European Union Aviation Safety Agency

Guidelines

on

Design verification of UAS operated in the 'specific' category and classified in SAIL III and IV

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1. Background

In 2018, a new Basic Regulation (Regulation (EU) 2018/1139) was adopted, followed by the new European Commission Implementing Regulation (EU) 2019/947 (which became applicable on 31 December 2020) and Delegated Regulation (EU) 2019/945 (which became applicable on 1 July 2019). These documents set the new UAS regulatory framework, which is a proportional risk-based approach to UAS. Its pillar is the identification of three categories of operation: 'open', 'specific' and 'certified'.

While the 'open' category includes strict operational limitations, the 'specific' category has the potential to capture a wide range of UAS operations. The detailed provisions for the 'certified' category of operations have not yet been adopted at the issuance date of these Guidelines.

For operations in the 'specific' category, an operational authorisation issued by the competent authority of registration is required, unless the operation is covered by a standard scenario. This operational authorisation will be based on the outcome of the risk assessment conducted in accordance with Article 11 of Regulation (EU) 2019/947. As an acceptable methodology for such risk assessments, EASA published the specific operation risk assessment (SORA) as AMC to Article 11. These Guidelines provides guidance on the application of the AMC to Article 11.

The SORA consolidates the ground and air risk analyses within the specific assurance and integrity level (SAIL), which drives the required activities. The SAIL is a figure from I to VI, leading to the identification of operational safety objectives (OSOs) to be met with a certain level of robustness (i.e. integrity and assurance), which tend to increase with an increasing SAIL. According to SORA, in cases of UAS operations in SAIL V and VI, the design-related OSOs have a high level of robustness, requiring verification by EASA[1].

If the level of robustness of any of the OSOs linked with the design is medium (i.e. SAIL III and IV), the national competent authority should require an EASA design verification[2] of the UAS. The same applies to mitigation means linked with design[3] and claimed as medium robustness, as well as for the verification of the 'enhanced containment' as defined by SORA 'Step 9'.

Similarly, when the national competent authority grants a light UAS operator certificate (LUC) to a UAS operator, they should specify in the terms of the approval when the use of a UAS with an EASA design verification is required.

In those cases, EASA performs a design verification. Its scope can cover one or more of the following points:

— the full design of the UAS;

— the mitigation means linked with the design;

— the enhanced containment function.

Upon a satisfactory verification of the design, EASA issues a design verification report to the applicant, including the limitations and conditions for its validity. The conditions will be those linked with the

[1] In this case, EASA will issue for UAS operated in SAIL V and VI a TC or an RTC according to Regulation (EU) 748/2012 (Part 21).
[2] According to Article 77 of the Basic Regulation, EASA is competent to assess the design of the UAS, while the MSs are competent to assess the operational requirements and remote pilot competency.
[3] As per Chapter 2.3.2 of the EASA AMC on Regulation 2019/947 'Step #3 – Final GRC determination'

CONOPS, as described in the SORA, and resulting from the UAS design verification. The competent authority issuing the operational authorisation can rely on the EASA design verification report for compliance with design-related OSOs, mitigation means and enhanced containment. However, the determination of compliance with all the other applicable OSOs and steps remains with the competent authority. The operational authorisation will contain the requirements and limitations imposed on the operation of the UAS resulting from compliance with OSOs, mitigation means and containment, and including the conditions/limitations identified by EASA in the design verification report (as applicable).

If the national competent authority decides that a design verification is not needed, and accepts a declaration of compliance with the design-related OSOs and mitigation means issued by the UAS operator, the national competent authority bears the responsibility for the decision to not require a verification of the design.

It is recommended that the national competent authority should consider the declarative option only for UAS operations where the probability of harming third parties due to non-compliance with the design integrity as indicated in the SORA is remote (e.g. operations in SAIL I and II and mitigation means with a low level of robustness). In general, operations conducted over populated areas, or in proximity to areas with higher air risks, should be subject to a design verification by EASA.

Manufacturers may also decide, due to business considerations, to apply to EASA for a design verification independently of a request from the national competent authority. In such a case, these Guidelines are also relevant.

Manufacturers of UAS for operations in SAIL III and IV may voluntarily apply for a Type Certificate (TC) or a Restricted Type Certificate (RTC) according to Regulation (EU) 748/2012 (Part 21). However, it is not foreseen that for such operation, a TC or a RTC would be requested by national competent authorities, since this would also require the application of production organisation and continuing airworthiness regulations, imposing requirements which are considered not proportionate for this range of products. In cases of voluntary applications for a TC, EASA will apply the certification process defined in Part 21, complemented by the content of DOARI 2020-01[4] for the initial investigation of the design organisation.

2. Provision of a design verification service

Following an application by a UAS manufacturer or UAS operator, EASA will assess the application, and upon its acceptance, enter into the design verification phase. If the applicant has satisfactorily demonstrated compliance with a defined set of technical design specifications, EASA will provide a design verification report. EASA will also assess during the design verification process whether those elements pertaining to the design organisation, as traceable from the SORA, are satisfactory.

An applicant will be responsible for those aspects of the design which were in the scope of the verification of compliance, that is:

- the full design of the UAS;
- the mitigation means linked with the design; and
- the enhanced containment function.

[4] https://www.easa.europa.eu/sites/default/files/dfu/doari_2020-01_consultation_paper.pdf

For example, an applicant may wish to install a parachute on a UA manufactured by a third organisation in order to gain credit for the ground risk (according to the M2 mitigation means of SORA). In this case, EASA would only verify that the design of the parachute and its installation provide the operational integrity of the mitigation means. The applicant will show compliance for the mitigation functions and not for the full design of the UAS.

The list of the UAS for which a design verification report has been provided by EASA, along with the contact data of the related holder organisation, will be published on the EASA website. Those UAS may be used across the EU in conjunction with the relevant data detailed in the design verification report and the applicable limitations and/or conditions, without additional design verification by EASA, by all UAS operators conducting operations for which the risk assessment demonstrates that the design of such UAS is appropriate for the operation).

Any change to the design of a UAS which has been verified by EASA invalidates the verification unless the design of the change is verified by EASA in the frame of a new design verification project. Repairs that require design changes also need to be subjected to EASA verification.

2.1. Design Verification Basis and Demonstration of Compliance

A design verification report documents that the UAS design complies with the relevant SORA elements as specified by the report. As explained in Chapter 1, such elements can be the OSOs linked with the design, and / or the mitigation means linked with the design and/or SORA Step 9 with enhanced integrity.

Content of the Application

When applying for a design verification, the applicant should provide at least the following minimum set of data:

- a detailed description of the design, including all the configurations to be verified;
- a risk assessment according to SORA and the CONOPS that will include:
  - the proposed operating characteristics and limitations;
  - the intended use of the product and the kind of operations for which the design verification is requested;
  - the relevant parts of the CONOPS that drive design aspects;
  - the characterisation of the operational volume and ground buffers in terms of both the ground and air risks;
  - the identified ground risk class, air risk class and SAIL; and
  - any applicable restrictions, limitations, or assumptions about adjacent areas and design-related mitigation means which may influence the applicable specification or the means of compliance.
- the design verification basis;
- a design verification programme for the demonstration of compliance, including a proposal for the means of compliance (MoC) and the related compliance documents.
- a project schedule, including the major milestones

Determination of the Design Verification Basis

The applicant should consider the Special Condition for Light UAS - Medium Risk[5]. If needed, adaptations may be considered. The environmental protection requirements are managed according to the principles reported in Chapter 2.2.

Design Verification Process

The applicant should demonstrate compliance with the design verification basis and the environmental protection requirements, as applicable, and should provide EASA with the means by which such compliance is demonstrated.

Since the SC for LUAS is objective-based, these means of compliance need to achieve two targets:

1. describe/specify the concrete UAS design-related auditable or measurable data, and
2. define how to demonstrate compliance with this data (e.g. design review, calculation/analysis, laboratory tests, ground tests, flight tests etc.)

To achieve these two targets, the applicant may propose means of compliance based on either existing technical specifications or industry standards or their relevant sections, or may propose new means of compliance (MoC) if no adequate specifications / standards can be identified.

EASA may accept MoCs based on extensive product tests complemented by design criteria, depending on the safety objectives and the operational risk. Such a methodology may help in addressing the verification of products based on COTS with limited evidence of development standards.

Regarding electrical lift/thrust/power systems, they will usually be approved as part of the UAS design, and therefore, the means of compliance need to consider not only their integration, but also their qualification. The SC for Light-UAS already indicates various pertinent design objectives, with further considerations to be addressed in the MoC.

The design verification provides evidence of the appropriate integration of air risk tactical mitigation means in the UAS architecture, if such means are provided. The operational acceptance that the tactical mitigation means is appropriate to mitigate the residual air risk remains with the competent authority authorising the operation, supported by the competent authority for the airspace where the operation is performed. (For example, if an ADS-B IN system is integrated into the drone architecture, the design verification process assesses whether it is appropriately installed and integrated into the UAS. Nevertheless, the appropriateness of ADS-B IN to address the residual air risk for the volume of airspace where the operation is carried out needs to be agreed by the competent authority for the airspace, and with the NAA).

Design Verification report

The design verification report issued by EASA includes the operational limitations and any conditions or assumptions under which the design verification holds its validity.

2.2. Environmental protection

Noise should be measured by the applicant according to appropriate procedures, which may depend on the design of the drone. Depending on the project, where the available noise evaluation

[5] https://www.easa.europa.eu/sites/default/files/dfu/special_condition_sc_light-uas_medium_risk_01.pdf

procedures are not adequate, they will be agreed as part of the project. EASA determines which noise evaluation procedure is appropriate for a given drone design.

Applicants will carry out the noise measurements and declare the resulting noise levels to EASA, who will include those noise levels as part of the design verification report. EASA may decide on its participation on a case-by-case basis.

As part of future rulemaking activities, EASA may establish noise limits for UAS, in which case, the applicant will need to declare compliance with those limits.

3. Fees and Charges

Fees and charges applied by EASA are defined by Regulation (EU) 2019/2153, in which fees for UAS are not included. EASA, therefore, charges an hourly rate considering the time spent on the project by EASA staff. EASA charges the actual time spent on the evaluation of the project only, and additional time spent to improve the regulatory framework is financed by other means.

Considering the variety of the potential projects in this category, an estimate applicable to all cases cannot be provided. EASA expects that the effort spent for the verification of the design of the subject UAS should not exceed 180 working hours (WH) per year in case of typical complexity ([6]).

4. References

4.1. EU Regulations

— Commission Implementing Regulation (EU) 2019/947 of 24 May 2019 on the rules and procedures for the operation of unmanned aircraft (OJ L 152, 11.6.2019, p. 45)

— Commission Delegated Regulation (EU) 2019/945 of 12 March 2019 on unmanned aircraft systems and on third-country operators of unmanned aircraft systems (OJ L 152, 11.6.2019, p. 1)

— Commission Regulation (EU) No 748/2012 of 3 August 2012 laying down implementing rules for the airworthiness and environmental certification of aircraft and related products, parts and appliances, as well as for the certification of design and production organisations (OJ L 224, 21.8.2012, p. 1)

— Commission Implementing Regulation (EU) 2019/2153 of 16 December 2019 on the fees and charges levied by the European Union Aviation Safety Agency, and repealing Regulation (EU) No 319/2014 (OJ L 327, 17.12.2019, p. 36–65)

4.2. EASA ED Decisions/ Special conditions/DOARI

— Executive Director Decision 2019/021/R of 9 October 2019 issuing Acceptable Means of Compliance and Guidance Material to Commission Implementing Regulation (EU) No 2019/947 ‘Rules and procedures for the operation of unmanned aircraft’

— Special Condition for Light UAS

— DOARI 2020-01

[6] Simple projects or verification limited to mitigation means may require a limited effort while more complex projects may require a larger number of hours to be spent by EASA staff. Elements like numbers of UAs controlled in parallel, or complexity of the design of the single UA or the Command Unit would be taken into consideration.