Methodology for the assessment of drone standards

D2.2

AW-Drones

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AW-Drones

Abstract

AW-Drones aims at supporting the on-going EU regulatory process for the definition of technical rules, standards and procedures for civilian drones to enable safe, environmentally sound and reliable operations in the EU.

In Work Package 3 of the AW-Drones project standards that are potentially suitable to serve as an Acceptable Means of Compliance (AMC) against drone regulations are identified.

Subsequently in WP3 and WP4 of the AW-Drones project their suitability as an Acceptable Means of Compliance (AMC) against drone regulations and the effect of not having a standard that could serve as AMC are assessed. Also gaps in the available standards are identified. The assessment is performed using the methodology described in this document, which is the output of task 2.2 of the AW-Drones project.

The assessment methodology is based on Multi-Criteria Analysis which works as follows:

- A criterion represents the effect of a potential standard or lack of a standard on a certain aspect. Criteria are: maturity of standard, type of standard, effectiveness to fulfil KPA requirement, cost of compliance, environmental impact, impact on EU Industry competitiveness, social Acceptance;
- For each criterion a ranking system is defined which allows to express the magnitude of the effect of an option on the applicable aspect;
- Rankings for the various criteria can have different units of measurements. To allow the combination of criteria, non-dimensional numerical scores are defined for each ranking system;
- The various criteria are combined by algebraically summing the scores of each criterion using a weight factor for each criterion. The weight factor expresses the importance of a criterion relative to the other criteria.

Feedback on the draft version of the assessment methodology has been received from EASA during the workshop with EASA on 6-7 June 2019 at EASA in Cologne. The proposed assessment methodology will be further validated with external stakeholders during the first workshop of the AW-DRONES project, which will be held on the 19th of September, 2019 at Eurocontrol in Brussels.

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THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO. 824292.

Acronyms

AMC	Acceptable Means of Compliance
ARO	Authority Requirements for air Operations
ASTM	American Society for Testing and Materials
ATPL	Air Transport Pilot License
CPL	Commercial Pilot License
CS-LSA	Certification Specifications - Light Sport Aircraft
CS-UAS	Certification Specifications - Unmanned Aircraft System
CS-VLA	Certification Specifications – Very Light Aircraft
EASA	European Aviation Safety Agency
EC	European Commission
EU	European Union
EUROCAE	European Organisation for Civil Aviation Equipment
ISO	International Standards Organisation
KPA	Key Performance Area
MPL	Multi-Pilot License
N.A.	Not Applicable
NCC	Non-Commercial operations with Complex motor-powered aircraft
NCO	Non-Commercial operations with Other-than-complex aircraft
ORO	Organisation Requirements for air Operations
OSO	Operational Safety Objectives
PPL	Private Pilot License
RTCA	Radio Technical Commission for Aeronautics

SORA	Specific Operational Risk Assessment
SPO	SPecialised Operations
UAS	Unmanned Aircraft System
WP	Work Package

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1 Introduction

1.1 Purpose of this document

The purpose of this document is to describe the methodology for assessing the standards identified in WP3 of the AW-Drones project (see section 1.2 for further details). It is the output of task 2.2 of the AW-Drones project.

1.2 Context of assessment methodology within AW-Drones project

In WP3 of the AW-Drones project standards that are potentially suitable to serve as an Acceptable Means of Compliance (AMC) against drone regulations are identified.

Subsequently in WP3 and WP4 of the AW-Drones project these standards are ranked in terms of their suitability as an Acceptable Means of Compliance (AMC) against drone regulations, and gaps in the available standards are identified. The ranking is performed using the assessment methodology described in this document.

Finally in WP4 of the AW-Drones project, standards with high scores will be proposed as AMC. Standards with medium score will be listed as possible AMC subject to decision by Authority. In case of partial coverage the gaps will be indicated.
In case of gaps potentially suitable standards from manned aviation and other industries will be proposed, or recommendations to amend standards or develop suitable standards will be provided by WP4 of the AW-Drones project.

Three assessment iterations are foreseen:

1)
The first iteration will focus on the Specific Category of operations (ref.6), in particular on standards that correspond with the following SORA (ref.7) requirements.

- All requirements defined for Ground Risk Mitigations
- All requirements defined for Air Risk Mitigations
- Requirements related to Operational Safety Objectives up to SAIL IV (priority will be given to airworthiness requirements)

During the AW-Drones project kick-off meeting it was agreed (see ref.8) that the above scope is likely to be adequate as most of the operations in the Specific Category will be within SAIL IV in the short to medium term. During the 1st Workshop this assumption will be validated with relevant stakeholders. The Project Management Board will then decide, in accordance with INEA, DG-MOVE and EASA whether to extend the scope and/or to add details on the material developed for the first iteration. Possible topics for scope extension could be: Environment and Security (Cyber, Physical, Operator's, Personnel).

2)
The second iteration will include UTM.

3)
The third iteration will include autonomous operations.

In each iteration all topics previously addressed will be re-assessed and the outcomes updated accordingly.

1.3 Validation of assessment methodology

Feedback on the draft version of the assessment methodology has been received from EASA during the workshop with EASA on 6-7 June 2019 at EASA in Cologne. This feedback is described in Appendix B.

The proposed assessment methodology will be further validated with external stakeholders during the first workshop of the AW-DRONES project, which will be held on the 19th of September, 2019 at Eurocontrol in Brussels.

1.4 Planned update of assessment methodology

The assessment methodology as described in this document will be refined following the feedback from external stakeholders during the first workshop of the AW-DRONES project and lessons learnt after the first round of data collection and assessment. Deliverable D2.2 will report the final version of the assessment methodology to be used for the rest of the project.

1.5 Content of this document

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The remainder of this document is structured as follows: chapter 2 describes the methodology for assessing the standards, Appendix A provides an example of the application of the assessment methodology to a standard, and Appendix B describes the feedback received from EASA on the draft version of the assessment methodology.

2 Methodology for assessing the standards

In the assessment of each standard, three different cases will be considered:

- **CASE 1**: a standard that is potentially suitable to comply with a certain requirement has been identified (e.g. OSO #xx);
- **CASE 2**: a standard that is potentially suitable to comply with a certain requirement(e.g. OSO #yy) has not been identified;
- **CASE 3**: a standard that does not map on any requirement has been identified ("orphan" standard).

Note: during the first iteration of assessing the standards, CASE 3 will not be considered. It will be decided later whether to use CASE 3 for further iterations of assessing the standards.

The assessment methodology is based on so called Multi-Criteria Analysis (see section 2.1).

As first step the structured standards will be assessed in WP3 of the AW-Drones project using an initial set of criteria:

- Maturity of standard
- Type of standard

Note: for case 2 these criteria are not applicable due to the lack of a standard.

Then as second step the structured standards will be assessed in WP4 of the AW-Drones project using a full set of criteria.

- Criteria from step 1 (for CASE 2 not applicable)
- Effectiveness to fulfil KPA requirement
- Cost of compliance
- Environmental impact
- Impact on EU Industry competitiveness
- Social Acceptance

These criteria, their scoring system, the weight factors and the conclusions based on the total scores are described in sections 2.4, 2.5 and 2.6 for CASE 1, CASE 2 respectively CASE 3.

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2.1 Multi Criteria Analysis

Multi Criteria Analysis is an analytical method that is used to compare and rank options when the effects of an option on multiple aspects must be considered, for example the effect of a proposed new regulation on safety, cost, the environment and the society, or the effect of a proposed aircraft design solution on aircraft fuel consumption, system procurement cost, maintenance cost and training cost.

Multiple criteria Analysis works as follows:

- A criterion represents the effect of an option on a certain aspect such as safety, cost, the environment or the society.
- For each criterion a ranking system is defined which allows to express the magnitude of the effect of an option on the applicable aspect. The ranking system can qualitative (e.g. very negative/negative/no effect/positive/very positive, low/medium/high) or quantitative (e.g. amount of euros, number of decibels, amount of particles per m^3).
- Rankings for the various criteria can have different units of measurements. To allow the combination of criteria, non-dimensional numerical scores are defined for each ranking system (e.g. very negative = 1, negative = 2, no effect = 3, positive = 5, very positive =5 (e.g. 1 to 10000 euros is = -1, 50 to 100 dB = -2, 100 – 150 dB = -3).
- The various criteria are combined by algebraically summing the scores of each criterion using a weight factor for each criterion. The weight factor expresses the importance of a criterion relative to the other criteria. (e.g. effect on safety has weight factor 3, effect on environment has weight factor 1)

EASA uses Multiple criteria Analysis in the so called Preliminary Rulemaking Impact Assessment which assesses the effects of possible regulatory options and the expected safety benefits and to identify the preferred option.
The Preliminary Rulemaking Impact Assessment format and methodology is available via the EASA public website at the following link: http://easa.europa.eu/rulemaking/procedures-and-work-instructions.php).
It was used for example in the Study on High Performance Aircraft (ref.9) which a consortium consisting of Ecorys and NLR performed on behalf of EASA.

The European Commission provides guidelines for impact assessment which are also structured around Multiple Criteria Analysis (see ref.5).

The Multi Criteria Analysis used by AW Drones is in line with the EASA pre-RIA method as well as with the EC guidelines.

2.2 Weight factors used

The weight factors for calculating the total score from the scores per individual criterion, and their rationale are as follows:

Criterion	Weight factor	Rationale
Maturity of standard	1	
Type of standard	1	
Effectiveness to fulfil KPA requirement	3	Safety is considered the most important criterion.
Sum of two criteria from step 1	3	The availability of a mature standard specification is a prerequisite for potentially being an acceptable means of compliance.
Cost of compliance	2	Cost of compliance is considered the second most important criterion.
Environmental impact	1	
Impact on EU Industry competitiveness	1	
Social Acceptance	1	

Table 1: Weight factors for calculating the total score

Criteria can be disregarded by setting their weigh factor to zero. For example:

- It is questionable whether a rating for the criterion 'Social acceptance' can be determined in a reliable and repeatable way. Results from the project are awaited before it will be decided whether or not to use this criterion.

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2.3 Differences in criteria for the three cases

The criteria for the three cases differ in the following manner:

For CASE 2 ‘maturity of a standard’ and ‘type of standard’ are not applicable as there is no standard.

The criterion ‘effectiveness to fullfil KPA requirement’ differs between the three cases as follows:

- CASE 1:
  In case of an incomplete coverage of a requirement by a standard, the applicant must demonstrate by other means that the requirement is met. There is a risk that missing aspects will be overlooked by either the applicant or the regulator. To quantify the effect on safety it is most conservatively assumed that the missing aspects are overlooked. Therefore partial coverage and full coverage of a requirement corresponds with a medium respectively large positive effect on safety.
- CASE 2:
  In case of missing standards the applicant must demonstrate by other means that the requirement is met. There is a risk that aspects will be overlooked by either the applicant or the regulator. Therefore missing standards have no positive effect on safety.
- CASE 3:
  A standard that does not map onto a requirement but seems useful nonetheless suggests that either the standard is not safety related or the requirements are incomplete (which will be analysed during the next phase of the project).

For CASE 2 ‘the cost of compliance with’, ‘the effect on the environment, ‘social acceptance’ of the regulation without having a standard, and the ‘effect on EU industry competiveness’ of the lack of a standard are considered.

2.4 CASE 1: a standard that is potentially suitable to comply with a certain requirement has been identified

This section contains the criteria and the scoring system for the assessment of the standards for CASE 1.

2.4.1 Criteria for step 1

This section contains the criteria and the scoring system for the assessment of the standards for CASE 1. Table 3 shows the assessment criteria with corresponding weights, and Table 4 shows the scoring scales for the considered criteria.

Criterion	Description	Weight
Maturity of standard	Although the exact wording may differ, all organisations/groups involved in making standards apply a similar process, or work flow (refs 1-4). In essence they all follow the approach of: Planning, Drafting, Internal Consultation, External Consultation, and Published. • Drafting: is considered to be the phase in which a person or (small) team of persons has actually started working on drafting the standard. • Internal Consultation: is considered to be the phase in which a (first) draft of the standard is provided to a higher body within that same organisation for review and/or approval (thus a sub group provides a draft to a working group or a working group provides a draft in a plenary meeting). In case no (internal) status updates for a standard are provided the status of that standard will remain 'Drafting' until it's published for external consultation. After the internal consultation review/comments are gathered the draft standard may be revised to address the comments. For this rating process the status will remain at 'internal consultation' up to and including this revision period. • External Consultation: After internal consultation and internal approval it is good practice to issue the draft standard for external consultation. After the external consultation review/comments are gathered the draft standard may be revised to address the comments. For this rating process the status will remain at 'external consultation' up to and including this revision period. • Published: Once all external consultation comments are addressed, either by revising the standard text or provide a clarification or rationale on that specific comment, the standard can be published either after ratification or other form of approval or directly. For this rating process the status is only changed to published once the standard is classified as	1

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	Final and that standard is available in the public domain (either free of charge or at charges). • Recognised / accepted / used: published standards that are actually used by applicants. In specific cases in which no status updates can be found or obtained for a specific standard (i.e. it cannot be verified in which of the above stages the standard is) that standard is rated as planned and is changed to published once that standard is available in the public domain (either free of charge or at charges). Standards will be checked on maturity just before drafting the respective deliverable and the status will be frozen at that moment.	
Type of standard	The type of the standard is considered to be a measure for the applicability of that standard. For this purpose three types of standards are identified: • Information guidance: A standard with non-binding explanatory and interpretation material (including examples) on how to achieve, interpret and/or apply the requirements contained in a specific or sets of rule(s) and/or regulation(s) (based on ref: EASA FAQ n.19026) • Best practice: A standard that has proven to lead to a desired result in a repetitive (reliable) way. If this cannot be substantiated by research and/or documented experience, the standard should be rated as information guidance. • Standard Specification: A standard that could be proposed as an acceptable means of compliance (EASA FAQ n.19026) to a specific rule or regulation.	1

Table 2: Criteria for step 1 (CASE 1)

Item	-2 (lowest ranking)	-1	0	1	2 (highest ranking)
Maturity of standard	Drafting	Internal Consult.	External Consult.	Published	Recognized / Accepted / Used
Type of standard	N.A.	N.A.	Information Guidance	Best Practice	Standard Specification

Table 3: Criteria and scoring system step 1 (CASE 1)

Each rating must be accompanied by a rationale.

2.4.2 Criteria for step 2

This section contains the criteria and the scoring system for the assessment of the standards for CASE 1. The criteria are given in Table 4 and the scoring scales in Table 5.

Criterion	Description	Weight
Effectiveness to fulfill KPA requirement	This criterion will address the effectiveness of the candidate standard to fulfil a given requirement with respect with its relevant Key Performance Area (e.g. Safety, Security) The primary material on which the assessment of a standard will be performed will be the beginning of the standardisation document, i.e. sections such as the abstract, scope, applicability and background information. It will be assessed to what extent the standard covers a requirement: low, medium, high or full coverage. In case of an incomplete coverage the applicant must demonstrate by other means that the requirement is met. There is a risk that missing aspects will be overlooked by either the applicant or the regulator. At this stage, it is conservatively assumed that the missing aspects are overlooked. Therefore partial coverage and full coverage of a requirement corresponds with respectively a neutral and positive effect on KPAs. In case of partial coverage of a requirement the gaps must be indicated.	3
Sum of scores of the two criteria from step 1		1
Cost of compliance	The objective of this criterion is mainly to assess and quantify the feasibility and practicability for the drone industry of adopting a certain standard. Cost of compliance is a metric to measure them. All costs incurred to comply with the selected standard shall be identified and quantified at a qualitative level. The analysis should consider all affected stakeholders such as:	2

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	Manufacturers, Maintenance organisations, Training organisations, Operator organisations, Remote pilots, Regulators, Oversight authorities, General public. The assessment should include (as a minimum): • Development costs incurred to develop a product/system compliant with the standards (e.g. Cost for manufacturers to develop a DAA compliant with EUROCAE/RTCA standard, or an entire UAS compliant with CS-UAS or ISO UAS product standard. Cost for training organization to develop a training course compliant with ASTM standard, cost for Remote Pilots to get a license) • Operational costs related to the limitations coming from the applicability of the selected standard (e.g. if a standard is applicable only to operations in uncontrolled airspace, there is a cost for the operator that cannot fly in controlled airspace. If a standard is applicable only to rotorcraft, there is a cost related to the efficiency of operations requiring to fly long distances and more suitable for fixed-wing drones) • Time required to complete the development of all products/systems/infrastructures required to comply with the selected standard (e.g. time for Remote Pilots to obtain a license in line with a selected training standard, time for manufacturers to implement production processes that allows to produce UAS compliant with CS-UAS) • Compatibility/consistency with existent standards should be considered as a way to reduce overall costs by possibly reusing products/systems/technologies already developed. • Both one-off and recurring costs shall be identified. All the costs and resources listed here should be measured or derived with an expert judgement taking into consideration the different magnitude and business case of the considered stakeholders. Costs considerations will cover the sustainability and feasibility of the adoption of the considered standard for a certain organization, rather than the absolute value of the sustained costs (e.g. Airbus and DJI may have very different costs for the production of a certain component but with a similar affordability within their respective business cases).	
Environmental impact	Effects on emission of greenhouse gases; noise nuisance; energy and fuel consumption. Effect on areas, scenic view, and resources. Likelihood of causing fires, explosions or accidents. Effects on (local) fauna.	1

	Impact can be beneficial, neutral or harmful. For example, a standard directed at reducing consumption of resources has a beneficial impact. On the other hand, a standard may be harmful when, for instance, it induces high noise nuisance or fuel consumption. Standards are expected to have mostly a neutral impact.	
Impact on EU Industry competitiveness	This criterion defines the impact (both positive and negative) of the adoption of the selected standard on EU industrial stakeholders (manufacturers, operators, service providers, etc.) competitiveness. The analysis should consider all affected stakeholders and include (as a minimum): • Cost of compliance specifically for the European stakeholders (high costs mean a negative impact); • Readiness of EU industry in adopting the standard (long times for adoption lead to a negative impact) • Readiness of EU aviation authorities (EASA and NAAs) in adopting the standard (long times for adoption lead to a negative impact) • Potential benefits for EU manufacturers of certifiable technologies (positive impact) or need to rely on non-EU manufacturers to integrate certifiable technology (negative impact) • Both one-off and recurring costs and benefits for EU industry shall be identified.	1
Social Acceptance	Social acceptance shall identify behavioural change caused from a selected standard and its content that is being assessed. It assesses: • the attitude change or the degree to which people receive favourably or negatively a standard and the measures it introduces. • Is there acceptance of the standard and its measures by the stakeholders? • Any positive or negative impact on society. Does it have an impact on job creation and demand for labour or improvement in job quality? • What benefit does it bring to the end user but also to society? Is there an impact on employment like making dirty jobs redundant • Does the standard have an adverse impact due to strict regulations • Does the standard affect market penetration of drones thus making them more acceptable • Does the standard introduce measures that make drones easier to use for certain applications	1

Table 4: Criteria for step 2 (CASE 1)

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Item	-2 (lowest ranking)	-1	0	1	2 (highest ranking)
Effectiveness to fulfill KPA requirement	N.A.	N.A.	Partial coverage	N.A.	Full coverage
Cost of compliance	Very High	High	Medium	Low	Very Low
Environmental impact	Bad	N.A.	Neutral	N.A	Good
Impact on EU Industry competitiveness	Very negative	Negative	No impact	Positive	Very Positive
Social Acceptance	Very negative	Negative	No impact	Positive	Very Positive

Table 5: Criteria and scoring system for step 2 (CASE 1)

Each rating must be accompanied by a rationale.

2.4.3 Conclusions based on weighted score

Depending on the weighted score, the following conclusions will be drawn:

- A standard that corresponds with a requirement and has a high score (see figure 1) will be proposed as AMC. In case of partial coverage the gaps will be indicated.
- A standard that correspond with a requirement that has a medium score (see figure 1) will be listed as possible AMC subject to decision by Authority. In case of partial coverage the gaps will be indicated.
- For a standard that corresponds with a requirement and has a low score (see figure 1), possible applicable standards from manned aviation and other industries will be proposed, or a recommendation to amend the standard will be provided. In case of partial coverage the gaps will be indicated.

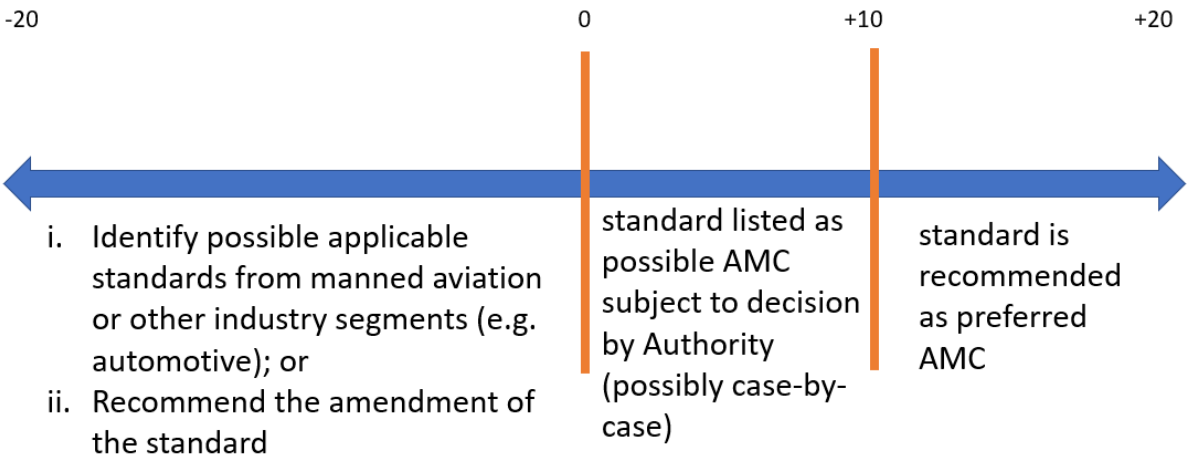

Figure 1, Conclusions for CASE 1 based on weighted score

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2.5 CASE 2: a standard that is potentially suitable to comply with a certain requirement has not been identified

This section contains the criteria and the scoring system for the assessment of the standards for CASE 2.

2.5.1 Criteria for step 1

No assessment needed in step 1.

2.5.2 Criteria for step 2

This section contains the criteria and the scoring system for the assessment of the standards for CASE 2. The criteria are given in Table 6 and scoring scales in Table 7.

Criterion	Description	Weight
Safety (or other reference KPA) impact	In case of missing standards the applicant must demonstrate by other means that the requirement is met. The objective of this criterion is mainly to assess and quantify the impact on Safety (or other relevant KPAs) of the need of complying with the identified requirement with no definition of adequate standards. There is a risk that aspects will be overlooked by either the applicant or the regulator. Therefore missing standard might have a negative impact on safety (or other relevant KPAs) .	3
Cost of compliance (to the requirement with a lack of standard)	The objective of this criterion is mainly to assess and quantify the feasibility and practicability for the drone industry of complying with the identified requirement with no definition of adequate standards. Cost of compliance is a metric to measure it. All costs incurred to comply with the selected requirement shall be identified and quantified at a qualitative level. The analysis should consider all affected stakeholders such as: Manufacturers, Maintenance organisations, Training organisations, Operator organisations, Remote pilots, Regulators, Oversight authorities, General public. The assessment should include (as a minimum): • Development costs incurred to develop a product/system that fulfils the selected requirement without guidance from existing standards • Operational costs related to the limitations incurred to comply with the selected requirement without a reference standard	2

	• Time required to complete the development of all products/systems/infrastructures required to comply with the selected requirement • Both one-off and recurring costs shall be identified. All the costs and resources listed here should be measured or derived with an expert judgement taking into consideration the different magnitude and business case of the considered stakeholders. Costs considerations will cover the sustainability and feasibility of complying to the requirement for a certain organization, rather than the absolute value of the sustained costs (e.g. Airbus and DJI may have very different costs for the production of a certain component but with a similar affordability within their respective business cases).	
Environmental impact	Effects of lack of a standard on emission of greenhouse gases; noise nuisance; energy and fuel consumption. Effect on areas, scenic view, and resources. Likelihood of causing fires, explosions or accidents. Effects on (local) fauna. The effect of a lack of a standard is expected to have mostly a neutral impact.	1
Impact on EU Industry competitiveness -	This criterion defines the impact (both positive and negative) of the lack of standards for the considered requirement on EU industrial stakeholders (manufacturers, operators, service providers, etc.) competitiveness. The analysis should consider all affected stakeholders and include (as a minimum): • Cost of compliance to the requirement specifically for the European stakeholders in absence of suitable standards (high costs mean a negative impact); • Readiness of EU industry in proposing suitable standards for the selected requirement (long times for proposal lead to a negative impact) • Impact for EU aviation authorities (EASA and NAAs) of having a regulatory framework that is not covered by suitable standards for the selected requirement • Impact for the EU market of having a regulatory framework that is not covered by suitable standards for the selected requirement • Both one-off and recurring costs and benefits for EU industry shall be identified.	1
Social acceptance	Social acceptance shall identify behavioural change caused from the lack of standards for the considered requirement. It assesses: • Does the absence of the standard covering a requirement affects social acceptance	1

Table 6: Criteria for step 2 (CASE 2)

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Item	-2 (lowest ranking)	-1	0	1	2 (highest ranking)
Safety (or other reference KPA) impact	Very High	High	Medium	Low	Very Low
Cost of compliance (to the requirement with a lack of standard)	Very High	High	Medium	Low	Very Low
Environmental impact	Bad	N.A.	Neutral	N.A	Good
Impact on EU Industry competitiveness	Very negative	Negative	No impact	Positive	Very Positive
Social acceptance	Very negative	Negative	No impact	Positive	Very Positive

Table 7: Criteria and scoring system for step 2 (CASE 2)

Each rating must be accompanied by a rationale.

2.5.3 Conclusions based on weighted score

Depending on the weighted score, the following conclusions will be drawn:

- For a requirement that has no corresponding standards (gaps) and a low score (see figure 2), possible applicable standards from manned aviation and other industries will be proposed, or a recommendation to develop a suitable standard will be provided. It should be noted that in manned aviation regulations the level of robustness as defined in SORA is dependent on the category of aircraft operation and category of aircraft:
    - Per category of aircraft certain airworthiness regulations are applicable: e.g. CS-LSA, CS-VLA, CS-23 normal/utility/aerobatic, CS-23 commuter, CS-25
    - Per category of operation, certain air operations regulations are applicable: e.g. part NCO, part NCC, part ARO, part ORO, part SPO, part SPA
    - For each combination of category of aeroplane and category of operation certain Flight Crew Licensing regulations are applicable. e.g. LAPL, PPL without type rating, PPL with type rating, CPL, MPL, ATPL

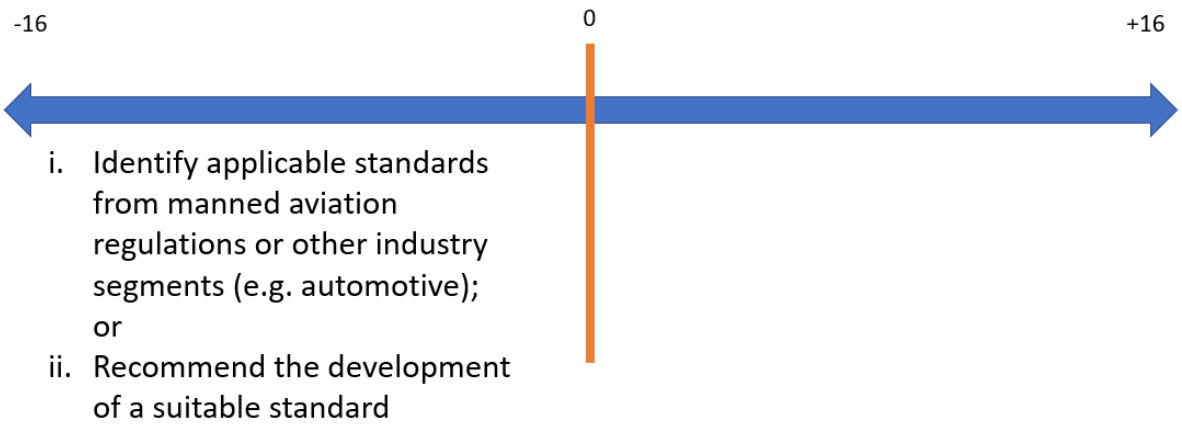

Figure 2, Conclusions for CASE 2 based on weighted score

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2.6 CASE 3: a standard that does not map on any requirement has been identified

This section contains the criteria and the scoring system for the assessment of the standards for CASE 3.

2.6.1 Criteria for step 1

This section contains the criteria and the scoring system for the assessment of the standards for CASE 3. The criteria are given in Table 8 and the corresponding scoring system in Table 9.

Criterion	Description	Weight
Maturity of standard	Although the exact wording may differ, all organisations/groups involved in making standards apply a similar process, or work flow (refs 1-4). In essence they all follow the approach of: Planning, Drafting, Internal Consultation, External Consultation, and Published. • Drafting: is considered to be the phase in which a person or (small) team of persons has actually started working on drafting the standard. • Internal Consultation: is considered to be the phase in which a (first) draft of the standard is provided to a higher body within that same organisation for review and/or approval (thus a sub group provides a draft to a working group or a working group provides a draft in a plenary meeting). In case no (internal) status updates for a standard are provided the status of that standard will remain 'Drafting' until it's published for external consultation. After the internal consultation review/comments are gathered the draft standard may be revised to address the comments. For this rating process the status will remain at 'internal consultation' up to and including this revision period. • External Consultation: After internal consultation and internal approval it is good practice to issue the draft standard for external consultation. After the external consultation review/comments are gathered the draft standard may be revised to address the comments. For this rating process the status will remain at 'external consultation' up to and including this revision period. • Published: Once all external consultation comments are addressed, either by revising the standard text or provide a clarification or rationale on that specific comment, the standard can be published either after ratification or other form of approval or directly. For this rating process the status is only changed to published once the standard is classified as Final and that standard is available in the public domain (either free of charge or at charges). • Recognised / accepted / used: published standards that are actually used by applicants.	1

	In specific cases in which no status updates can be found or obtained for a specific standard (i.e. it cannot be verified in which of the above stages the standard is) that standard is rated as planned and is changed to published once that standard is available in the public domain (either free of charge or at charges). Standards will be checked on maturity just before drafting the respective deliverable and the status will be frozen at that moment.	
Type of standard	The type of the standard is considered to be a measure for the applicability of that standard. For this purpose three types of standards are identified: • Information guidance: A standard with non-binding explanatory and interpretation material (including examples) on how to achieve, interpret and/or apply the requirements contained in a specific or sets of rule(s) and/or regulation(s) (based on ref: EASA FAQ n.19026) • Best practice: A standard that has proven to lead to a desired result in a repetitive (reliable) way. If this cannot be substantiated by research and/or documented experience, the standard should be rated as information guidance. • Standard Specification: A standard that could be proposed as an acceptable means of compliance (EASA FAQ n.19026) to a specific rule or regulation.	1

Table 8: Criteria for step 1 (CASE 3

Item	-2 (lowest ranking)	-1	0	1	2 (highest ranking)
Maturity of standards	Drafting	Internal Consult.	External Consult.	Published	Recognized / Accepted / Used
Type of standard	N.A.	N.A.	Information Guidance	Best Practice	Standard Specification

Table 9: Criteria and scoring system for step 1 (CASE 3)

Each rating must be accompanied by a rationale.

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2.6.2 Criteria for step 2

This section contains the criteria and the scoring system for the assessment of the standards for CASE 3. The criteria are given in Table 10 and the corresponding scoring system is given in Table 11.

Criterion	Description	Weight
Impact on relevant KPA	This criterion addresses the potential benefit given by the compliance to the considered standard in absence of a corresponding requirement. The criterion assesses the impact on the KPAs for which the standard has been produced (e.g. Safety, Security). A standard that does not map onto a requirement but seems useful nonetheless suggests that either the standard is not safety related or the requirements are incomplete.	3
Sum of scores of the two criteria from step 1		1
Cost of compliance	The objective of this criterion is mainly to assess and quantify the feasibility and practicability for the drone industry of adopting a certain standard. Cost of compliance is a metric to measure them. All costs incurred to comply with the selected standard shall be identified and quantified at a qualitative level. The analysis should consider all affected stakeholders such as: Manufacturers, Maintenance organisations, Training organisations, Operator organisations, Remote pilots, Regulators, Oversight authorities, General public. The assessment should include (as a minimum): • Development costs incurred to develop a product/system compliant with the standards (e.g. Cost for manufacturers to develop a DAA compliant with EUROCAE/RTCA standard, or an entire UAS compliant with CS-UAS or ISO UAS product standard. Cost for training organization to develop a training course compliant with ASTM standard, cost for Remote Pilots to get a license) • Operational costs related to the limitations coming from the applicability of the selected standard (e.g. if a standard is applicable only to operations in uncontrolled airspace, there is a cost for the operator that cannot fly in controlled airspace. If a	2

	standard is applicable only to rotorcraft, there is a cost related to the efficiency of operations requiring to fly long distances and more suitable for fixed-wing drones) • Time required to complete the development of all products/systems/infrastructures required to comply with the selected standard (e.g. time for Remote Pilots to obtain a license in line with a selected training standard, time for manufacturers to implement production processes that allows to produce UAS compliant with CS-UAS) • Compatibility/consistency with existent standards should be considered as a way to reduce overall costs by possibly reusing products/systems/technologies already developed. • Both one-off and recurring costs shall be identified. All the costs and resources listed here should be measured or derived with an expert judgement taking into consideration the different magnitude and business case of the considered stakeholders. Costs considerations will cover the sustainability and feasibility of the adoption of the considered standard for a certain organization, rather than the absolute value of the sustained costs (e.g. Airbus and DJI may have very different costs for the production of a certain component but with a similar affordability within their respective business cases).	
Environmental impact	Effects on emission of greenhouse gases; noise nuisance; energy and fuel consumption. Effect on areas, scenic view, and resources. Likelihood of causing fires, explosions or accidents. Effects on (local) fauna. Impact can be beneficial, neutral or harmful. For example, a standard directed at reducing consumption of resources has a beneficial impact. On the other hand, a standard may be harmful when, for instance, it induces high noise nuisance or fuel consumption. Standards are expected to have mostly a neutral impact.	1
Impact on EU Industry competitiveness	This criterion defines the impact (both positive and negative) of the adoption of the selected standard on EU industrial stakeholders (manufacturers, operators, service providers,	1

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	etc.) competitiveness. The analysis should consider all affected stakeholders and include (as a minimum): • Cost of compliance specifically for the European stakeholders (high costs mean a negative impact); • Readiness of EU industry in adopting the standard (long times for adoption lead to a negative impact) • Readiness of EU aviation authorities (EASA and NAAs) in adopting the standard (long times for adoption lead to a negative impact) • Potential benefits for EU manufacturers of certifiable technologies (positive impact) or need to rely on non-EU manufacturers to integrate certifiable technology (negative impact) • Both one-off and recurring costs and benefits for EU industry shall be identified.	
Social Acceptance	Social acceptance shall identify behavioural change caused from a selected standard and its content that is being assessed. It assesses: • The attitude change or the degree to which people receive favourably or negatively a standard and the measures it introduces. • Is there acceptance of the standard and its measures by the stakeholders? • Any positive or negative impact on society. Does it have an impact on job creation and demand for labour or improvement in job quality? • What benefit does it bring to the end user but also to society? Is there an impact on employment like making dirty jobs redundant • Does the standard affect market penetration of drones thus making them more acceptable • Does the standard introduces measures that make drones easier to be used for certain applications	1

Table 10: Criteria for step 2 (CASE 3)

Item	-2 (lowest ranking)	-1	0	1	2 (highest ranking)
Impact on relevant KPA	N.A.	N.A.	No impact	N.A.	Positive Impact
Cost of compliance	Very High	High	Medium	Low	Very Low
Environmental impact	Bad	N.A.	Neutral	N.A	Good
Impact on EU Industry competitiveness	Very negative	Negative	No impact	Positive	Very Positive
Social Acceptance	Very negative	Negative	No impact	Positive	Very Positive

Table 11: Criteria and scoring system for step 2 (CASE 3)

Each rating must be accompanied by a rationale.

2.6.3 Conclusions based on weighted score

Depending on the weighted score, the following conclusions will be drawn:

- For a standard that does not correspond with any requirement and has a high ranking, a new requirement will be proposed to match this standard.

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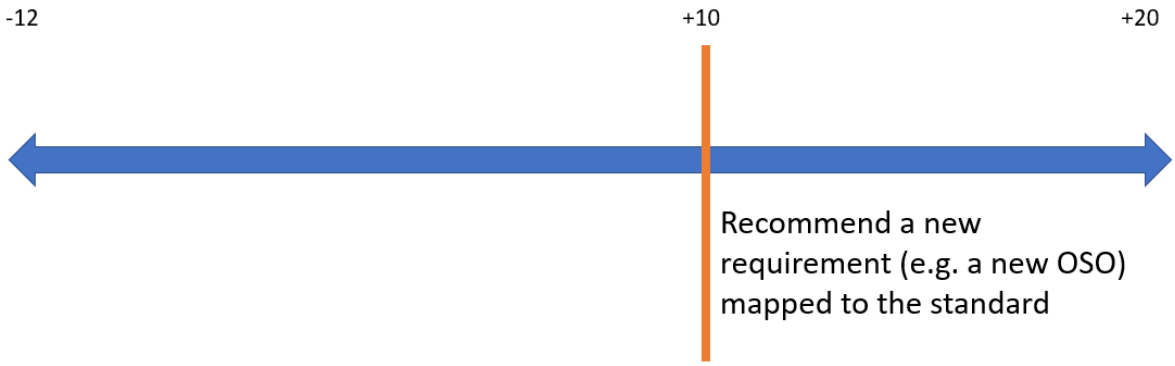

Figure 3, Conclusions for CASE 3 based on weighted score

3 References

1 EASA (https://www.easa.europa.eu/sites/default/files/dfu/EASA%20MB%20Decision%2018-2015%20on%20Rulemaking%20Procedure.pdf)

2 JARUS (http://jarus-rpas.org/sites/jarus-rpas.org/files/imce/attachments/jarus_tor_v06.17_and_annex_scb_tor_130818.pdf)

3 ISO :Proposal Stage* / Preparatory stage / Committee stage / Enquiry stage* / Approval stage / Publication stage* (https://www.iso.org/stages-and-resources-for-standards-development.html)

4 Eurocae (https://www.eurocae.net/media/1567/eurocae-public-twp-2019.pdf)

5 European Commission, Impact Assessment Guidelines, SEC(2009) 92, 15 Jan 2009

6 COMMISSION IMPLEMENTING REGULATION (EU) 2019/947 of 24 May 2019 on the rules and procedures for the operation of unmanned aircraft

7 JARUS guidelines on Specific Operations Risk Assessment (SORA), JAR-DEL-WG6-D.04, Edition 2.0, 30.01.2019

8 Minutes of AW Drones Kick-Off Meeting, 24th January 2019, Ibis Brussels City Centre

9 Study on High Performance Aircraft, Ecorys, Specific contract No SC004 (SAP: 500007063) implementing framework contract No. EASA.2011.FC25, Final Report, Version 2.0, 14 November 2016

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4 Appendix A – example of application of methodology

This section contains an example of the methodology for CASE 1.

Standard	EUROCAE ED-267, Operational services and environment definition for detect & avoid in very low level operations	
SORA requirement	OSO#23 Environmental conditions for safe operations are defined, measurable and adhered to.	
Assessment criteria	**Ranking / score**	**Rationale**
Maturity of standards	0	Under external consultation
Type of standard	2	Standard specification
Effectiveness to fulfill KPA requirement	0	The main purpose of this standard is not the definition of environmental conditions for safe operations, while the main focus is on the detect&avoid system. Nonetheless, it defines standard defines environmental conditions to be considered and describes how to measure them. However, not all environmental conditions that could be encountered during operations are included. For example sand storms, volcanic ash and wind shear are missing. The adherence to environmental conditions for safe operations is dependent on the remote pilot responding to alerts from the DAA system. Remote pilot selection and training is not covered by this standard though. Therefore adherence is not covered.
Cost of compliance	0	At this level (OSED) the cost of compliance for this standard cannot be defined. It will strongly depend on the detect&avoid technologies and their technical standards.
Environmental impact	2	Has a positive effect on local fauna by asserting that the UA must keep clear of flying wildlife.

Impact on EU Industry competitiveness	2	The standard would lead to the development of a wide range of DAA related technologies, such as sensors, lidars, vision systems, transceivers, etc, potentially creating a large business for EU industry. In addition, some databases will be needed (e.g. Digital elevation models) as well as data process algorithms (e.g. data fusion). In conclusion both manufacturers and IT industries would benefit from the adoption of the standard.
Social Acceptance	2	Describes operational scenarios and operating environments that will improve safety under Very Low Level operations thus improving the possibility of negative acceptance from accidents. Also, discusses the necessity of VLL Air Traffic Management services (part of other standards) that can generate additional job vacancies and make such operations safer.
Total score	(3*0)+(1*(2+0))+(3*0)+(1*2)+(1*2)+(1*2) = **8**	

Table 12: Example of application of methodology

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5 Appendix B – feedback received from EASA

Feedback on the draft version of the methodology has been received from EASA during the workshop with EASA on 6-7 June 2019 at EASA in Cologne. The feedback is described in the following table.

Comment	*Accepted/Rejected*	*Rationale*
Criterion 'Relation of SDO to EU regulatory process' shall be deleted.	Accepted	
Criterion 'Impact on EU industry competitiveness' shall be merged with 'cost of compliance'.	Rejected	There is a need to discuss this with other stakeholders such as manufacturers and/or DG-GROW
"Cost of compliance" shall be described more in terms of feasibility or practicability. The cost itself can be misleading as different manufacturers (e.g. DJI vs AIRBUS) might have different cost for producing the same product.	Accepted	
It was questioned whether a rating for the criterion 'Social acceptance' can be determined in a reliable and repeatable way. Results from the project are awaited before it will be decided whether or not to use this criterion.	Accepted	
The criterion 'Regulatory compliance' (which was renamed 'Global harmonisation') shall be deleted because it is judged to be not applicable for standards (only for regulations).	Accepted	
Case 3 (orphan standards) shall be deleted because it is assumed that the SORA requirements are complete.	Partially accepted	In the first iteration Case 3 will not be considered. This choice might be

		reconsidered at a later stage.
Each rating shall be accompanied by a rationale	Accepted	
For criterion 'Effectiveness to fulfil KPA (e.g. SORA) requirement' the rating shall be simplified to no, partial and full coverage. A standard with no coverage should not be assessed further using the other criteria.	Accepted	
For criterion 'Effectiveness to fulfill SORA requirement' the gaps must be indicated in case of partial coverage.	Accepted	
Do not assess planned standards, give highest rating for recognized/accepted/used standards (shift rating to the left by one, add recognized/accepted/used to the right)	Accepted	
'Environmental Impact' criteria: hard to measure. Describe and assess it in terms of e.g. production pollution, noise; reduce to three level (good, neutral, bad); Standards are expected to have mostly a neutral impact.	Accepted	

Table 13: Feedback received from EASA

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