Joint Authorities for Rulemaking of Unmanned Systems

Module - FLIGHT AREA PDRA 02 to complement the BASIC Operations Manual:

- Generic,
- Lightly populated area,
- segregated or reserved airspace,
- containment (low)

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Contents

1. Introduction

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This module is intended to complement the Basic Operations Manual. It gives an example on how to present a flight area in accordance to annex A.

The operator has to ensure that the flight areas are reflecting his planed locations for his operation.

The flight area should be adjusted to reflect the actual UAS operation, however significant care should be directed to the mutual dependency of SORA risk assessment and comprehensive safety portfolio (compliance matrix). For example, a higher Flight Altitude (FG) might be possible in the flight area as long as the Operational Volume is completely within the segregated or reserved airspace. The calculations have to be adjusted to reflect this altitude.

The competent authority will review the resulting description of the FLIGHT AREA in the process of reviewing the application in accordance with the provisions arising from the risk assessment and the respective SAIL. In this process, the implementation of all technical and operational requirements is checked based on the descriptions in the operations manual, or other associated documents as required. The competent authority has the option to request revisions of documents or to ask for additional supporting documentation.

2. Scope of Module - Flight Area PDRA 02

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(a) Scope

This module provides an example for – FLIGHT AREA PDRA 02:

- Generic nature,
- Lightly populated area,
- Segregated or reserved airspace for the operation and
- Low containment

(b) Module characterisation and conditions

The characterisation and conditions for this module are summarised in section 3.

3. Flight Area

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In section 2.7.1.3

replace action RPIC

- Check Ground area
- Check Airspace

with

- Check controlled ground established
- Check airspace reserved for the operation is established

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In Chapter C, 3.2

please add a section for the flight area

3.2 Flight Area (PDRA 02)

3.2.1 Description

The following flight area is a generic one in Country.

In order to conduct flight operations in a certain area, the following conditions apply beyond the general operating limits.

The maximum flight altitude (H_{FG}) is 120 m AGL (above ground level) at all times and may only be exceeded within a horizontal distance of 50 m from an artificial obstacle taller than 105 metres. The maximum height of the UAS operation may then be increased up to 15 m above the height of the obstacle at the request of the entity responsible for the obstacle.

The adjacent area is calculated from the CV as follows

S_{AV} = 180 s * operating speed [m/s] = 180 s * 35 m/s = 6300 m (values from 3.1.2)

3.2.2 Ground risk:

The UAS may only be operated such that the operating volume (FG and CV) and the ground risk buffer as a whole are classified as a LIGHTLY POPULATED AREA (< 50 people/km²).

This includes for example areas of small farms. Residential areas with very large lots (~ 4 acres or 16,000 m²).

It has to be assured before commencing flight operation that the ADJACENT AREA does not have an average population density above 5000 ppl/km² (sheltered environment) nor contain assemblies of people above 40k people.

- *Please specify which data source has been used to assess the population density (e.g. global human settlement layer Epoch YYYY).*

3.2.3 Air risk:

Flight operations may only be conducted in a segregated or reserved airspace, with an initial risk class of ARC-a.

This is achieved by:

- *Please specify how this is done, e.g. restricted airspace for the operation, or part of a controlled airspace where separation is guaranteed by ATC.*

Compliance with these criteria is checked on a daily basis.

3.2.4 Documentation

For each flight location to be flown, a kml file must be created with the values for CV, GRB listed here.

The flight locations are recorded in the Flight-Log.

The flight location and the unique name of the kml file have to be entered in the field “flight area”.

All data (kml file and Flight-Log) must be available for an audit at any time.

3.2.5 Calculation of CV / GRB

The calculation of the contingency volumes and of the ground risk buffer is based on the “Guidelines on collecting and presenting system and operation information for a specific UAS operation” (Annex A).

This explicit calculation was performed using the ”map tool” of the Digital Platform for Unmanned Aviation (dipul), version 1.0.

3.2.5.1 Input values used for the calculation of CV/GRB

UAS characteristics:

- Type: Rotorcraft with parachute
- Type of altimetry: Barometric
- Maximum speed v_0: 5.0 m/s
- Maximum wind speed allowed v_{Wind}: 5.0 m/s
- Characteristic Dimension: < 3.0 m
- Maximum pitch angle Θ_{max}: 30.0 °
- Parachute opening time $t_{parachute}$: 2.0 s
- Descent rate with parachute v_z: 2.0 m/s

The following parameters were used:

- Height of flight geography H_{FG}: 120.0 m
- Horizontal contingency volume manoeuvre: stopping
- Vertical contingency manoeuvre: kinetic into potential energy
- Ground risk buffer manoeuvre: Parachute

Assumptions

- GPS inaccuracy S_{GPS}: 3.0 m
- Position holding error S_{POS}: 3.0 m
- Map error S_K: 1.0 m
- Reaction time t_{Reak}: 1.0 s
- Altitude error (barometric) H_{Baro}: 1.0 m

3.2.5.2 *Calculation contingency volume*

Lateral:

$$S_{RZ} = 5m$$

$$S_{CM} = 2,2m \text{ (stopping the UAS with maximum pitch)}$$

$$S_{CV} = S_{GPS} + S_{Pos} + S_K + S_{RZ} + S_{CM} = 14,2m$$

$$S_{CV} = 14,2m$$

Vertical*:*

$$H_{RZ} = 3,5m$$

$$H_{CM} = 1,3m \text{ (kinetic to potential energy)}$$

$$H_{CV} = H_{FG} + H_{baro} + H_{RZ} + H_{CM} = 125,8m$$

$$H_{CV} = 125,8m$$

3.2.5.3 *Calculation ground risk buffer with parachute:*

$$t = 2s \text{ (time parachute to open)}$$

$$V_{Wind} = 5\frac{m}{s}$$

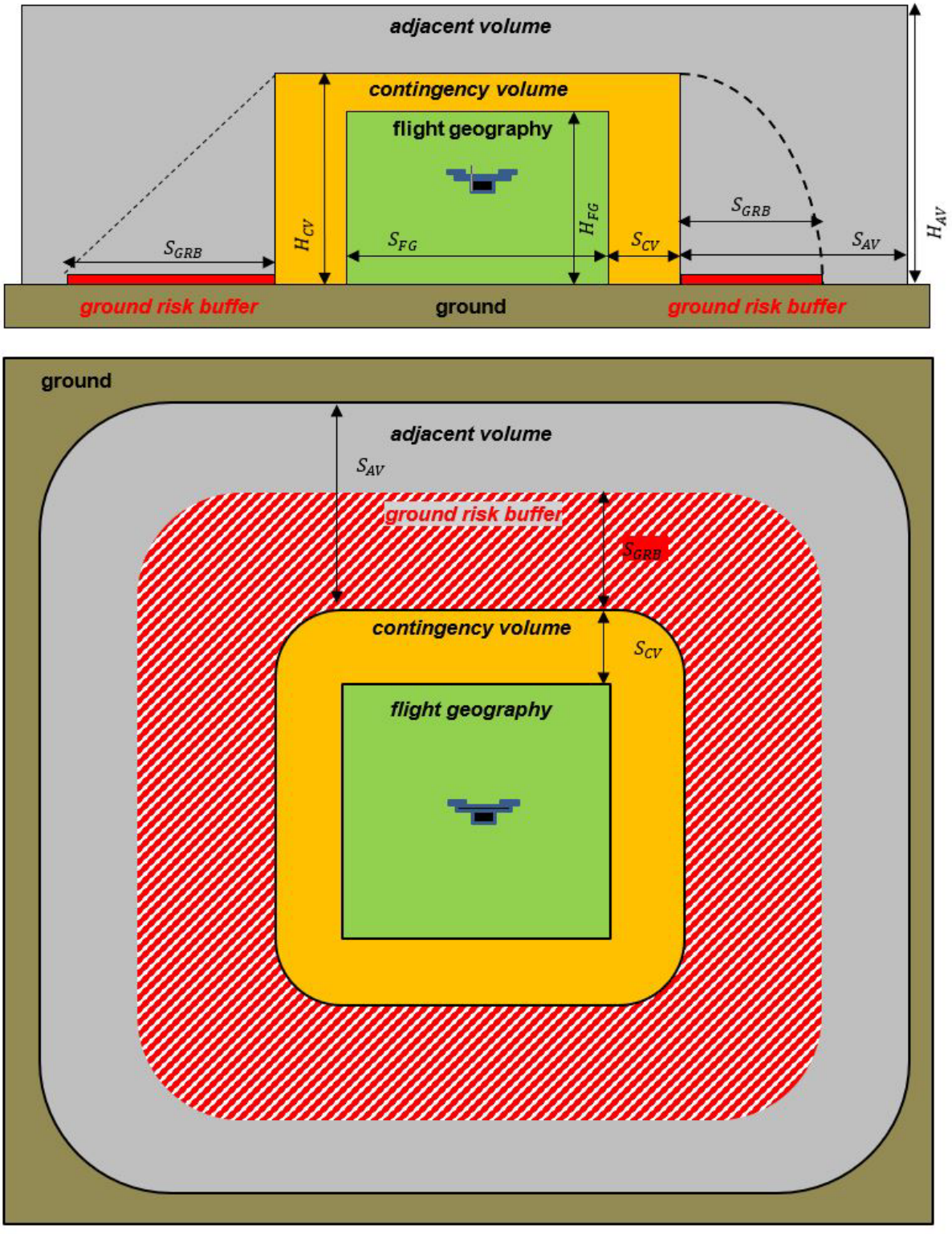
$$V_z = 5\frac{m}{s}$$

$$S_{GRB} = V_0 * t + V_{Wind}\frac{H_{CV}}{V_z} = 324,4m$$

$$S_{GRB} = 324,4m$$

3.2.5.4 *Results of the CV/GRB calculation*

- Horizontal contingency volume S_{CV}: 14.2 m
- Vertical contingency volume H_{CV}: 125.8 m
- Ground risk buffer calculation S_{GRB}: 324.4 m
- Height of flight geography H_{FG}: 120.0 m



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157 *Figure 1: Simplified presentation of flight geography, contingency volume and ground risk buffer*

3.2.6 Specific Procedures of the Flight Area

3.2.6.1 Controlled Ground

- Not necessary as unused

3.2.6.2 M1 Mitigation

(Please refer to the appropriate module to include this mitigation)

3.2.6.3 ARC-Mitigation

- Not necessary as unused

3.2.6.4 Information to Third Parties

In case third parties are affected by the operation, all necessary information will be provided in advance to all persons concerned and relevant authorisations will be obtained if needed.

3.2.7 Emergency Response Plan (ERP) - Local Information

Instructions and completion aids for the ERP template (see 8.3.1)

Air traffic controllers possibly affected (ATM)

- Bremen +49(0)1234 xxxxxxx
- Langen +49(0)1234 xxxxxxx
- München +49(0)1234 xxxxxxx

Nearest emergency services:

- Fire/Police/EMS 112