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Innovation and Digitalisation

FOCA GM

Operation Manual

Drone Spraying Applications

Scope	Guidance for the elaboration of an OM for Drone Spraying
Applies to	Spraying Applications with UAS
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Prepared by	Nathanel Apter / ID
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0 Introduction

All Guidance Material (GM) are intended to assist the organisation/operator in complying with autorisation requirements and administrative matters. The requirements and processes are intended to facilitate liaising with the Federal Office of Civil Aviation (FOCA). The GM is to be considered a tool for the organisation/operator in order to ease processes of obtaining required and defined approvals and authorisations issued by the FOCA. Using the GM will be conducive to establishing compliance with FOCA requirements and will lead through the respective certification or variation process in regard to administrative tasks.

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: http://www.easa.europa.eu/abbreviations.

When used throughout the GM/INFO the terms such as «shall, must, will, may, should, could, etc.» shall have the meaning as defined in the English Style Guide (https://ec.europa.eu/info/files/english-resources-english-style-guide_en) of the European Commission.

0.2 Legal References

Commission Regulation (EU) No 923/2012:

- SERA.3115

0.3 Purpose of this GM

This GM aims at providing Guidelines for the elaboration of an Operation Manual for spraying application with drones. This GM is valid for operations of the specific category.

0.4 Scope

The spraying application shall take place within the limitations defined in the form “Authorisation Drone Application Spraying”. The Substances that can be used in this context concern pesticides and fertilizers authorized for applications on the ground as well as application of preparations.

0.5 Organisation / Operator Responsibilities

The applicant bears overall responsibility for the operation. Specifically, the applicant must ensure compliance with all requirements of the standard permit application procedure as well as any other requirements associated with the permit. The applicant may name an employee and instruct said employee to carry out the operation. Overall responsibility remains with the applicant.

1 Organisation Overview

1.1 Responsibilities and associated Duties

Describe the responsibilities and duties of the UAS operator and personnel, describe all positions and people involved.

1.2 Safety

Describe how safety is integrated in the organization. What Safety Management System (SMS) is in place?

1.3 Training of staff involved in operations

Describe the training organization to qualify all staff involved in operations.

1.4 Maintenance

Describe the maintenance instructions and procedures.

2 Operations

2.1 Standard Operating Procedures

Describe the standard operating procedures (SOP) applicable to all operations for which an approval is requested.

The Pre-mission checklist addresses at least the following:

- Evaluation of the people in the operational Volume and the ground risk buffer. Only people directly involved with the operation of the UAS are allowed to be present. Those people should be fully aware of the risks involved with the UAS operation and have accepted these risks. They should furthermore be informed and able to follow relevant effective emergency procedures and contingency plans.
- Evaluation of the airspace where the operation takes place, its class, requirements and other airspace users expected in the area. Coordination with local airports/heliports (5km radius) available if necessary: https://map.geo.admin.ch/?topic=aviation&bgLayer=ch.swisstopo.pixelkarte-grau&layers=ch.bazl.einschraenkungen-drohnen&X=189554.62&Y=664804.11&zoom=1&catalogNodes=1379&layers_opacity=0.6&lang=fr
- The assessment of the surrounding environment and airspace, including, for example, the activation of restricted zones and potential activities by other airspace users; Includes the assessment of the Daily Airspace Bulletin (DABS):https://www.skybriefing.com/
  No flights in restricted and prohibited areas are allowed.
- Evaluation of Obstacles (High Voltage Lines, Buildings and so on): The operational volume and the ground risk buffer should not contain areas with obstacles unless under the control of the applicant. The flight should be planned accordingly.
- Evaluation of roads and railways: The Operational volume and the ground risk buffer shall not contain areas with roads and railways unless closed or under control of the applicant.

Further guidance on the content of checklists can be found here:

https://www.bazl.admin.ch/dam/bazl/fr/dokumente/Gut_zu_wissen/Drohnen_und_Flugmodelle/guidance_material_onsora_oso8_pre_and_postflight_inspections.pdf.download.pdf/Guidance%20Material%20on%20SORA%20OSO%208%20Pre-%20and%20Postflight%20Inspections.pdf

(Note that this Guidance applies for SORA and that not everything is applicable for Spraying Activities).

2.2 Normal procedures

The Normal Operation Strategy should contain all the safety measures, such as technical or procedural measures, crew training 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.

The intent of this chapter is to get a clear understanding of how the operation takes place within the approved technical, environmental, procedural limitations. Procedures to evaluate environmental conditions before and during the mission are available.

2.3 Abnormal operation and emergency operation

Describe the following procedures:

- Contingency procedures: Procedures when a UA breaches the flight geography.
- Emergency procedures: This procedure comes into force when exiting the contingency volume.
- Procedures to cope with uninvolved persons entering the controlled ground area, if applicable.

- De-confliction scheme (i.e. the criteria that will be applied for the decision to avoid incoming traffic).

2.4 Emergency Response Plan

The ERP addresses situations with:

- Injured People
- Fire or Explosion of a Battery
- Leeking of Pesticides after a crash
- Fly-Away cases

3 Training

Brief description of the processes and procedures that the operator uses to develop and maintain the necessary competence for all staff involved in operations. Provide a reference to the applicable training program(s) for all staff involved in operations. This might simply be a reference to the program as required by regulation or, if the operator has developed a specific program, a reference to the operator's training program.

Description of the processes and procedures that the operator uses to recruit and qualify all staff involved in operations. In particular, it should be described which are the licensing and rating requirements for remote operators (if any) or, if license is not required, how their qualification is carried out.

Describe which processes and procedures the operator uses to ensure that the remote operators (if any) or other operational staff acquire and maintain the required currency to execute the various types of duties.

Describe the Crew Training to avoid misunderstanding when communicating and to provide support and Monitoring.

For spraying of pesticides, following guidelines shall be trained for the handling of the substance:

https://www.seco.admin.ch/seco/fr/home/Publikationen_Dienstleistungen/Publikationen_und_Formulare/Arbeit/Arbeitsbedingungen/Broschuren/Pflanzenschutzmittel.html

https://www.bafu.admin.ch/bafu/fr/home/themes/eaux/publications/publications-eaux/produits-phytosanitaires-agriculture.html

4 UAS Description

Describe in detail the physical characteristics of the Aircraft (mass, center-of-mass, dimensions, etc.). Include photos diagrams and schematics, whenever deemed necessary to support the description of the UA.

4.1 Aircraft Performance Characteristics

Describe the performance of the aircraft within the proposed flight envelope.

Specifically, address at least the following items:

a) Maximum altitude
b) Maximum endurance
c) Maximum range
d) Maximum rate of climb
e) Maximum rate of descent
f) Maximum bank angle
g) Nominal cruise speed
h) Max cruise speed
i) Never exceed airspeed

4.2 Propulsion System

Describe the motors, ESCs and propellers and their ability to provide reliable and sufficient power to take off, climb, and maintain flight at expected mission altitudes.

a) Provide a high-level description of the electrical distribution architecture. Include items such as regulators, switches, buses, and converters, as necessary.
b) What type of motor is used?
c) How many motors are installed?
d) If a limited life power source such as batteries is used, what is the useful life of the power source during normal and emergency conditions? How was this determined?
e) How is information on battery status and remaining battery capacity provided to the operator (if one is in the loop) or watchdog system?
f) How is the propulsion system performance monitored?
g) What status indicators and alerts (such as warning, caution and advisory) messages are provided to the operator?
h) How does the Unmanned Aircraft respond, and what safeguards are in place to mitigate the risk of propulsion system loss for each of the following?
    - Low battery
    - Failed signal input from the control station
    - Motor controller failure

4.3 Payloads

Describe the payload equipment on-board the aircraft. Describe all payload configurations that significantly change weight and balance, electrical loads, or flight dynamics.

5 UAS Control Segment

Provide an overall system architecture diagram of the avionics architecture. Include the location of all air data sensors, antennas, radios, and navigation equipment. Describe any redundant system, if available.

5.1 Navigation

a) How does the UAS determine its location?

b) How does it navigate to its intended destination?

c) Describe the procedures to test the altimeter navigation system (position, altitude)?

d) How does the system identify and respond to a loss of the primary means of navigation?

e) Is there a backup means of navigation?

f) How does the system respond to a loss of the secondary means of navigation, if available?

5.2 Autopilot

a) How was the autopilot system developed? Which industry or regulatory standards were used in the development process?

b) Is the autopilot a commercial off-the-shelf (COTS) product? If so, name the type/manufacturer and provide the criteria that was used in selecting the COTS autopilot?

c) Describe the procedures used to install the autopilot. How is correct installation verified? Reference any documents or procedures provided by the manufacturer and/or developed by your organization.

d) A management of the control software versions shall be available.

e) Does the autopilot employ input limit parameters to keep the aircraft within defined limits (structural, performance, flight envelope, etc.)? If so, what are these limits? How were these limits defined and validated?

5.3 Control Station

a) Describe or diagram the CS configuration. Include screen captures of the control station displays.

b) How accurately can the operator determine the attitude, altitude (or height) and position of the UA?

c) What critical commands are safeguarded from inadvertent activation and how is that achieved /for example, is there a two-step process to command “kill-engine”)? What kind of inadvertent input could the operator enter to cause an undesirable outcome (for example, accidentally hitting the “kill engine” command in flight)?

d) What are the provisions taken against a CS display or interface lock-up?

e) What alerts (such as warning, caution, and advisory) does the system provide to the operator (for example low fuel or battery, failure of critical systems, operation out of control)?

f) Describe the means of power to the CS, and redundancies if any.

g) What are the procedures in place in case of CS loss of primary and secondary power (if any)?

5.4 Command and Control (C2) Link segment

Provide a detailed control system architecture diagram that includes informational or data flows and subsystem performance. Include values for data rates and latencies, if known. Describe the control link(s) connecting the UA the CS and any other ground systems or infrastructures, if applicable.

Specifically address the following items:

a) What spectrum will be used for the control link? What is the maximum power spectrum?

b) Is there a radio signal strength and/or health indicator or similar display to the operator? How is the signal strength and health value determined, and what are the threshold values that represent a critically degraded signal?

c) What design characteristics or procedures are in place to prevent or mitigate the loss of the datalink due to the following?

- Radio Frequency (RF) or other interference
- Flight beyond communications range
- Antenna masking (during turns and/or at high attitude angles)
- Loss of UA functionality
- Atmospheric attenuation including precipitation

5.5 C2 Link Degradation and/or loss

a) What are the procedures in case of C2 link degradation?

b) How is the status of the C2 Link displayed to the operator?

c) What are the conditions to trigger the C2 link loss procedure?

d) What are the measures in case of loss of the C2 link (lost link)?

5.6 Safety Features

Describe the emergency recovery capability to prevent third party risk (incoming air traffic or people entering the ground control area). This typically consist of:

a) A flight termination system (FTS), procedure or function that aims to immediately end the flight, or,

b) An Automatic Recovery System (ARS) that is implemented through UAS crew command or by the on-board systems. This may include automatic preprogramed course of action to reach a predefined and unpopulated forced landing area.