



Version 1
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Authorisation request for BVLOS UAS operations with Airspace Observers (AO) over sparsely populated areas

Application for a permit to operate an unmanned aircraft system beyond visual line of sight with Airspace Observers (AOs) over sparsely populated areas in uncontrolled airspace according to Art. 17 para. 1 and Art. 18 of the Ordinance on Special Category Aircraft (OSCA).

Applicant

Company name / Name:

Address:

Town / Postcode:

Country:

Telephone no:

Email:

Name of operator:

Address of operator:

Details of drone model

Manufacturer:

Model:



This BVLOS authorisation request contains two parts. For the first part, the UAS operator should submit an **operation manual (OM)** containing the aspects mentioned in the OM BVLOS with AO document and which will undergo an evaluation by the FOCA. This document will be used by the accountable manager and the crew to prepare and conduct operations.

The second part consists of the following declaration of compliance by the UAS operator.

The UAS operator agrees to operate under the following limitations:

1. Operational characterisation

1.1 Level of human intervention

- No autonomous operations: the remote pilot shall have the ability to maintain control of the UA, except in the case of a loss of the command and control (C2) link.
- The remote pilot shall operate only one UA at a time.
- The remote pilot shall not operate from a moving surface vehicle.
- The remote pilot shall not hand over the control of the UA to another command unit.

1.2 Range limit from remote flight crew

- Launch / recovery: VLOS from the remote pilot, if not operating from a safe prepared area.

Note: 'safe prepared area' means a controlled ground area that is suitable for the safe conduct of the launch/recovery of the UA.

- In flight:
 - If no AOs are employed: UA is not operated further than 1 km (or other distance defined by the FOCA) from the remote pilot.

Note: The remote pilot's workload should allow him or her to continuously scan the airspace.
 - If AOs are employed: the range is not limited as long as the UA is not operated further than 1 km (unless a different distance is defined by the FOCA) from the AO who is nearest to the UA.

1.3 Areas overflown

Sparsely populated area.

1.4 UA limitations

- Maximum characteristic dimension (e.g. wingspan or rotor diameter/area or maximum distance between rotors in the case of a multicopter): 3m.
- Typical kinetic energy up to 34kJ.

1.5 Flight height limit

The maximum flight height of the operational volume shall not be greater than 120m above the surface overflown (or any altitude reference defined by the FOCA).

Note: In addition to the vertical limit for the operational volume, an air risk buffer is to be considered (see '2.3 Air Risk')

1.6 Airspace

Operations shall be conducted only in G airspace class (uncontrolled airspace) over sparsely populated areas.

1.7 Others

The UA shall not be used to drop material or carry dangerous goods, except for dropping items in connection with agricultural, horticultural or forestry activities in which the carriage of the items does not contravene any other applicable regulations.

1.8 Visibility

At no time shall the UA be operated in an area where the minimum flight visibility is less than 5km.

Note: This flight visibility should be understood as the distance from which an UA can be visually detected by the remote crew.

2. Operational mitigations

2.1 Operational volume

To determine the operational volume the UAS operator shall consider the position keeping capabilities of the UAS in 4D space (latitude, longitude, height and time).

In particular the accuracy of the navigation solution, the flight technical error of the UAS and the path definition error (e.g. map error) and latencies shall be considered and addressed when determining the operational volume.

The remote pilot should activate emergency procedures as soon as there is an indication that the unmanned aircraft may exceed the limits of the operational volume.

2.2 Ground risk

- A ground risk buffer shall be established to protect third parties on the ground outside the operational volume.
- The minimum criterion shall be the use of the 'one-to-one rule' (e.g. if the UA is planned to operate at a height of 120m, the ground risk buffer shall at least be 120m).
- The operational volume and the ground risk buffer shall be in a sparsely populated area.
- The UAS operator shall evaluate the area of operations typically by means of an on-site inspection or appraisal, and can justify a lower density of people at risk.

2.3 Air risk

- The UAS operator should establish an air risk buffer to protect third parties in the air outside the operational volume.

- This air risk buffer shall be in G airspace class (uncontrolled airspace) over sparsely populated areas.
- Operational volume shall be out of an airport environment.
- Prior to flight, the proximity of the planned operation to manned A/C activity shall be assessed.

2.4 Airspace observers

- If the UAS operator decides to use one or more airspace observers (AOs), the remote pilot may operate the UAS up to the distance specified in section 1.2.
- The UAS operator shall ensure the correct placement and number of AOs along the intended flight path. Prior to each flight, the UAS operator shall perform the following assessment:
 - Check the compliance between visibility and planned range for AOs.
 - Assess the potential terrain obstruction for AOs.
 - Confirm there are no gaps between the zones covered by each of the AOs.
- The AO(s) necessary for the safe conduct of the operation must be in place during flight operations.

Note: Instead of an AO, the remote pilot may perform the visual scan of the airspace provided that the workload is adequate to perform his/her duties.

3. UAS operator and UAS operations provisions

3.1 Operator competency

The UAS operator shall comply with all of the following:

- establish procedures and limitations adapted to the type of the intended operation and the risk involved, including:
 - operational procedures to ensure the safety of the operations;
 - procedures to ensure that security requirements applicable to the area of operations are complied with in the intended operation;
 - measures to protect against unlawful interference and unauthorised access;
 - guidelines for its remote pilots to plan UAS operations in a manner that minimises nuisances, including noise and other emissions-related nuisances, to people and animals.
- designate a remote pilot for each operation or
- ensure that all operations effectively use and support the efficient use of radio spectrum in order to avoid harmful interference;
- ensure that before conducting operations, remote pilots comply with all of the following conditions:

- have the competency to perform their tasks in line with the applicable training defined in section 4;
- follow remote pilot training which shall be competency based and include the following competencies:
 - ability to apply operational procedures (normal, contingency and emergency procedures, flight planning, pre-flight and post-flight inspections);
 - ability to manage aeronautical communication;
 - manage the unmanned aircraft flight path and automation;
 - leadership, teamwork and self-management;
 - problem solving and decision-making
 - situational awareness;
 - workload management;
 - coordination, as applicable.
- have been informed about the UAS operator's operations manual;
- obtain updated information relevant to the intended operation about any geographical restriction applicable;
- develop an operations manual (OM) (for template refer to the FOCA GM OM);
- develop an emergency response plan (ERP, see Section 3.5);
- ensure the adequacy of the contingency and emergency procedures and prove it through any of the following:
 - dedicated flight tests; or
 - simulations, provided that the representativeness of the simulation means is proven for the intended purpose with positive results.

3.2 UAS operations

- Operational procedures as well as safety features and procedure in case of command and control link degradation should be defined and developed after the document Guidance Material OM EVLOS.
- Operational procedures shall consider human errors and shall include at a minimum:
 - a clear distribution and assignment of tasks;
 - an internal checklist to check that staff is properly performing assigned tasks adequately.
- The adequacy of the contingency and emergency procedures shall be proved through:
 - dedicated flight tests, or

- simulations, provided that the representativeness of the simulation means is proven for the intended purpose with positive results, or
- any other means acceptable to the FOCA.
- The remote crew shall be competent and be authorised by the UAS operator to carry out the intended operations.
- A list of remote crew members authorised to carry out UAS operations is established and kept up to date.
- A record of all relevant qualifications, experience and/or training completed by the remote crew is established and kept up to date.

3.3 UAS maintenance

- The UAS maintenance instructions defined by the UAS operator shall be included in the OM and cover the UAS manufacturer instructions and requirements when applicable.
- The maintenance staff follow the UAS maintenance instructions when performing maintenance.
- The maintenance conducted on the UAS shall be recorded in a maintenance log system.

Note: The maintenance log may be requested for inspection/audit by the approving authority or an authorised representative.

3.4 External service

- The UAS operator shall ensure that the level of performance for any externally provided service necessary for the safety of the flight is adequate for the intended operation. The UAS operator shall declare that this level of performance is adequately achieved.
- Roles and responsibilities between the UAS operator and the external service provider shall be defined.

3.5 Emergency response plan (ERP)

The UAS operator shall establish an ERP in the OM 2.1.4 that:

- is expected to cover:
 - the plan to limit crash escalating effect (e.g. notify emergency services and other relevant authorities), and
 - the conditions to alert ATM.
- is suitable for the situation;
- limits the escalating effects;
- defines criteria to identify an emergency situation;
- is practical to use;
- clearly delineates remote crew member(s) duties.

4. Training provisions

4.1 Remote crew

The UAS operator shall ensure the entire remote crew (i.e. any person involved in the operation) are provided with competency-based theoretical and practical training specific to their duties, consisting of the following elements:

- Basic competencies from the competency framework necessary to ensure safe flight:
 - UAS regulation;
 - UAS airspace operating principles;
 - airmanship and aviation safety;
 - human performance limitations;
 - meteorology;
 - navigation/charts;
 - UA knowledge;
 - operating procedures;
 - assignment of tasks to the crew;
 - establishment of step-by-step communications;
 - coordination and handover.

Note: Evidence of training shall be presented for inspection upon request from the competent authority or authorised representative.

The operator shall provide competency-based theoretical and practical training covering the ERP that includes related proficiency requirements and training recurrences.

4.2 Airspace observers

Airspace observers' main responsibility shall be to:

- 1) maintain a thorough visual scan of the airspace surrounding the UA In order to identify any risk of collision with any manned aircraft;
- 2) maintain awareness of the position of the UA through direct visual observation or through assistance provided by electronic means; and
- 3) alert the remote pilot in case a hazard is detected and assist in avoiding or minimising the potential negative effects.

4.3 Remote pilot

The remote pilot has the authority to cancel or delay any or all flight operations for the following reasons:

- 1) the safety of persons;
- 2) property on the ground;
- 3) other airspace users are in jeopardy;
- 4) there is a violation of the terms of this authorisation.

If AOs are used, then the remote pilot shall ensure that the necessary AOs are available and correctly placed, and that the communication with them can be adequately performed.

The remote pilot shall ensure that the UA remains clear of clouds, and that the ability of the remote pilot or one of the AOs to maintain a thorough visual scan of the airspace where the unmanned aircraft is operating for any risk of collision is not hampered by clouds.

4.4 Multi-crew cooperation (MCC)

In applications where MCC might be required, the UAS operator shall:

- 1) include in the SOP procedures to ensure a coordination between the remote flight crew members with robust and effective communication channels. Those procedures shall cover at a minimum:
 - a) the assignment of tasks to the remote flight crew members;
 - b) the establishment of a step-by-step communication.
- 2) ensure that the training of remote flight crew covers MCC.

4.5 Remote crew fit to operate

The operator shall have a policy in the OM defining how the remote crew can declare themselves fit to operate before conducting any operation.

The remote crew shall declare they are fit to operate before conducting any operation based on the policy defined by the UAS operator.

4.6 Maintenance staff

Maintenance staff must be competent and able to follow manufacturers' instructions. A record of all relevant qualifications, experience and/or training completed by the maintenance staff is established and kept up to date.

*Chapter 4 based on EASA AMC2 Appendix A to Article 11

5. Technical provisions

5.1 General

- The means to monitor the critical parameters for a safe flight shall be available, in particular:
 - UA position, height or altitude, ground speed or airspeed, attitude and trajectory;
 - UAS energy status (fuel, batteries ...); and
 - status of critical functions and systems; at a minimum for services based on RF signals (e.g. C2 Link, GNSS ...), the means shall be provided to monitor the adequate performance and triggering of an alert if level is becoming too low.
- The UA shall have the performance capability to descend safely from its operating altitude to a 'safe altitude' in less than 1 minute, or have a descent rate of ≥ 2.5 m/s (500 fpm) as defined in the contingency procedures in the OM.

5.2 Human machine interface

- The UAS information and control interfaces shall be clearly and succinctly presented and shall not confuse, cause unreasonable fatigue, or contribute to remote flight crew error that could adversely affect the safety of the operation.
- If electronic means are used to support Airspace Observers in their role of maintaining awareness of the position of the unmanned aircraft, its HMI shall:
 - Be sufficient to allow the AOs to determine the position of the UA during operation;
 - Not degrade the AOs ability to:
 - perform thorough visual scan of the surrounding airspace where the UA is operating to identify any risk of collision with any manned aircraft; and
 - maintain effective communication with the remote pilot at all times.
- The UAS operator shall conduct an evaluation of the UAS considering and addressing human factors to determine the HMI is appropriate for the operation.

5.3 Command, control links (C2) and communication

- The UAS shall comply with the applicable requirements (see Swiss National Frequency Allocation Plan, OFCOM) for radio equipment and the use of RF spectrum.
- Protection mechanisms against interference shall be used, especially if unlicensed bands (e.g. ISM) are used for the C2 link (mechanisms like Frequency Hopping Spread Spectrum – FHSS, technology or frequency de-confliction by procedure).
- Communication between remote pilot and AO shall allow for the remote pilot to manoeuvre the UA with sufficient time to yield right-of-way in accordance with the following provisions:
 - The unmanned aircraft must yield the right of way to all aircraft and airborne vehicles.
 - No person may operate an unmanned aircraft close to another aircraft so as to create a collision hazard.

5.4 Tactical mitigation

- The UAS design must be adequate to ensure that the time required between a command given by the remote pilot and the UA executing it does not exceed 5 seconds.
- Where electronic means (e.g. FLARM, GliderNetwork, FlightRadar24 etc...) are used to assist the remote pilot and/or the AOs in being aware of UA position in relation to potential 'airspace intruders', the information is provided with a latency and update rate for intruder data (e.g. position, speed, altitude, track) that support the decision criteria.

Note: The decision criteria allows the Remote pilot to initiate the deconfliction scheme as defined in the OM.

5.5 Containment

To ensure a safe recovery from a technical issue involving the UAS or an external system supporting the operation, the UAS operator shall ensure:

- that no probable failure of the UAS or of any external system supporting the operation shall lead to operation outside the operational volume;
- that it is reasonably expected that a fatality will not occur from any probable failure of the UAS, or of any external system supporting the operation;
- the vertical extension of the operational volume is 120 m above the surface.

Note: The term 'probable' needs to be understood in its qualitative interpretation, i.e. 'anticipated to occur one or more times during the entire system/operational life of an item.'

A design and installation appraisal should be made available and shall cover at a minimum:

- design and installation features (independence, separation and redundancy);
- particular risks (e.g. hail, ice, snow, electromagnetic interference, etc.) relevant to the ConOps.

The following additional provisions should apply if the adjacent area includes an assembly of people or if the adjacent airspace is controlled airspace:

- The probability of leaving the operational volume shall be less than $10^{-4}/FH$.
- No single failure of the UAS or of any external system supporting the operation shall lead to operation outside the ground risk buffer.
- Compliance with the provisions i) and ii) above shall be substantiated by analysis and/or test data with supporting evidence in the OM Chapter 5.2.

Note: The term 'failure' should be understood as an occurrence which affects the operation of a component, part, or element in such a way that it can no longer function as intended. Errors may cause failures but are not considered to be failures. Some structural or mechanical failures may be excluded from the criterion if it can be shown that these mechanical parts were designed according to aviation industry best practices.

- Software (SW) and Airborne Electronic Hardware (AEH) whose development error(s) could directly lead to operations outside the ground risk buffer shall be developed to an industry standard or methodology recognised as adequate by the competent authority.

Note 1: The proposed additional safety provisions cover both the integrity and assurance levels.

Note 2: The proposed additional safety provisions do not imply a systematic need to develop the SW and AEH according to an industry standard or methodology recognised as adequate by the competent authority. For instance, if the UA design includes an independent engine shutdown function which systematically prevents the UA from exiting the ground risk buffer due to single failures or a SW/AEH error of the

flight controls, the intent of the above mentioned provisions could be considered to be met.

6. Other Provisions

6.1 Occurrence reporting

UAS operators/pilots need to report accidents and serious incidents via the REGA alarm centre (Tel. 1414, from abroad +41 333 333 333) immediately to the aviation department of the Swiss Transportation Safety Board (STSB). In addition, all UAS operators/pilots must report all safety-related incidents with serious or fatal injuries to persons or involving manned aircrafts within 72 hours to the Federal Office for Civil Aviation (FOCA) through www.aviationreporting.eu

6.2 Liability insurance

Flights may only be carried out if liability claims by third parties on the ground of at least CHF 1 million are covered through the conclusion of a liability insurance policy in accordance with Art. 20 of the Ordinance on Special Categories of Aircraft (SR 748.941).

6.3 Operational amendments

The authorisation holder must evaluate any modifications in operations. Modifications must be reported to the FOCA and classified as follows:

- Deviations: all modifications that have an effect on the requirements defined in the application form are classified as deviations;
- Change: modifications to procedures, operational conditions and/or technical systems that do not affect the requirements listed in the application form shall be classified as change to a current authorisation.

Changes and deviations must be authorised by the FOCA by means of a 'Notice of Amendment'. The authorisation holder shall evaluate any change that affects the security of the aircraft and inform the FOCA.

I, the undersigned, hereby declare that the UAS operation will comply with:
— any applicable national rules related to privacy, data protection, liability, insurance, security and environmental protection;
— the limitations listed in this document and the operation as described in my operation manual;
— the limitations and conditions defined in the authorisation provided by the competent authority,

Location

Date

Signature

Please send this form to: rpas@bazl.admin.ch

7. Glossary of terms

Airport Environment	Airport environment is generally defined as Class A, B, C, D, or E controlled airspaces which touch the surface with an airport and/or controlled airspaces which do not touch the surface, but in connection to an airport (normally depicted on aeronautical charts and sectionals)
External Systems	An external system is defined as any systems (equipment, software or facility) interconnected to the main systems. (e.g. launch pad, GNSS, U-Space Service, Mobile Network)
Sparsely Populated Environment:	A sparsely populated area is defined in Switzerland as an area with less than 10 inhabited houses including a 100-metre radius around it. A populated area is defined as an area with more than 10 inhabited houses including a 100-metre radius around it.
RF spectrum	A radio frequency spectrum is part of the electromagnetic spectrum. Frequencies range from 30 Hz to 300 GHz
Uncontrolled Airspace	For the purpose of this assessment, uncontrolled airspace is defined as Class G airspace.