



AW DRONES

AW-Drones - Supporting evaluation of drone standards



This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.

- What is AW-Drones?
- Objectives
- Methodology
- Scope
- Involvement of external experts
- Expected Outcomes



- AW-Drones is a **3-years** Coordination and Support Action (CSA) funded under the EU H2020 program.

- Consortium:

- Coordinator:



- **Collect information** on on-going and planned work with regards to technical and operational **standards** developed for drones worldwide
- Carry out a **critical assessment/benchmarking** of all collected data to identify best practices, gaps, bottlenecks and applicability **... in other words a “metastandard”**
- Propose and **validate** a well-reasoned set of standards for each category of drone operations
- Create a **knowledge base** (online repository) to explore the data
- **Engage** with key stakeholders and end-users, i.e. representatives of the whole drone value chain



Collection of drone standards

→ airworthiness, operations & procedures, ...

EUSCG RDP
ANSI Roadmap

Collection of drone-related and applicable general standards

EUROCAE, RTCA, ISO, ASTM, ...

→ component, subcategories, industrial level

Assessment of standards - categorization & evaluation

→ maturity, safety, cost, suitability ...

Data collection of drone (-related) standards

General Data		Drone Category	Categorization			
Domain Topic Subtopic	Document Data Type N° Title Organization Status Description		Open Spec Cert	Affected OSOs #01 ... #24	Affected GRM M1 [1...2] M2 ERP	Affected ARM Strat Tact

Actual Data



EUSCG Rolling development plan



ANSI Standardization Roadmap for Unmanned Aircraft Systems



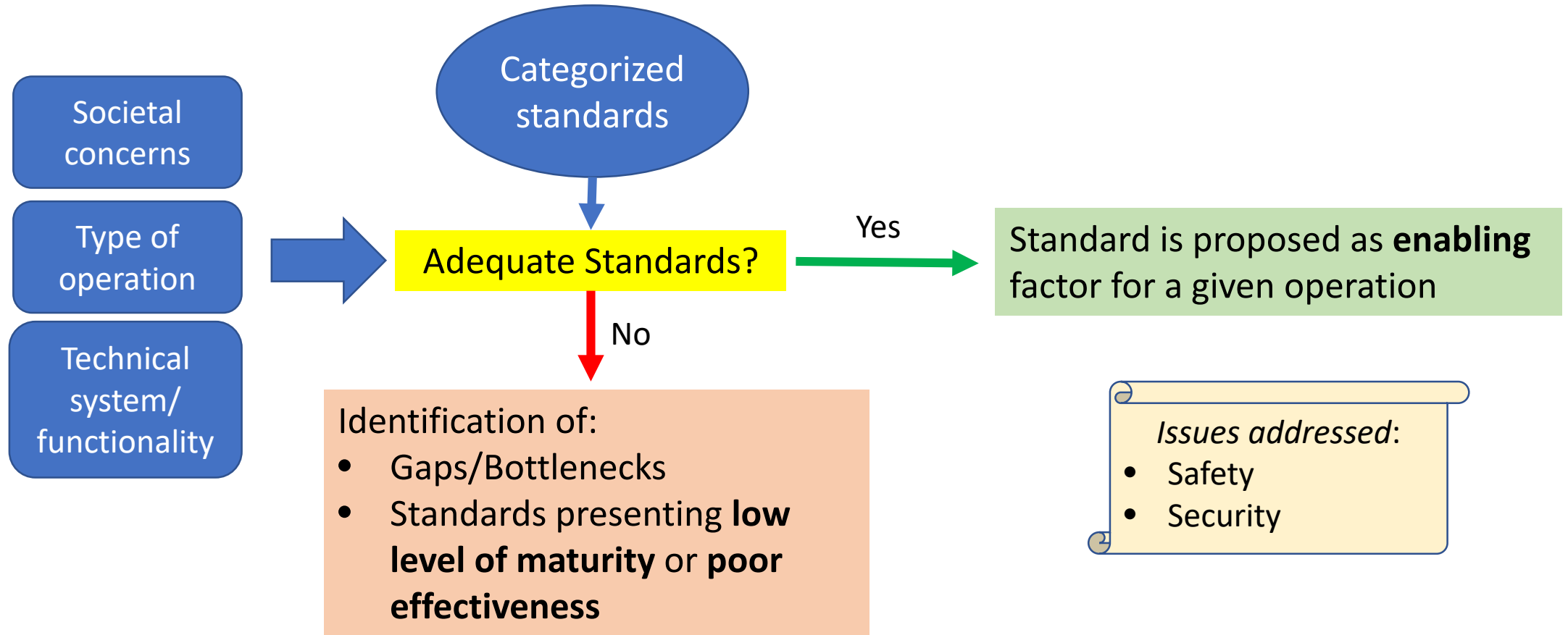
ASTM UAS Roadmap



Collection of other applicable standards (ASTM, ISO, DIN, RTCA, SAE, ...)



Methodology - Developing a “meta” standard




Three different **cases** can be identified:

- **CASE 1:** a standard **potentially** suitable to comply with a certain requirement (e.g. OSO #6)
- **CASE 2:** **NO standard** suitable to comply with a certain requirement (e.g. OSO #XX)
- **CASE 3:** a standard **not mappable** with any requirement (“orphan” standard)



Each CASE will be assessed using “tailored” Multi Criteria Analysis

- **Analytic method to compare and rank options**
 - Allows to translate any assessment (qualitative or quantitative with different units of measurements) into **non-dimensional numerical scores ... which can be algebraically summed**
 - Scores may have different **'weight'**
 - Allows to scope analysis considering **any relevant perspective:**
 - **Standards maturity**
 - **Effect on Safety**
 - **Cost**
 - **Regulatory compliance**
 - **Effect on environment**
 - **Etc.**
- 
- Recommendations** for Authorities/
Standard Making Bodies on the basis
of the results (i.e. the weighted
algebraic totals)

Although the exact wording may differ, all organisations/groups involved in developing standards apply a similar process, or work flow.

In essence the following development phases can be distinguished:

- Drafting
- Internal Consultation
- External Consultation
- Published
- Recognised / accepted / used by EU Authorities/FAA

Description

Scoring

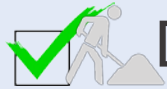
-2 (lowest ranking)	-1	0	1	2 (highest ranking)
Drafting	Internal Consult.	External Consult.	Published	Recognised / accepted / used



Progress



Data collection



Data mapping to SORA



Data assesement

Status

Currently > 600 standards collected

~50% mapped to SORA requirements

~70% of the mapped stadards assessed

- Year 1: Standards required to support effectively the Specific Operations Risk Assessment (**SORA**) methodology
- Year 2: Standards supporting the development of **U-Space** in Europe
- Year 3: Standards needed to support the operation of **highly automated UAS** and to ensure that they can be operated safely in a variety of applications



Iterative approach

Results will be regularly updated

AW-DRONES PUBLIC EVENTS

JANUARY 2019
START OF PROJECT

AUTUMN 2019
"DRONE OPERATIONS IN THE SPECIFIC CATEGORY" WORKSHOP

AUTUMN 2020
"U-SPACE" WORKSHOP

SUMMER 2021
"AUTONOMOUS UAS OPERATIONS" WORKSHOP

DECEMBER 2021
PRESENTATION OF AW-DRONES FINDINGS

DECEMBER 2021
END OF PROJECT



RELEASE OF AW-DRONES PROPOSED STANDARDS

DECEMBER 2019
SORA
DRONE OPERATIONS IN THE SPECIFIC CATEGORY

DECEMBER 2020
U-SPACE
UNMANNED TRAFFIC MANAGEMENT

DECEMBER 2021
AUTONOMOUS UAS
OPERATIONS



- An **yearly report** about “State-of-the-Art” of standards for UAS
- An yearly report containing a “**well-reasoned**” **set of standards**:
 - Applicability
 - Maturity
 - Safety Effectiveness
- An **open repository** containing structured information about technical rules, procedures and standards for drones worldwide, including applicability to different UAS OPS categories and different SAIL = **metastandard**





<http://www.aw-drones.eu/>





AW DRONES

Thank you for the attention

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Backup slides



General	<ul style="list-style-type: none"> Definitions Classification of UAS operations Manuals Classification of drones
Design & Airworthiness (at product level)	<ul style="list-style-type: none"> Manufacturer organization (design & production) Maintenance Design Production Systems safety assesment Electrical System Propulsion systems Fuel Noise & Environment Level of Automation/Autonomy Flight Control System Management of Continuous Airworthiness Electromagnetic Compatibility and Lightning Protection Software Development & Assurance Emergency capabilities & Health monitoring Structures Flight Handling Performance Ground Control Station
Avionics & Equipment	<ul style="list-style-type: none"> General Communication Detect and Avoid Navigation Lights Cyber-security Instruments Traffic surveillance (tracking) Command and Control (C2) Link

Operations	<ul style="list-style-type: none"> General Security (operator's responsibility) Marking and Registration Level of Automation/Autonomy Operator organization C2 Link Service Provider RPS Service Provider Ground Handling Service Standard Scenarios Accident/Incident investigation UAS-ATM (IFR above VLL and below FL 600) Take-off/Landing zones (urban vertiports) Risk Assessment (Operations)
	<ul style="list-style-type: none"> Remote Pilot competence UAS Maintenance personnel competence Additional crew members competence (non-regulated professions) Human Factors Instructors Examiners Assessors Training organizations
	<ul style="list-style-type: none"> General E-Identification Service Providers Tracking Geo-awareness
	<ul style="list-style-type: none"> Notified bodies and Qualified Entities

- **CASE 1: standard potentially suitable to comply with a certain requirement (e.g. OSO #6)**
 - Assessment criteria

Item	Level -2 (lowest ranking)	Level -1	Level 0	Level 1	Level 2 (highest ranking)
Effectiveness to fulfill KPA requirement	N.A.	N.A.	Partial coverage	N.A.	Full coverage
Maturity	Drafting	Internal Consult.	External Consult.	Published	Recognized / Accepted / Used
Type of standard	N.A.	N.A.	Information Guidance	Best Practice	Standard Specification
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

Example Criterion: Effectiveness to fulfill reqs.

Description

- 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.

Scoring

-2 (lowest ranking)	-1	0	1	2 (highest ranking)
		No coverage	Partial coverage	Full coverage



- **CASE 1:** a standard **potentially** suitable to comply with a certain requirement (e.g. OSO #6)
 - Assessment criteria

Criterion	Weight
Effectiveness to fulfill KPA requirement	3
Maturity	1
Type of standard	1
Cost of compliance	2
Environmental impact	1
Impact on EU Industry competitiveness	1
Social Acceptance	1

5 LEVEL SCORES FOR EACH CRITERION:
-2, -1, 0, 1, 2

-26  +26

MIN/MAX TOTAL WEIGHTED SCORE

➤ CASE 1: a standard **potentially** suitable to comply with a certain requirement (e.g. OSO #6)

-20

0

+10

+20



- i. Identify possible applicable standards from manned aviation or other industry segments (e.g. automotive); or
- ii. Recommend the amendment of the standard

standard listed as possible AMC subject to decision by Authority (possibly case-by-case)

standard is recommended as preferred AMC