

SHEPHERD

EASA.2022.C05

D4.3 - Final Report

Disclaimer



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SUMMARY

This document summarises the objectives, activities, methodology used, and key results of the project “Standards Evaluation Project supporting European Regulations for Drones”, referred hereafter as the “SHEPHERD project”. The main objective of SHEPHERD was to perform a technical assessment of the suitability of the standards proposed by AW-Drones project and those included in the European UAS Standards Coordination Group EUSCG U-RDP as potential candidates to fulfil the requirements contained in the Specific Operations Risk Assessment (SORA) as adopted by EASA, EASA’s Special Condition (SC) Light-UAS for Medium Risk and Commission Implementing Regulation (EU) 2021/664, including related AMC/GM.

The project developed first a work methodology to identify the requirements to assess the standards against and the criteria to perform the assessment. Using this methodology, 47 standards were assessed against more than 500 different requirements. This activity was carried out by the project team with the support of a group of external stakeholders representing Standard Development Organisations (SDOs) and other authorities outside EASA. The final results were discussed with EASA experts and included in a dedicated report which will be used as a starting point for the development of Means of Compliance to support the implementation of the UAS and U-space regulations in Europe.

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ABBREVIATIONS

ACRONYM	DESCRIPTION
AMC	Acceptable Means of Compliance
CAA	Civil Aviation Authority
CASA	Civil Aviation Safety Authority (Australia)
EU	European Union
EUROCAE	European Organisation for Civil Aviation Equipment
EUSCG	European UAS Standards Coordination Group
GM	Guidance Material
GUTMA	Global UTM Association
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IR	Implementing Regulation
JARUS	Joint Authorities for Rulemaking on Unmanned Systems
MoC	Means of Compliance
N/A	Not applicable
NPA	Notice of Proposed Amendment
OSO	Operational Safety Objective
RDP	Rolling Development Plan
SAIL	Specific Assurance and Integrity Level
RTCA	Radio Technical Commission for Aeronautics
SAIL	Specific Assurance and Integrity Level
SC	Special Condition
SDO	Standards Development Organisation
SHEPHERD	Standards Evaluation Project supporting European Regulations for Drones
SORA	Specific Operations Risk Assessment
UAS	Unmanned Aircraft Systems
U-RDP	UAS Standardisation Rolling Development Plan

1. INTRODUCTION

The main objective of the SHEPHERD project was to build upon the work performed by the AW-Drones project by complementing its analysis through the **technical assessment of the suitability of the standards** listed by AW-Drones as good candidates to fulfil the requirements contained in the following provisions:

- Specific Operations Risk Assessment (SORA), in line with the Acceptable Means of Compliance AMC1 to Article 11 of Implementing Regulation (IR) (EU) 2019/947 published in December 2020:
 - mitigation means;
 - operational safety objectives (OSOs); and
 - requirements for the containment of the operation (i.e., Step #9);
- Special Condition (SC) Light-UAS Medium Risk, as published by EASA in December 2020;
- Chapters 2, 3, and 4, and Annex 3 to the U-space Regulation, IR (EU) 2021/664.

The initial list of standards to be assessed was based on the AW-Drones deliverables. However, because the development of standards by the different standards developing organisations (SDOs) is still ongoing, in particular in the field of U-Space, new standards related to the demonstration of compliance with Chapters 2, 3, and 4, and Annex 3 to the U-space Regulation, IR (EU) 2021/664 were introduced in the Unmanned Aircraft Systems (UAS) Rolling Development Plan (U-RDP) by the European UAS Standards Coordination Group (EUSCG) and considered in the scope of the SHEPHERD project.

Overall, a total of 47 standards were assessed in the scope of the project against more than 500 requirements.

To ensure that assessment performed by the SHEPHERD project was impartial, systematic, and consistent a work methodology was developed as a first step. This methodology was based on the following core elements:

- “level of confidence that the standard meets the safety objective of the provisions”; and
- “easiness of the implementation of the standard(s)”.

The assessment identified, for each of the standards, the list of recommended sections, subsections, paragraphs, or combination thereof that have been deemed suitable and, hence, may be used as a basis for a means of compliance (MoC) for the relevant requirements or a part thereof. In the same manner, it also lists and provides clear justification for the elements of the standards that have been found not technically adequate or need to be tailored and/or complemented before being proposed as a MoC.

The project has been supported by a Stakeholders consultation group whose members represented Standard Design Organisations (e.g., EUROCAE, ASTM, ISO), authorities not part of EASA Member States (e.g., UK CAA and CASA), and associations (e.g., JEDA). The Stakeholders consultation group helped in aligning the project outcomes with the ongoing standardisation efforts.

2. PROJECT OBJECTIVES AND STRUCTURE

The main objectives of the SHEPHERD's project can be summarised as follows:

1. **Define a methodology for the technical assessment of UAS-related standards:** This objective involved developing a structured approach to evaluate the technical suitability of the standards.
2. **Identify which standards (or elements thereof) are considered technically adequate to demonstrate compliance with the requirements within the scope of the SHEPHERD project:** This objective entailed examining the industry standards in the scope of the project to determine their suitability for meeting the requirements they were mapped with. Through a systematic assessment process outlined in the methodology, standards or specific elements that fulfil technical criteria were identified as technically adequate for demonstrating compliance.
3. **Identify which standards (or elements thereof) are NOT considered technically adequate to demonstrate compliance with the requirements within the scope of the SHEPHERD project:** In contrast, this objective involved identifying standards or elements thereof that fall short of meeting the requirements to which they were initially mapped. This objective was achieved by implementing the same methodology defined above.

To achieve the project objectives, four main activities were carried out. A simplified representation of their interrelations is presented in the following figure.

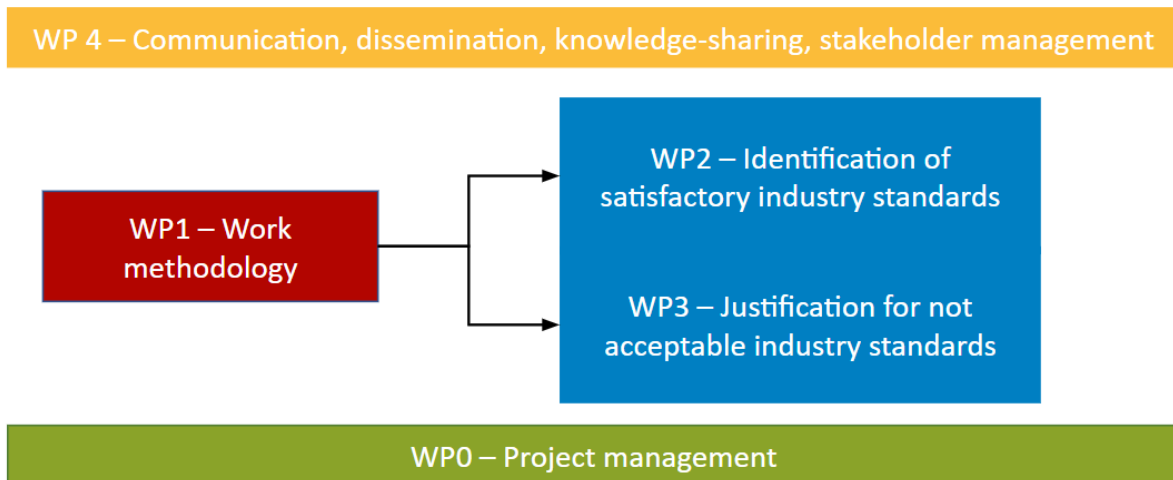


Figure 1: SHEPHERD Work Structures

In addition to the usual Project Management, the main activities included:

- The development of a rigorous methodology assuring impartial, systematic, and consistent assessment results (WP1).
- The assessment of the standards (WP2-3) to identify which standards (or elements of the standard) are considered technically adequate to demonstrate compliance with the different requirements within the scope of SHEPHERD project and which are not.
- The implementation of a communication and dissemination strategy to engage and inform relevant stakeholders in the project activities (WP4). This included the establishment and management of a Stakeholders Consultation Group that provided expert feedback on the project results before their final publication.

3. WORK METHODOLOGY FOR THE STANDARDS' ASSESSMENT

To evaluate the technical suitability of the standards, it was considered of paramount importance to develop a rigorous methodology assuring impartial, systematic, and consistent assessment results.

The work methodology proposed by SHEPHERD is composed of four steps:

- Step #1 - Identify the standards in scope and the requirements against which the standards need to be assessed;
- Step #2 - Categorise the requirements against which the standards in scope need to be assessed;
- Step #3 - Assess with a 4-eye independent principle each proposed standard linked to 'type A' requirements (objective-based);
- Step #4 - Summarise the assessment.

1.1 Step #1 - Identify the standards and the requirements against which the standards need to be assessed

As explained in the introduction, the list of standards proposed to be considered within the scope of the SHEPHERD project was extracted from the AW-Drones project deliverables¹, which are aligned with the EUSCG U-RDP²:

- For SORA: [AW-Drones D4.3.b\) proposed standards](#) | Section 4;
- For SC Light-UAS Medium Risk: [AW-Drones D4.3.a\) proposed standards](#) | Sections 2.7, 3.6, 4.10, 5.5.4, 6.10, 7.5, and 8.5; and
- For U-Space:
 - [AW-Drones D4.3.c\) proposed standards](#) | Sections 3.4, 4.4, 5.4, 6.4, 7.4, and 8.4;
 - [EASA Notice of Proposed Amendment \(NPA\) 2021-14](#) | AMC1 & GM1 Art 5(1), GM1 Art 5(1)(b), GM1 Art 5(1)(f), AMC4 & GM2 Art 8(1), AMC1 Art 8(2), GM1 Art 8(3), GM1 Art 8(4), GM2 Art 9(2), and GM1 Art 10(5).

For each of the standards, the following was identified:

- title, version (year of publication or 'not yet published' status), and SDO;
- associated domain, in line with EASA.2021.HVP.22 Tender Specifications;
- allocation among SHEPHERD consortium members and contractors; and

¹ <https://www.aw-drones.eu/resources/>

² <https://www.euscg.eu/rdp/>

- proposed priority (P1/P2).

In addition, a list of standards not yet published but identified in the various SDOs roadmaps was proposed to be included in the scope of the SHEPHERD project. The initial list comprised around 60 standards which were then reduced to 47 because some of the standards initially included did not reach a sufficient level of maturity to be assessed.

1.2 Step #2 - Categorise the requirements against which the standards need to be assessed

The requirements identified above were categorised either as:

- **A.1: Technical objective-based:** performance-oriented requirements targeting a specific technical consideration or design but leaving flexibility on the implementation up to the UAS manufacturer.
- **A.2: Operational / organisational objective-based:** performance-oriented requirements leaving flexibility on the implementation at operational (e.g., with respect to training / manual and procedures) or organisational levels up to the UAS operator.
- **B: Technology-dependent:** performance requirements whose implementation strongly depends on the technology chosen by the applicant.

1.3 Step #3 - Assess with a 4-eye independent principle each standard

The third step of the methodology consisted in technically assessing the standards. This process was carried out through the following sub-steps:

Step #3.1 - Preliminary high-level assessment

A preliminary high-level assessment was carried out in order to clearly identify (and isolate) those sections, subsections, or paragraphs which did not address the requirement(s) that a given standard is assessed against or which addressed them at a very high level (e.g., at a regulatory-like level) with no further guidance, criteria, or best practices. In such cases, rationale was provided to justify that no detailed technical assessment is needed.

Step #3.2 - Detailed technical assessment

A detailed technical assessment was then performed only to those sections, subsections, or paragraphs identified in the preliminary high-level assessment as potentially addressing the particular requirement(s). The criteria considered for the assessment are summarised in the following table.

Table 1: List of assessment criteria

Criteria	Standard assessment result
C1 – Level of confidence that the standard meets the requirement	
C1.1 – Completeness / coverage	<ul style="list-style-type: none"> ● C: Completely addresses the requirement assessed ● Pa: partially addresses the requirement assessed ● N/A: does not address the requirement assessed
C1.2 – Correctness	<ul style="list-style-type: none"> ● A: Applicable as it is ● I: Intent of the requirement can be applied, provided some specific (slight) adaptations are made ● T: to be Tailored
C1.3 – Proportionality	<ul style="list-style-type: none"> ● Pr: the standard is proportionate to the associated SAIL(s) ● No Pr: the standard is not proportionate to the associated SAIL(s).
C1.4 – Interoperability	<ul style="list-style-type: none"> ● Interoperable ● Not interoperable ● N/A
C2 – Easiness of implementation of the standard	
C2.1 – Proven implementability / maturity	<ul style="list-style-type: none"> ● Proven to be implementable / mature ● Not proven to be implementable / mature
C2.2 – Implementation agnostic	<ul style="list-style-type: none"> ● Implementation agnostic ● Not implementation agnostic

The assessment rating (Recommended / Not recommended) reflects the technical adequacy of the section, subsection, or paragraph under assessment to demonstrate compliance with the objective of the requirement. The following principles were followed:

- **Recommended** - was assigned to a section, subsection, or paragraph when, at a minimum the following conditions were met:
 - C1.1 - Completeness / coverage: **C** (i.e., completely addresses the OSO/mitigation criterion, SC Light-UAS requirement or U-Space requirement assessed) **or Pa** (i.e., partially addresses the OSO/mitigation criterion, SC Light-UAS requirement, or U-Space requirement assessed), **AND**
 - C1.2 Correctness: **A** (i.e., applicable as it is) **or I** (i.e., intent of the requirement can be applied, provided some specific (slight) adaptations are made), **AND**
 - C1.3 Proportionality: **Pr** (i.e., proportionate to the associated SAILs for which the standard is targeted), **OR**
 - C1.4 Interoperability (if applicable): **Interoperable**.
- **Not recommended** - was assigned to a section, subsection, or paragraph when 'Recommended' could not be assigned.

Step #3.3 - Independence of the assessment

The independence was ensured by using at least two experts from two different companies for each standard assessment, one doing the primary assessment and the other a peer review.

1.4 Step #4 - Summarise the assessment

Once the previous steps were completed, an assessment summary was produced for each standard, covering all the requirements assessed against. The format and content of the results is presented in the following section.

4. RESULTS

For each standard assessed the results are presented in two different formats:

- An excel file containing the detailed technical assessment,
- A word file providing a summary of the assessment.

The excel file contains the following information:

- A high-level assessment that clearly identifies those sections, subsections, or paragraphs which do not address the requirement(s) that a given standard is assessed against or which address them at a very high level (e.g., at a regulatory-like level) with no further guidance, criteria, or best practices. In such cases, rationale is provided to justify that no detailed technical assessment is needed.
- A detailed technical assessment related only to those sections, subsections, or paragraphs identified in the preliminary high-level assessment as potentially addressing the particular requirement(s). The detailed assessment includes an evaluation against all criteria and a justification for the results provided.

The assessment summary explains and justifies the following:

- all sections, subsections, or paragraphs rated as ‘Recommended’, including, where applicable:
 - the evidence and justification captured as regards where and which adaptations are needed (e.g., when rated as ‘I’ under criterion C1.2 Correctness);
 - those sections, subsections, or paragraphs that, individually “partially addressing the requirement” under criterion C1.1 Completeness / coverage, may be combined to conform to an encompassing MoC, as well as, where applicable and relevant, any limitations / adaptations that such an eventual MoC may require;
 - any additional information deemed relevant (e.g., limitations).
- where appropriate, any other relevant outcome of the preliminary high-level assessment or the detailed technical assessment.

An example of how this standard assessment summary looks like for a given standard XXX is provided in Tables 2 and 3 below. Table 2 is the format used to list the sections that are fully recommended. Table 3 is instead related to those sections that are recommended but would require tailoring / adaptation.

Table 2: Example of assessment summary (recommended sections)

Standard XXXX-20YY			
Requirement	SAIL Integrity / Assurance	Recommended section(s)	Additional relevant information
OSO#XX	Integrity SAIL III	Sections a.bc & d.e	Partial coverage
OSO#XX	Integrity SAIL IV
OSO#XX	Integrity SAIL V & VI	Sections f.gh, i.jk & l.m	Full coverage
Light-UAS.23xxx	SAIL III & IV

Light-UAS.23xxx	SAIL V & VI
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Table 3: Example of assessment summary (recommended sections requiring tailoring/adaptation)

Standard XXXX-20YY			
Section	Title / Subject	Requirement	Required tailoring / complementing
Section n.op	Power system performance	Light-UAS.24yy Medium (M) & High (H)	No criteria, limitations, or instructions are provided
Section q.r	Equipment installation	Light-UAS.25zz Medium (M)	The proposed criteria is deemed excessive for Medium (M)

In addition, the project has produced a summary table in which all requirements identified in the scope of the assessment are listed. For each requirement the table indicates if:

- A standard (or a section thereof) provides full coverage and can be considered an adequate Mean of Compliance.
- A standard (or a section thereof) provides partial coverage. In this case the table highlights the reason why the coverage is partial. In some cases, the combination of different standards with partial coverage is assessed as adequate to provide overall a full coverage of the requirement.
- No standard is needed to support the demonstration of compliance.
- No standard within the scope of the project was considered adequate.

An extract of the summary table is provided in Table 4.

Table 4: Extract of summary table

SORA reference	Integrity / Assurance	Level of robustness	Criterion #	Requirement full reference	Recommended section(s)	Coverage	Overall coverage	Comments
SC-Light-UAS Subpart U-Space service	Light-UAS .2xxx U-Space article	Associated AMC & GM						
SORA OSOs								
OSO#05	Integrity	Low (L)	N/A	OSO#05 Integrity Low (L)	ED-279	Partial	Full	The overall coverage is considered 'Full', as ED-280 provides a generic methodology to perform safety assessment suitable for OSO#5 Low Integrity. For their part, ED-279 and the recommended sections of F3298-19 complement ED-280. Specifically, ED-279 provides a methodology to perform an FHA as a starting point, whilst F3298-19 indicates a way to handle specific failure cases.
					ED-280	Full		
					F3298-19: Sections 5.6.2, 7.9.2.7, 7.10.1.2(5), 16.3 & A2.3	Partial		
OSO#05	Assurance	Low (L)	N/A	OSO#05 Assurance Low (L)	ED-279	Partial	Full	Recommended sections of F3309 complete ED-280 by providing criteria for design and installation appraisal. ED-279 provides a methodology to perform an FHA as a starting point.
					ED-280	Partial		
					F3309/F3309-21: Sections 4.4.1, 4.4.2 & 4.6	Partial		

All project results are described in detail in the following deliverables:

- D1.2: Work methodology;
- D2.1-D3.1: Identification of satisfactory industry standards and justification for not acceptable industry standards – Part I; and
- D2.2-D3.2: Identification of satisfactory industry standards and justification for not acceptable industry standards – Part II.

5. KEY FINDINGS

The project assessed 47 standards against more than 550 requirements. The key findings of this assessment activity were the following:

- 19% of the requirements are mapped with a standard (or section thereof) with FULL coverage;
- 28% of the requirements are mapped with a standard (or section thereof) with PARTIAL coverage;
- 43% of the requirements cannot be mapped with any standard;
- for the remaining requirements no standard was considered needed to demonstrate compliance.

Overall, this indicates that for more than half of the requirements considered by the project a comprehensive and fully adequate MoC does not exist. This situation can be explained by the fact that most of the standards were developed before the UAS or U-Space regulations were published and thus were not developed to target these specific requirements and therefore their coverage can never be full.

The situation is expected to improve considering that SDOs, under the coordination of the EUSCG are working to develop new standards and update the existing ones to close as many gaps as possible.

6. EXTERNAL EXPERTS' INVOLVEMENT

The project involved a group of external experts through a Stakeholders Consultation Group (SCG). Comprising key experts from the drone industry, its objectives included reviewing project outcomes, guiding fundamental aspects such as methodology for standard assessment, and providing recommendations to enhance the SHEPHERD approach and results.

In close coordination with EASA, the SCG's establishment, participant selection, organisation, and activities were executed. A call for participation, distributed alongside EASA, invited relevant stakeholders to nominate representatives, ensuring a manageable group size for regular review meetings while maintaining a diverse range of competencies. The SCG included EASA experts and representatives of the following organisations:

- Standard Development Organisations (SDOs): EUROCAE, ASTM, ASD-STAN;
- Associations: GUTMA, JEDA; and
- Authorities: CASA.

In addition to the establishment of the SCG the project engaged in the following activities to maximise the dissemination of the project results and ensure coordination with relevant stakeholders:

- Regular participation in the meetings of the European UAS Standards Coordination Group (EUSCG);
- Presentation of the project activities to the JARUS Plenary in April 2023; and
- Regular information of project status and results through the dedicated EASA website and the LinkedIn profiles of the project participants.

ANNEX. ASSESSED STANDARDS

ASSESSED STANDARDS				
#	SDO	Reference	Title	SHEPHERD deliverable
1	ASTM	F1583-95(2019)	Standard Practice for Communications Procedures – Phonetics	D2.2-D3.2
2	ASTM	F2483-18	Standard Practice for Maintenance and the Development of Maintenance Manuals for Light Sport Aircraft	D2.1-D3.1
3	ASTM	F2908-18	Standard Specification for Unmanned Aircraft Flight Manual (UFM)	D2.1-D3.1
4	ASTM	F2909-19	Standard Practice for Maintenance and Continued Airworthiness of Small Unmanned Aircraft Systems (sUAS)	D2.1-D3.1
5	ASTM	F3002-14a	Standard Specification for Design of the Command and Control System for Small Unmanned Aircraft Systems (sUAS)	D2.2-D3.2
6	ASTM	F3003-14	Standard Specification for Quality Assurance of a Small Unmanned Aircraft System (sUAS)	D2.2-D3.2
7	ASTM	F3005-14a	Standard Specification for Batteries for Use in Small Unmanned Aircraft Systems (sUAS)	D2.2-D3.2
8	ASTM	F3178-16	Operational Risk Assessment of Small Unmanned Aircraft Systems (sUAS)	D2.2-D3.2
9	ASTM	F3201-16	Standard Practice for Ensuring Dependability of Software Used in Unmanned Aircraft Systems (UAS)	D2.2-D3.2
10	ASTM	F3266-18	Standard Guide for Training for Remote Pilot in Command of Unmanned Aircraft Systems (UAS) Endorsement	D2.1-D3.1
11	ASTM	F3269-21	Methods to Safely Bound Behavior of Aircraft Systems Containing Complex Functions Using Run-Time Assurance	D2.2-D3.2
12	ASTM	F3298-19	Standard Specification for Design, Construction, and Verification of Lightweight Unmanned Aircraft Systems (UAS)	D2.1-D3.1 D2.2-D3.2
13	ASTM	F3309/F3309M-21	Standard Practice for Simplified Safety Assessment of Systems and Equipment in Small Aircraft	D2.1-D3.1
14	ASTM	F3322-18	Standard Specification for Small Unmanned Aircraft System (sUAS) Parachutes	D2.1-D3.1
15	ASTM	F3330-18	Standard specification for Training and the Development of Training Manuals for the UAS Operator	D2.1-D3.1
16	ASTM	F3364-19	Standard Practice for Independent Audit Program for Unmanned Aircraft Operators	D2.2-D3.2

ASSESSED STANDARDS				
#	SDO	Reference	Title	SHEPHERD deliverable
17	ASTM	F3365-19	Standard Practice for Compliance Audits to ASTM Standards on Unmanned Aircraft Systems	D2.2-D3.2
18	ASTM	F3366-19	Standard Specification for General Maintenance Manual (GMM) for a small Unmanned Aircraft System (sUAS)	D2.1-D3.1
19	ASTM	F3367-21a	Standard Practice for Simplified Methods for Addressing High-Intensity Radiated Fields (HIRF) and Indirect Effects of Lightning on Aircraft	D2.2-D3.2
20	ASTM	F3379-20	Standard Guide for Training for Public Safety Remote Pilot of Unmanned Aircraft Systems (UAS) Endorsement	D2.1-D3.1
21	ASTM	F3389/F3389M-21	Standard Test Method for Assessing the Safety of Small Unmanned Aircraft Impacts	D2.2-D3.2
22	ASTM	F3411-22a	UAS Remote ID and Tracking	D2.1-D3.1
23	ASTM	F3442/F3442M-20	Detect and Avoid performance Requirements	D2.1-D3.1
24	ASTM	F3548-21	Standard Specification for UAS Traffic Management (UTM) UAS Service Supplier (USS) Interoperability	D2.2-D3.2
25	ASTM	F3600-22	Standard Guide for Unmanned Aircraft System (UAS) Maintenance Technician Qualification	D2.2-D3.2
26	EUROCAE	ED-12C	Software Considerations in Airborne Systems and Equipment Certification	D2.1-D3.1
27	EUROCAE	ED-80	Design Assurance Guidance for Airborne Electronic Hardware	D2.1-D3.1
28	EUROCAE	ED-266	Guidance on Spectrum Access, Use and Management for UAS	D2.2-D3.2
29	EUROCAE	ED-269	Minimum Operational Performance Standard (MOPS) for Geo-Fencing	D2.1-D3.1
30	EUROCAE	ED-270	Minimum Operational Performance Standard (MOPS) for Geo-Caging	D2.1-D3.1
31	EUROCAE	ED-279	Generic Functional Hazard Assessment (FHA) for UAS/RPAS	D2.1-D3.1
32	EUROCAE	ED-280	Guidelines for UAS safety analysis for the Specific category (low and medium levels of robustness)	D2.1-D3.1
33	EUROCAE	ED-282	Minimum Operational Performance Standards (MOPS) for UAS E-Reporting	D2.1-D3.1
34	EUROCAE	ED-301	Guidelines for the Use of Multi-GNSS Solutions for UAS Specific Category – Low Risk Operations SAIL I & II	D2.1-D3.1

ASSESSED STANDARDS				
#	SDO	Reference	Title	SHEPHERD deliverable
35	IEC	IEC 62133-2:2017 + AMD1:2021	Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications – Part 2: Lithium systems	D2.2-D3.2
36	IEEE	IEEE 802.15.3c-2009	Standard for Information technology – Local and metropolitan area networks – Specific requirements – Part 15.3: Amendment 2: Millimetre-wave-based Alternative Physical Layer Extension	D2.2-D3.2
37	IEEE	IEEE 802.11-2020	Standard for Information Technology – Telecommunications and Information Exchange between Systems - Local and Metropolitan Area Networks – Specific Requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications	D2.2-D3.2
38	IEEE	IEEE 802.22-2017	Standard for Regional Area Networks	D2.2-D3.2
39	ISO	ISO 16803-1:2016	Space - Use of GNSS-based positioning for road Intelligent Transport Systems (ITS). Part 1: Definitions and system engineering procedures for the establishment and assessment of performance	D2.1-D3.1
40	ISO	ISO 16803-2:2016	Space - Use of GNSS-based positioning for road Intelligent Transport Systems (ITS). Part 2: Assessment of basic performances of GNSS-based positioning terminals	D2.1-D3.1
41	ISO	ISO 21384-2:2021	Unmanned aircraft systems – Part 2: UAS components	D2.2-D3.2
42	ISO	ISO 21384-3:2023	Unmanned aircraft systems – Part 3: Operational procedures	D2.2-D3.2
43	ISO	ISO 23629-7:2021	UAS Traffic Management (UTM) Part 7 – Data Model for Spatial Data	D2.2-D3.2
44	ISO	ISO 23665:2021	Unmanned Aircraft Systems – Training for personnel involved in UAS operations	D2.1-D3.1
45	RTCA	DO-365A	Minimum Operational Performance Standards (MOPS) for Detect and Avoid (DAA) Systems - Phase 1	D2.1-D3.1
46	RTCA	RTCA DO-366A	Minimum Operational Performance Standards (MOPS) for Air-to-Air Radar for Traffic Surveillance	D2.2-D3.2
47	RTCA	RTCA DO-386	Vol I Minimum Operational Performance Standards for Airborne Collision Avoidance System Xu (ACAS Xu)	D2.2-D3.2

BIBLIOGRAPHY

European Union Aviation Safety Agency (EASA), Easy Access Rules for Unmanned Aircraft Systems – Revision from September 2022, September 2022.

European Union Aviation Safety Agency (EASA), Special Condition (SC) for Light-UAS - Medium Risk 01, December 2020.

European Commission, Commission Implementing Regulation (EU) 2021/664 on a regulatory framework for the U-space, April 2021.

European Union Aviation Safety Agency (EASA), Notice of Proposed Amendment (NPA) 2021-14 – Development of acceptable means of compliance (AMC) and guidance material (GM) to support the U-space regulation, December 2021.

Project reports

SHEPHERD, D1.1-D1.2 Industry standards assessment criteria and work methodology, September 2022.

SHEPHERD, D2.1-D3.1 Identification of satisfactory industry standards and justification for not acceptable industry standards (Part 1), April 2023.

SHEPHERD, D2.2-D3.2 Identification of satisfactory industry standards and justification for not acceptable industry standards (Part 2), April 2024.

SHEPHERD, D4.3 Final report, April 2024.



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