



Guidance Material on Adjacent Area/Airspace Considerations

Date: 19.11.2019

File reference: BAZL-022.2-10/18/2

This Guidance Material addresses the safety requirements delineated in Step #9 of the SORA of the Joint Authorities of Rulemaking for Unmanned Systems. This document is meant to provide guidance to fulfill these requirements.

1.1 General Containment

The safety requirement for containment is:

No probable¹ failure² of the UAS or any external system supporting the operation shall lead to operation outside of the operational volume.

Compliance with the requirement above shall be substantiated by a design and installation appraisal and shall minimally include:

- design and installation features (independence, separation and redundancy);
 - any relevant particular risk (e.g. hail, ice, snow, electro-magnetic interference...)
- associated with the ConOps.*

The probable failures of the unmanned system leading to operations outside of the operational volume should be identified by the applicant. A notional Failure Mode and Effect Analysis containing Functions, their mode failure rate (qualitatively) and their failure effect is sufficient in this context.

The probable failures are typically but not only:

- GPS/GNSS failure
- Compass failure
- C2 Link loss in the case of unlicensed frequencies
- Autopilot failure
- Propeller/Motor failure
- Remote Control Failure

¹ 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."

² The term "failure" needs to be understood as an occurrence, which affects the operation of a component, part, or element such that it can no longer function as intended. Errors may cause failures but are not considered as failures. Some structural or mechanical failures may be excluded from the criterion if it can be shown that these mechanical parts were designed to aviation industry best practices.



1.2 Containment adjacent to ARC-D, gatherings or in populated environments

Additional requirements apply for operations conducted:

- Where adjacent areas are:
 - i. Gatherings of people unless already approved for operations over gathering of people OR
 - ii. ARC-d unless the residual ARC is ARC-d
- In populated environments where
 - i. M1 mitigation has been applied to lower the GRC
 - ii. Operating in a controlled ground area

In those cases, the SORA requires that:

1. The probability of leaving the operational volume shall be less than $10^{-4}/FH$.
2. No single failure of the UAS or any external system supporting the operation shall lead to operation outside of the ground risk buffer.

Compliance with the requirements above shall be substantiated by analysis and/or test data with supporting evidence.

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

The first requirement should be addressed using either a quantitative or qualitative safety assessment method (e.g. Fault Tree). The second requirement should be addressed using a Failure Mode and Effect Analysis similar as in 1.1. The analysis will this time focus on the single failures leading to operation outside of the ground risk buffer (e.g. Geofencing failure).

At the time of writing an acceptable standard for compliance with the third requirement is being developed by industry standardization bodies (e.g. EUROCAE). In absence of an acceptable standard the applicant is advised to show that a SW or AEH failure cannot directly lead to operations outside of the ground risk buffer. Design and architectural considerations supported by common cause analysis are adequate to this scope.