1 – LOW LEVEL OF ROBUSTNESS – Pre-flight Inspections

The pre-flight inspections should contain as a minimum a check of the following:

1. UAS check:
   a. Rotors and propellers: no visible damage and propellers tight and mounted according to manufacturer's instructions
   b. UAS structure: no visible damage
   c. Batteries: charged and number of cycles in line with maintenance, emergency battery operational if applicable
   d. Compass and position sensors calibrated and accurate.
   e. GPS signal integrity and availability checked
   f. Remote Control Check: Control and command link signal and UAS response to control inputs: roll, pitch and yaw.
   g. Emergency Response System check if available, Parachute triggering system check.

2. Radio communication check, if applicable.

3. At least the following details must be recorded in a log book before each flight:

a. Date of the flight(s)
b. Location and time of take-off
c. Environmental conditions (including temperature, wind and gusts, precipitations, visibility)
d. Name of the pilot(s), observer(s) and the additional ground crew

4. For the awareness of NOTAM, danger area or restricted area activity, the on-site evaluation should also include the assessment of the operations published in the DABS.

Guidance OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#1 – LOW LEVEL OF ROBUSTNESS – Post-flight Inspections

The post-flight inspections should contain as a minimum a check of the following:

1. Disarm Motors

2. UAS Check:
   a. Rotors and propellers
   b. UAS structure
   c. ERS check if applicable

3. At least the following details must be recorded in a log book after each flight:
   a. Location and time of landing
   b. Any unusual technical or operational occurrences, e.g. opening of parachute, premature decoupling

Guidance OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#1 – LOW LEVEL OF ROBUSTNESS – Environmental Conditions

The environmental conditions verified in flight planning should be verified during the mission with a frequency rate appropriate for the operation.

Guidance OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#1 – LOW LEVEL OF ROBUSTNESS – Normal Procedures

Normal procedures in-flight are documented in the ConOps (operating instructions for the UAS):

- reference to or duplication of information from the manufacturer's manual;
- instructions on how to keep the UAS within the flight geography.

The in-flight procedures are part of the training syllabus.

In-flight procedures should include the assessment of the compatibility between visibility and potential range, the terrain obstruction, and the gaps between the zones covered by the pilot and/or the AOs during flight.

Guidance OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#1 – LOW LEVEL OF ROBUSTNESS – Contingency Procedures

Contingency procedures are the planned course of action designed to help respond effectively to a significant future event or situation that may or may not happen.
In practice, contingency procedures should cover as a minimum the following cases:

- **Breaching the limit between the flight geography and the contingency volume**: the UAS initiates contingency procedures. For instance, alerting the pilot who initiates an emergency landing, an automatic Return-To-Home function or hovering in position.
- **Losing the command and control (C2) link**: the UAS initiates loss of C2 link procedures. For example, hovering in position for a given time and if the C2 link is not recovered during this period, the UAS initiates a Return-to-Home.
- **Losing navigation capability (e.g GNSS)**: the UAS initiates procedures to stay within the flight geography. For example, landing after a given time without signal or manual control by the pilot).
- **UAS not responding in yaw, pitch and roll** as intended: procedures should be initiated to ensure that the UAS stays within the flight geography

Guidance OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#1 – LOW LEVEL OF ROBUSTNESS – Emergency Procedures

Emergency Procedures that are executed by the UAS pilot in command or by the aircraft to mitigate the effect of failures or malfunctions.
In practice, emergency procedures should cover as a minimum the following cases:

- **Breaching the limit between the contingency volume and the ground risk buffer**, emergency procedures are triggered. For example, a flight termination system is activated when breaching a predefined geofence.
- **Conflict with an incoming aircraft**: emergency procedures should be available to avoid a collision.
- **Third party entering the area of operation** when operating over a controlled ground area, procedures should be defined to interrupt the flight.

Guidance OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#1 – LOW LEVEL OF ROBUSTNESS – Occurrence Reporting

UAS operators / pilots are obliged to report accidents and serious incidents via the REGA alarm center (tel. 1414, from abroad +41 333 333 333) to the aviation department of the Swiss Transportation Safety investigation Board (STSB).

In addition, all UAS operators / pilots must generally report all safety-related incidents with serious or fatal injuries to persons or if manned aircraft are affected to the Federal Office of Civil Aviation (FOCA) or via the reporting system of the company concerned (www.aviationreporting.eu) within 72 hours.

Guidance OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#1 – LOW LEVEL OF ROBUSTNESS – Limitations of external systems

An external system which supports the operation is usually a system providing a function, such as a device used during flight (e.g. anemometer, thermometer used for pre-flight checks), a traffic detection and avoidance system (e.g FLARM, ADS-B in) or any other system supporting the operation.

For each system, performance limitations should be documented, e.g. the temperature range for thermometer or the velocity range for an anenometer.

1.2 Medium Robustness level

Requirements OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#1 – MEDIUM LEVEL OF ASSURANCE

- *Operational procedures are validated against standards considered adequate by the competent authority and/or in accordance with a means of compliance acceptable to that authority.*
- *Adequacy of the Contingency and Emergency procedures is proven through:*

- *Dedicated flight tests, or*
- *Simulation, provided the simulation is proven valid for the intended purpose with positive results.*

Guidance OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#1 – MEDIUM LEVEL OF ROBUSTNESS

The **same guidance as for low robustness level is applicable** for the flight planning, the preflight inspections, the post-flight inspections, the environmental conditions evaluation, the normal procedures, the contingency procedures, the emergency procedures, the occurrence reporting procedures and the limitations of the external systems.

In addition, for flight planning, the flight route and especially the point of departure, the landing point, the cruising speeds, the cruising levels (ISO, 2019) and the flight mode for each segment of the flight path should be determined.

Furthermore, **the pre-flight inspection must address the availability and integrity of tactical mitigation (detect function) systems**, if applicable and according to SORA Step 6 TMPR (e.g. Flight Radar, Involi, ADS-B, Flarm etc…)

2 Criterion #2 Procedure Complexity

2.1 Low Robustness Level

Requirements OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#2 – LOW LEVEL OF INTEGRITY

Operational procedures are complex and may[3] potentially jeopardize the crew's ability to respond by raising the remote crew's workload and/or the interactions with other entities (e.g. ATM…).[4]

Requirements OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#2 – LOW LEVEL OF ASSURANCE

Operational procedures do not require validation against either a standard or a means of compliance considered adequate by the competent authority.

The adequacy of the operational procedures is declared, except for Emergency Procedures, which are tested.

Guidance OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#2 – LOW LEVEL OF ROBUSTNESS

This criterion is considered fullfilled as long as procedures are available.

2.2 Medium Robustness Level

Requirements OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#2 – MEDIUM LEVEL OF INTEGRITY

Contingency/emergency procedures require manual control by the remote pilot[5] when the UAS is usually automatically controlled.

Requirements OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#2 – MEDIUM LEVEL OF ASSURANCE

- *Operational procedures are validated against standards considered adequate by the competent authority and/or in accordance with a means of compliance acceptable to that authority.*
- *Adequacy of the Contingency and Emergency procedures is proven through:*
  - *Dedicated flight tests, or*
  - *Simulation, provided the simulation is proven valid for the intended purpose with positive results.*

Guidance OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#2 – MEDIUM LEVEL OF ROBUSTNESS

Contingency/emergency procedures should specify the transitions between nominal and degraded mode (e.g from 'automatic' to 'degraded'/'manual' mode) in the event of the UAS behaving abnormally. Transition to recovery/abnormal flight modes can be manually launched by the crew or automatically by the UAS under specific programmed conditions.

[4] This should not be understood as a requirement but more as the absence of medium or high robustness requirements. In this context procedures do not need to be simple or optimised to prevent an increased workload for the crew.

[5] From JARUS Annex E comments section: This is still under discussion since not all UAS have a mode where the pilot can directly control the surfaces; moreover, some people claim it requires significant skill not to make things worse.

3 Criterion #3 Consideration of Potential Human Error

3.1 Low Robustness Level

Requirements OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#3 – LOW LEVEL OF INTEGRITY

At a minimum, operational procedures provide:

- *a clear distribution and assignment of tasks*
- *an internal checklist to ensure staff are adequately performing assigned tasks.*

Requirements OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#3 – LOW LEVEL OF ASSURANCE

Operational procedures do not require validation against either a standard or a means of compliance considered adequate by the competent authority.
The adequacy of the operational procedures is declared, except for emergency procedures, which are tested.

Guidance OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#3 – LOW LEVEL OF ROBUSTNESS

For instance, the distribution of the tasks can be documented based on a Responsibility Assignment Matrix (RAM) or RACI matrix model, as follows:

Task	Pilot in Command	Accountable Manager	Observer
Task 1	R	A	I
Task 2	R	A	
Task 3	I	A	R
Etc..			

A: Accountable; R: Responsible; I: for Information, (C: Consulted)

The internal check to ensure the staff are adequately performing assigned tasks is as follows:

Items	Person in Charge	Action required	Verification
Checklist Item 1			✓
Checklist Item 2			✓
Checklist Item 3			…
…	…	…	…
Date and Signature:			

3.2 Medium Robustness Level

Requirements OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#3 – MEDIUM LEVEL OF INTEGRITY

Operational procedures take human error into consideration.

Requirements OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#3 – MEDIUM LEVEL OF ASSURANCE

Operational procedures do not require validation against either a standard or a means of compliance considered adequate by the competent authority.
The adequacy of the operational procedures is declared, except for emergency procedures, which are tested.

Guidance OSO#8, OSO#11, OSO#14, and OSO#21 – CRIT#3 – MEDIUM LEVEL OF ROBUSTNESS

In addition to the requirements for the low robustness level, the operational procedures are established taking account of potential human errors and the following in particular:

- Environmental conditions and physical environmental factors for the correct performance and well-being of the crew in operation are defined. They include temperature, fatigue, vibration, noise, time of the day, boring/stressful working environments.
- The crew is trained to avoid misunderstandings when communicating. Terminology and phraseology are clearly defined for the purpose of the operations.

The applicant might perform a task analysis or Human Reliability Assessment (HRA) depending on the type of operation, using for instance:

- **Human-HAZOP**: The UK Health and Safety Executive (HSE) provides a 7-step toolkit for identifying and managing human failures.
  Table 1 provides an example of HAZOP worksheet.
- **HFACS:** Human Factors Analysis and Classification System (HFACS) - SKYbrary Aviation Safety

Table 1: Example of Human-HAZOP worksheet applied to UAS operation

No	Guideword	Action (description)	Action Error	Possible causes	Possible consequences	Comments	Proposed improvements
1	Other than	Execute Return to home command	Wrong command input (e.g. Land in vertical position instead)	• Procedure error • Communication error • Human-Machine Interface (HMI) inadequate • Execution error (e.g. attentional failure, failures of memory)			
2	…						