EASA
European Union Aviation Safety Agency

U-space workshop

From the concept to the implementation

Cologne June 22, 23 2023

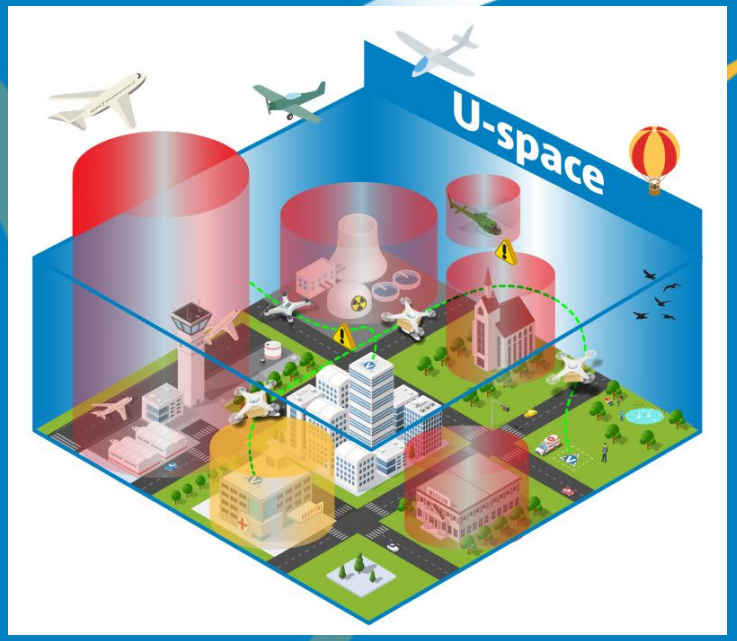
Your safety is our mission.

An Agency of the European Union

EASA
European Union Aviation Safety Agency

Workshop opening and introduction

Maria ALGAR RUIZ, EASA
Programme Manager - Drones



Established
2002

20 YEARS

EASA
European Union Aviation Safety Agency

800+
aviation experts
& administrators

Headquarters in
Cologne
Office in
Brussels

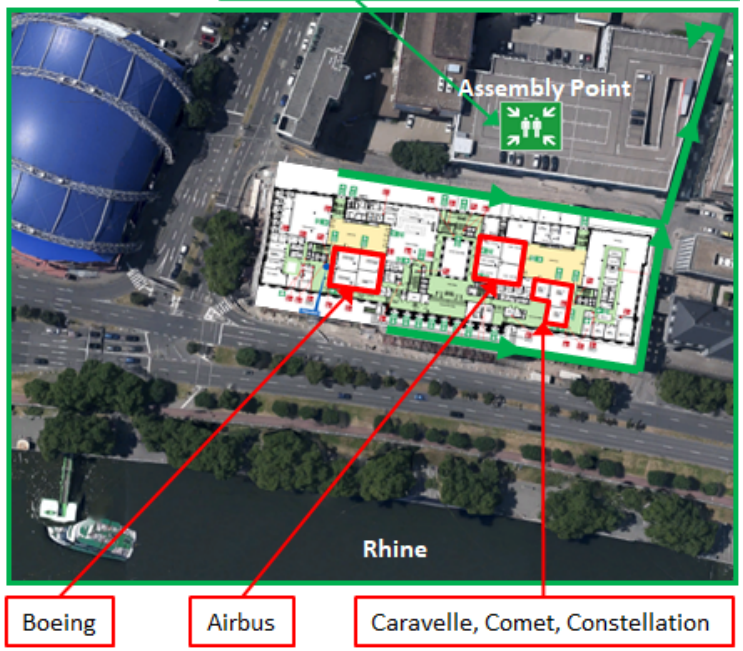
31 EASA member states
= **27** + **4**
EU + Switzerland, Norway
Iceland, Liechtenstein

EASA

Evacuation instructions: conference rooms

Escape route

Assembly Point: EASA Parking: Parkhaus Rhein Triadem, 3rd & 4th floor



EASA Emergency Number: 1111
In case of emergency call: **1111**
The desk phones have a emergency speed dial button.

1. when to Evacuate

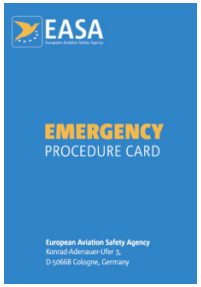
a) Following acoustic signal
b) Following instructions by emergency team

2. Evacuation signal and route

Signal: Continuous siren and/or voice message over loudspeaker
Routes: Nearest fire exit

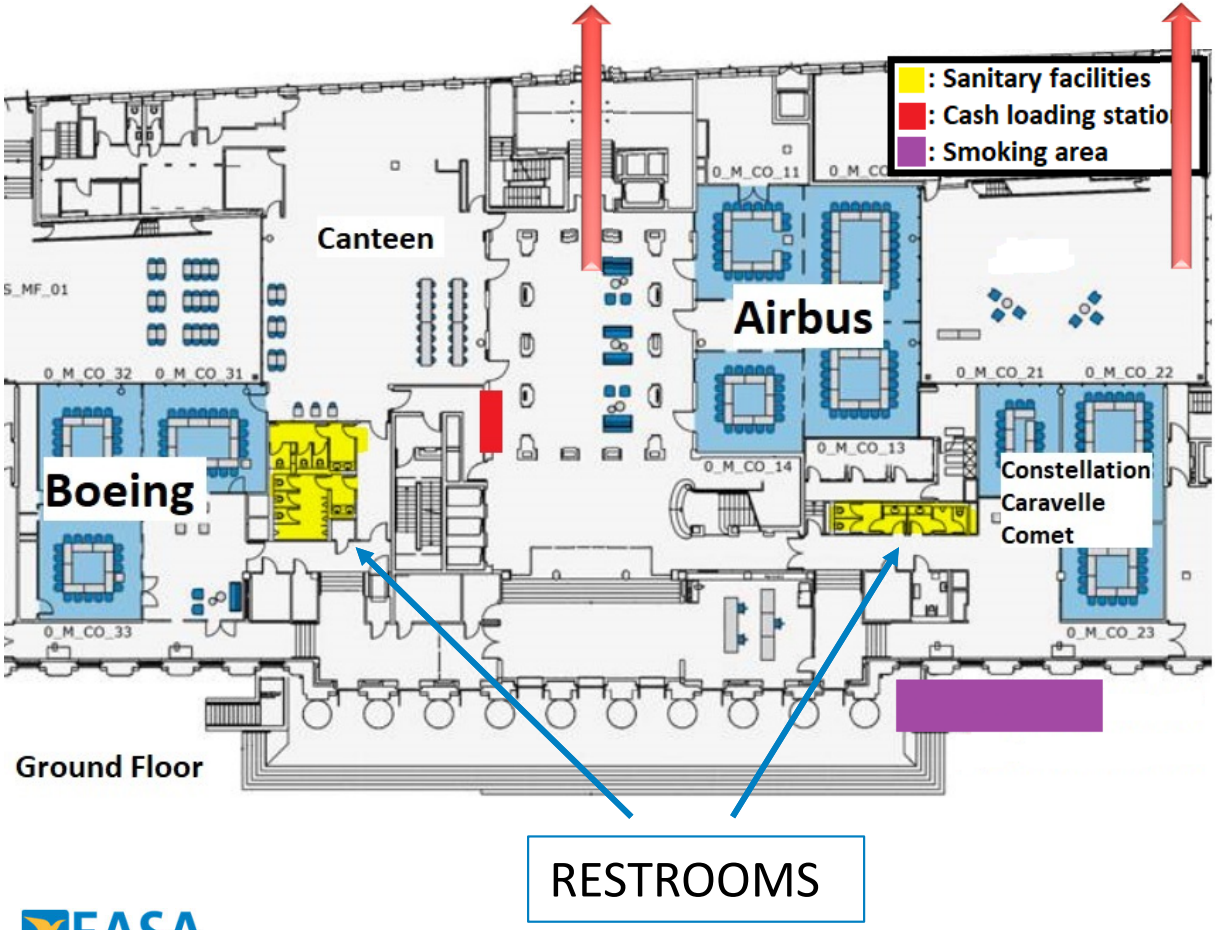
3. Evacuation procedure

a) Warn other people, help handicapped or injured persons
b) Only use stairs and marked escape routes
c) Do not use lifts
d) Do not return to collect personal belongings
e) Go directly to the assembly point
f) Do not return to the building until instructed to do so



Find more information at your **EASA Emergency Procedure Card** on your visitor lanyard!

EASA Direktion house rules



→ Respect

- → For phone calls kindly use the phone booths or the lobby
- → Do not disturb colleagues in the office spaces

→ Hospitality

- → EASA Bistro welcomes visitors but only accept bank card payments

→ Health

- → The whole building is a non-smoking zone
- → Smoking is allowed in front of the building to your right

→ Safety

- → For evacuation purposes, re-arranging the seating configuration of the room is forbidden
- → Do not open the IT floor tank, and do not use the wall plugs
- → Luggage are not permitted in the meeting room, ask the reception

EASA Drone Project Team

Justin CHIREA
Drone Project Manager

Stéphane VAUBOURG
Drone Project Manager

Ken ENGELSTAD
Drone Project Manager

Alberto CUNIAL
Drone Junio Professional

Laury Anako
Drone Project
Management Assistant

Sacha SCHOTT
Drone Section Manager

Maria ALGAR Ruiz
Drone Programme Manager

Thomas OSTER
Drone Project Manager

Giuseppe SCANNAPIECO
Drone Project Manager

Natale DI RUBBO
Drone Project Manager

Kai BAUER
IAM HUB Project Manager

Workshop agenda

Day 1	Thursday, 22 June 2023
09:00 – 09:30	Workshop opening
09:30 – 10:15	What is U-space?
	• *Why U-space - where are we coming from?* • *U-space principles* • *Overview of the regulatory framework* • *Presentation of the EASA/MS TF on s-CISP / USSP certification*
10:15 – 12:30	Roles and Responsibilities in the U-space – Part I
10:15 – 10:25 *10:25 – 10:40* *10:40 – 11:10* *11:10 – 11:25* *11:25 – 12:05* *12:05 – 12:30*	• *Introduction* • *R&R: MS + CA* • *R&R: CA, Art 18(f) – Coordination* • *~15 min break* • *R&R: MS, Art 3 – ARA* • *Final Q&A*
12:30 – 13:30	Lunch break
13:30 – 16:30	Roles and Responsibilities in the U-space – Part II *(including ~15 minutes break)*
13:30 – 14:15 *14:15 – 15:00* *14:45 – 15:00* *15:00 – 15:30* *15:30 – 16:00* *16:00 – 16:30* *16:30 – 16:45* *16:45 – 17:00*	• *R&R: CIS, Art 5 -CIS + outcome of the TF* • *R&R: ATM, Art 4 - DAR (& 2021/665) + outcome of the TF* • *~15 min break* • *R&R: USSP, Art 7* • *R&R: UAS operators, Art 6* • *R&R: Manned aircraft, e-conspicuity (2021/666)* • *R&R: Joint responsibilities, data quality and continuity of services* • *Final Q&A*
17:00 – 17:30	Closure of the day

Day 2	Friday, 23 June 2023
09:00 – 09:15	Day 2 opening
09:15 – 12:00	U-space services
09:15 – 09:25 *09:25 – 09:40* *09:40 – 09:55* *09:55 – 10:25* *10:25 – 10:40* *10:40 – 11:00* *11:00 – 11:15* *11:15 – 11:30* *11:30 – 12:00*	• *Introduction* • *Art 8 – Network Information* • *Art 9 – Geo-awareness* • *Art 10 – Flight Authorisation* • *~15 min break* • *Art 11 – Traffic Information* • *Art 12 – Weather Information* • *Art 13 – Conformance monitoring* • *Q&A*
12:00 – 12:30	Evolutions of the AMC/GM to the U-space regulatory framework
12:30 – 13:15	Lunch break
13:15 – 15:30	Single CISP & USSP certification framework and process
13:15 – 13:20 *13:20 – 13:50* *13:50 – 14:10* *14:10 – 14:30* *14:30 – 14:45* *14:45 – 15:00* *15:00 – 15:10* *15:10 – 15:30*	• *Introduction* • *Certification framework, tasks & effort, preliminary view on oversight* • *Organisation and SMS* • *Safety Assessment vs Safety Support Assessment* • *Software (+automated verification)* • *Cyber (+Part IS)* • *On-boarding process* • *Final Q&A*
15:30 – 16:00	Workshop closure

Rules of play

→ After each (set of) presentation we will have a Q&A session

→ Use **sli.do #USPACE** passcode: **czkgxo**

→ We are unable to monitor chats of Webex

SLI.DO

sdvvfrgh= **czkgxo**

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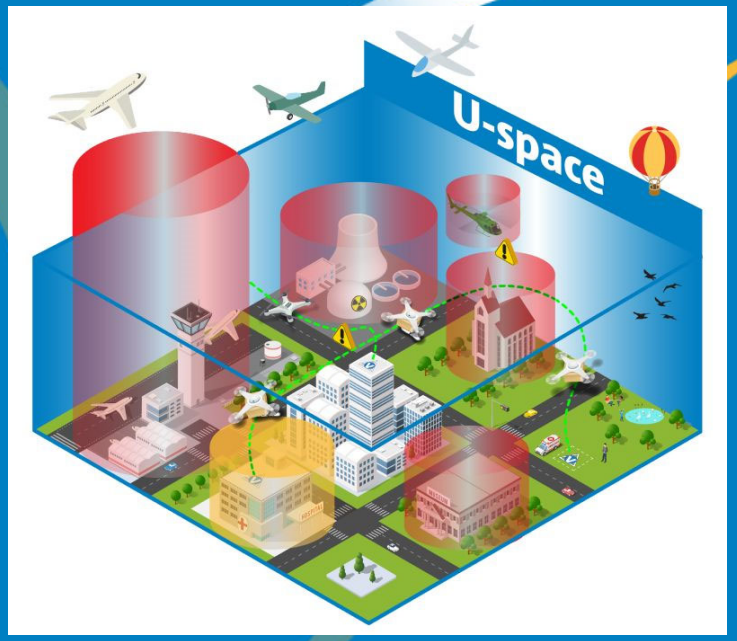
European Union Aviation Safety Agency

#USPACE
czkgxo

What is U-space ?

Maria ALGAR RUIZ, EASA
Programme Manager – Drones

Stéphane VAUBOURG, EASA
Drones Project Manager – U-space



Why U-space-Where we are coming from?

Warsaw's Declaration

High level Conference on Drones **24.11.2016** U-space by Transport Commissioner

SESAR 3JU U-space Blueprint

On 09.06.2017

U-space Network of Demonstrators

Established by EC on **19.10.2018** with the support of EASA, EUROCONTROL, SESAR 3JU

EASA's Opinion on 13.03.2020

U-space Regulations published on 21.04.2021

EASA's ED Decision with AMC/GM to U-space Regulations on 20.12.2022

Regulatory developments

EU Drone Strategy 2.0 published on 29.11.2022

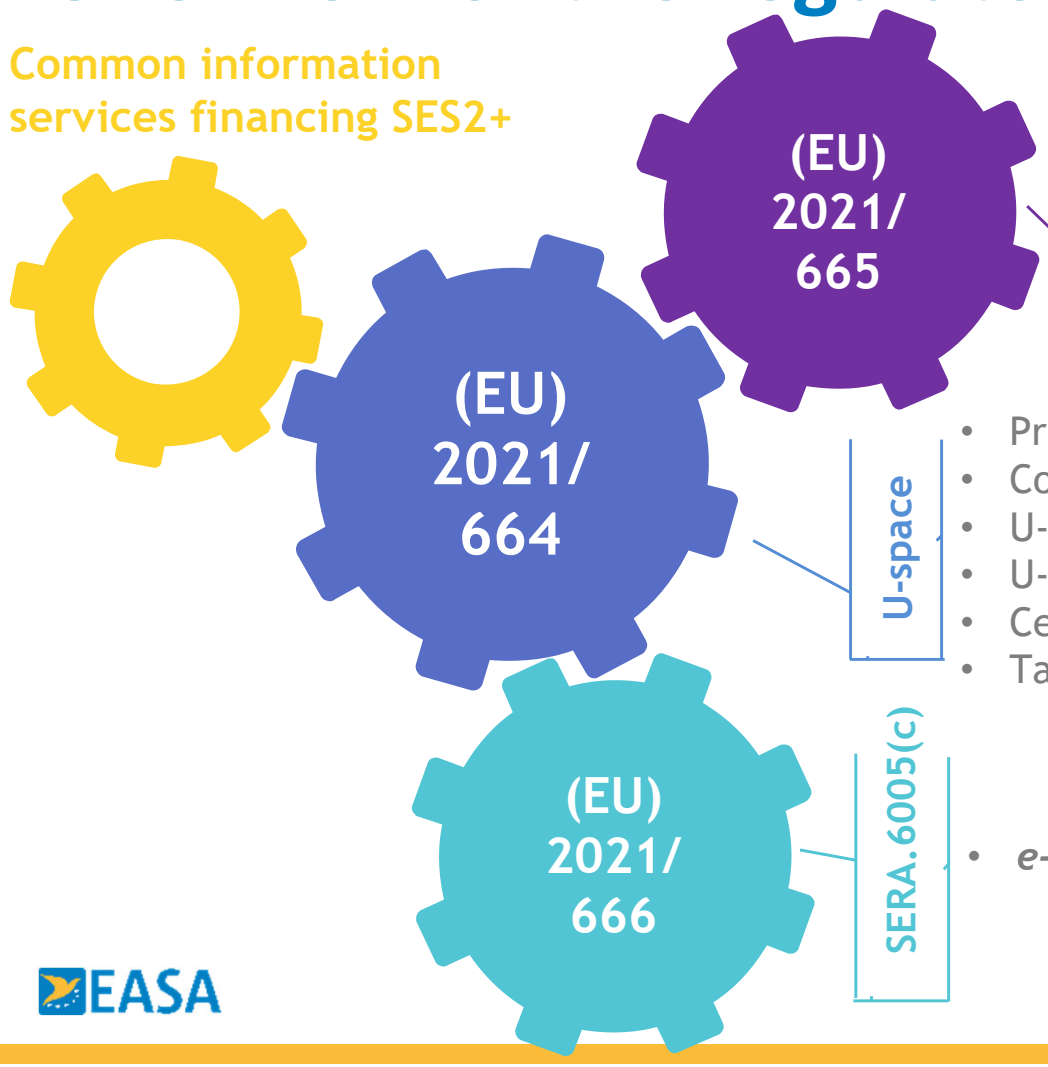
Enter into force of U-space regulations on 25.01.2023

Why U-space ? - the problem to solve and present limitations

- → Enable BVLOS flights and more complex UAS operations e.g. urban environment, close to airport
- → UAS SORA based authorisation is granted to each UAS operation but SORA does not address risk of UA to UA collision
- → There are other risks to consider (e.g. environment, security and privacy)
- → Air risk is often mitigated by a temporary airspace restriction, preventing a fair access to the other airspace users.

Overview of the regulatory framework 1/2

Common information services financing SES2+



ATM/ANS

- Provisions for ATS providers in relation to dynamic airspace reconfiguration in the U-space airspace

U-space

- Provisions on MS for designation of U-space airspace
- Common information service and (CIS) provider
- U-space service providers (USSP)
- U-space services
- Certification a CIS provider and U-space service providers
- Tasks of the Competent Authorities

SERA.6005(c)

- ***e-conspicuity*** for manned aircraft in U-space airspace

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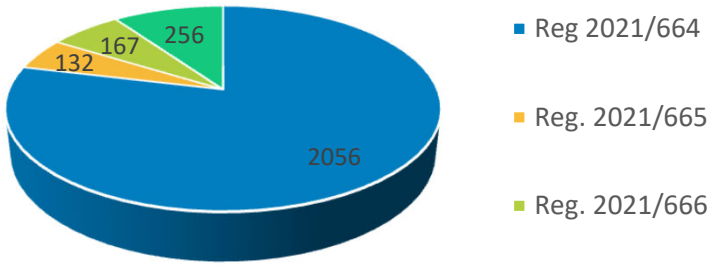
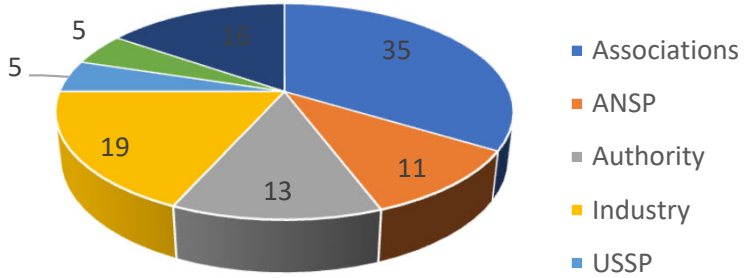
Overview of the regulatory framework 2/2

- EASA Opinion on U-space, published the April 2021
- Regulations (EU) 2021/664, 665, 666 published April 2021
- NPA 2021-14, AMC/GM published December 2021

2611 comments



104 stakeholders



- First version of the AMC/GM published December 2022 (alongside with EN and CRD)

Regulations have entered into force 26 January 2023

What is U-space?

WHY ?

- to enable fair and efficient sharing and use of the airspace
- to enable dense drones operations
- to enable complex and long distance UAS operations (BVLOS)
- to enable operations in urban environment
- **to ensure safe separation between manned aircraft and drones**
- **to ensure safe flights and operations of drones in the airspace**

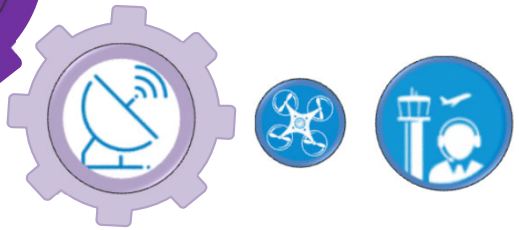
Volume of airspace

Geographical zone designated by the Member State on the basis of a risk assessment and considering safety, security, environment and privacy

A set of services

Information exchange

DIGITAL distribution of information and data relying on conventional internet services
Automated processing/decisions with limited human involvement



e-conspicuity

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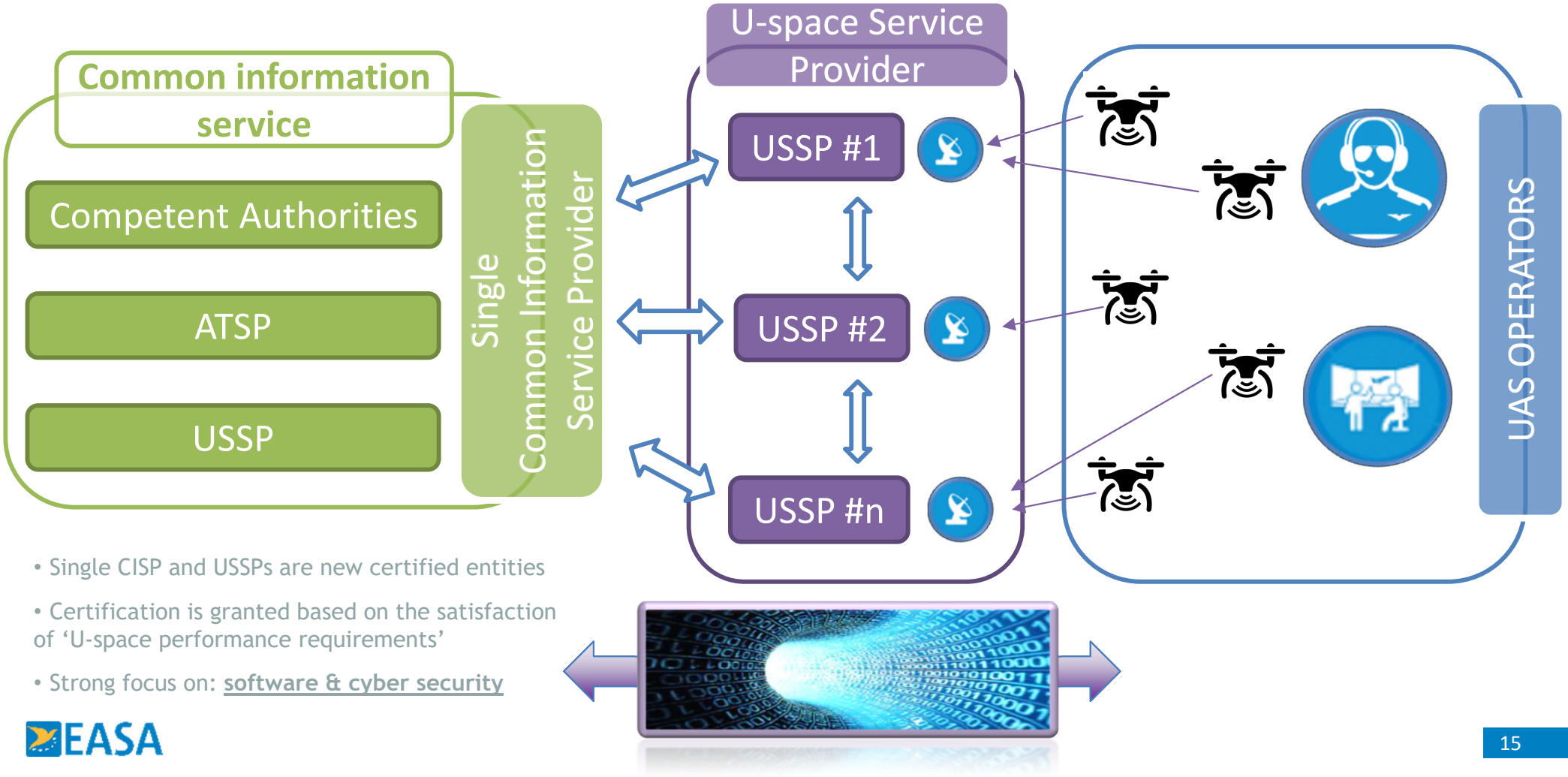
U-space architecture



- Single CISP and USSPs are new certified entities
- Certification is granted based on the satisfaction of 'U-space performance requirements'
- Strong focus on: **software & cyber security**

EASA

Safety and separation with manned aircraft

Mitigation layers

Strategic: U-space designation

Pre-tactical: Geo awareness; UAS flight authorisation

Tactical: Traffic info; Conformance monitoring; Geo awareness

Priority rules

Special operations

UAS Operators

Ensure **anticollision** relying on permanent situational awareness

U-space airspace

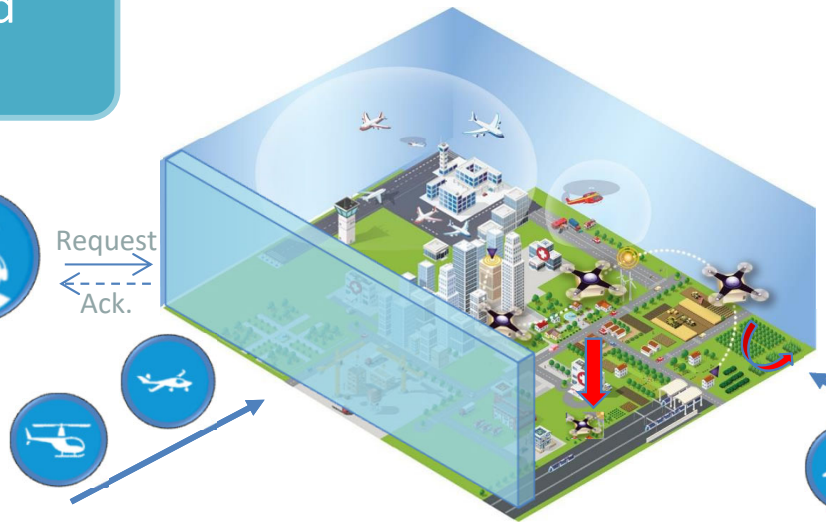
Controlled Aircraft

Dynamic Airspace Reconfiguration

(total or partial deactivation of the U-space airspace)

Request

Ack.



Uncontrolled Aircraft

e-Conspicuity

(anti-collision maneuvers are performed by the UAS operators)

U-space airspace designation

Identification of needs

From:
Members States,
USSP, Operators

Hazard identification

Air risk and ground risks collateral to mid-air collision
AND risks on:
security,
privacy, environment

Risk Analysis

Evaluation of the likelihood and severity of the effects induced by the hazards;
Determination of mitigations

U-space airspace design & constraint

U-space services performance requirements

UAS performance requirements

Responsibility of Member states

Public hearing

Involving U-space actors & citizens

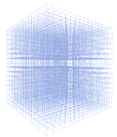
Public acceptance

Constant liaison and consolidation with U-space actors

U-space constraints and performance requirements

U-space Airspace Design

- Geographical limits (recommended up to 500ft AGL)
- Internal U-space airspace structure
- Operational limitations (e.g. restriction in time)

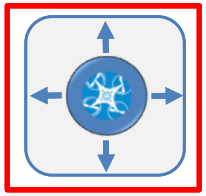


- Weather limitations and weather minimums (e.g. max. wind, visibility)
- Maximum capacity of UAS operations
- Minimum spacing, between:

U-space Services

- Set of U-space services required to be provided to the operators
- 'geographic proximity', 'surveillance volume'

- 'deviation thresholds', along the UAS flight path or operational volume



- 'latency' and 'frequency'/'refresh rate' to ensure validity of data
- Constraints ensuring an effective and fair use of the U-space airspace

UAS

- Climb/descent rates or vertical speed, horizontal speed
- autonomy/range/endurance
- Noise level
- Connectivity
- Required navigation equipment
- Flight data accuracy, integrity and latencies (refresh rate)
- Availability and integrity of the command-and-control link
- Resilience to environmental conditions
- Resilience to cyber threats and expected security measures

U-space is/does NOT (at this stage)

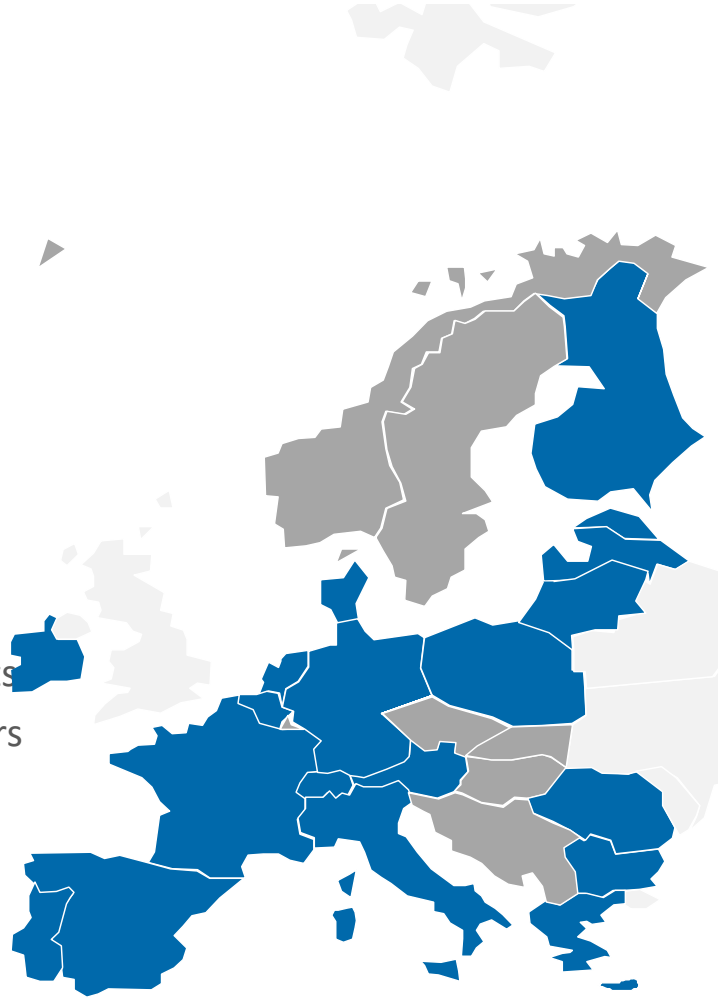
- An equivalent to (EU) 2017/373 for ATM/ANS (even if sharing similar spirit)
- An integrated airspace between manned and unmanned aircraft
- A controlled airspace (i.e. operations inside the U-space airspace are not placed under the responsibility of an ATC or “UTM controller”)
- Provide traffic information to manned aircraft
- Support to IFR drones operations
- Support operation with human passengers (e.g. autonomous “Air Taxi”)

U-space is/does 

- A safe and automated access to the airspace
- “Deconflicted” UAS operations
- Supported by certified and oversight service providers
- A coordinated airspace, including special (state) operations
- Ensure safety continuum with manned aviation
- An enabler for U-space operators
- A catalyzer for the drones market

Task Force on certification

- 19 Member States
- Objectives:
  - To support national competent authorities for regulatory compliance
  - To facilitate the U-space implementation
  - To exchange and develop best practices for certification
  - To ensure interoperability and harmonisation
- Work Packages:
  - WP1: Air Risk Assessment and definition of performance requirements
  - WP2: CIS + operational interfaces/interactions between U-space actors
  - WP3: s-CISP/USSP certification + continuous oversight
- Outputs and deliverables:
  - Clarifications and recommendations, e.g. white papers, FAQ
  - Certification material, e.g. application form, checklists
  - Set of BEST PRACTICES



Should be maintained until end 2023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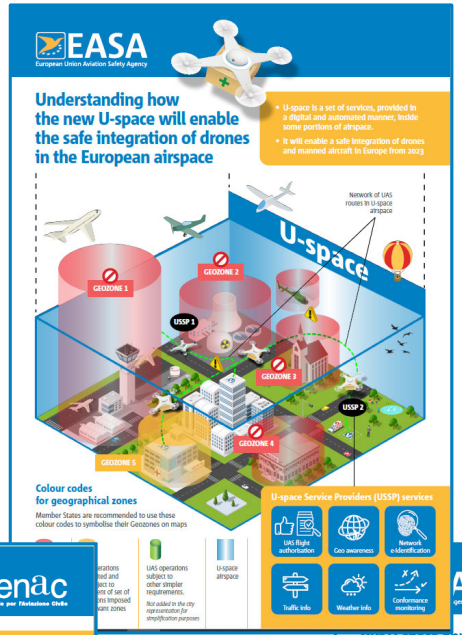
European Union Aviation Safety Agency
AESA
AGENCIA ESTATAL DE SEGURIDAD AÉREA
Cómo el nuevo U-space permitirá la integración segura de drones en el espacio aéreo europeo
• U-space es un conjunto de servicios, prestados de manera digital y automatizada, dentro de algunas porciones del espacio aéreo.
• Permitirá una integración segura de drones y aeronaves tripuladas en Europa a partir de 2023
Red de rutas UAS en el espacio aéreo U-space
U-space
Zona geográfica 1
Zona geográfica 2
Zona geográfica 3
Zona geográfica 4
Zona geográfica 5
USSP 1
USSP 2
Códigos de colores para zonas geográficas
Se recomienda a los Estados miembros que utilicen estos códigos de color para simbolizar sus zonas geográficas en los mapas.
Las operaciones de UAS están prohibidas en general.
Las operaciones de UAS están limitadas y sujetas al cumplimiento de un conjunto de condiciones impuestas para zonas relevantes.
Operaciones UAS sujetas a otros requisitos más simples.
No utilizado en la representación de la ciudad para mayor simplificación.
Espacio aéreo del espacio U
Servicios de proveedores de servicios de U-space (USSP)
Autorización de vuelo para UAS
Servicio de geoconsciencia
Red de identificación electrónica
Información sobre tráfico
Información meteorológica
Monitorización de la conformidad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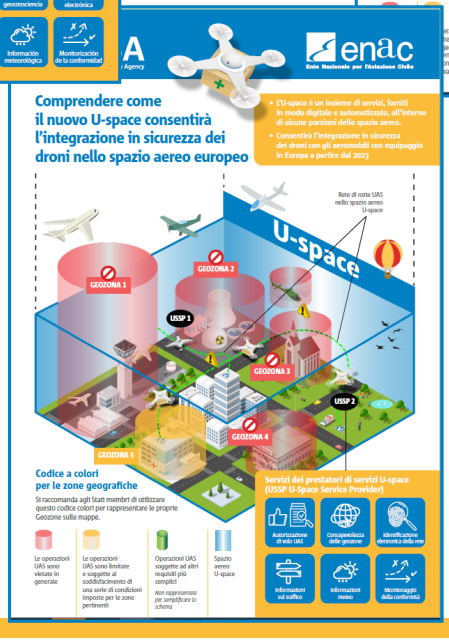
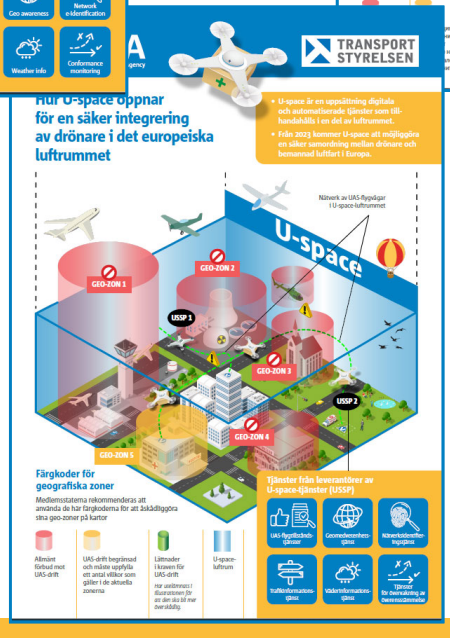
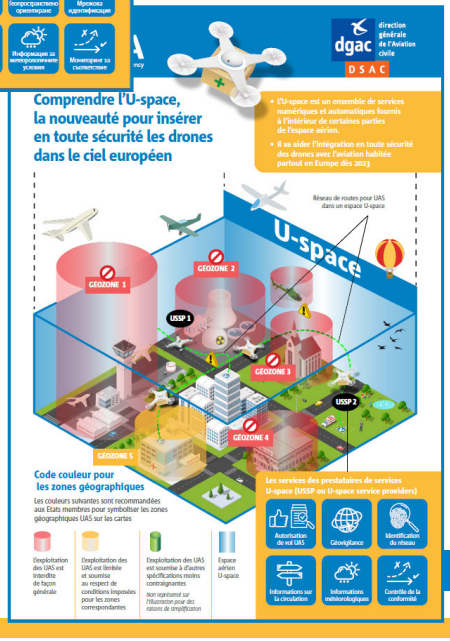
European Union Aviation Safety Agency
Understanding how the new U-space will enable the safe integration of drones in the European airspace
• U-space is a set of services, provided in a digital and automated manner, inside some portions of airspace.
• It will enable a safe integration of drones and manned aircraft in Europe from 2023
Network of UAS routes in U-space airspace
U-space
GEOZONE 1
GEOZONE 2
GEOZONE 3
GEOZONE 4
GEOZONE 5
USSP 1
USSP 2
Colour codes for geographical zones
Member States are recommended to use these colour codes to symbolise their Geozones on maps
UAS operations subject to other simpler requirements.
Not added in the city representation for simplification purposes
U-space airspace
U-space Service Providers (USSP) services
UAS flight authorisation
Geo-awareness
Network e-identification
Traffic info
Weather info
Conformance monitoring


EASA
European Union Aviation Safety Agency
ГРАЖДАНСКА ВЪЗДУХОПЛАВАТЕЛНА АДМИНИСТРАЦИЯ
U-space, новост за безопасното интегриране на дронове в европейското въздушно пространство
• U-space представлява набор от цифрови и автоматизирани услуги, предоставени в определени части на въздушното пространство.
• От 2023 ще спомогне за безопасно интегриране на дронове и пилотирана авиация в цяла Европа
Мрежа от маршрути на БПС във въздушно пространство U-space
U-space
ГЕОЗОНА 1
ГЕОЗОНА 2
ГЕОЗОНА 3
ГЕОЗОНА 4
ГЕОЗОНА 5
USSP 1
USSP 2
Цветови кодове за географски зони
Препоръчва се на държавите-членки да използват следните цветове за обозначаване на географските зони на БПС на картите:
Експлоатацията на БПС е предмет на други опростени изисквания
Не е илюстрирано на снимката
Въздушно пространство U-space
Услуги на доставчиците на обслужване за U-space (USSP или U-space service provider)
Разрешение за полети на БПС
Безпроблемно ориентиране
Мрежова идентификация
Информация за движението
Информация за метеорологичните условия
Мониторинг за съответствие


A
enac
Ente Nazionale per l'Aviazione Civile
Comprendere come il nuovo U-space consentirà l'integrazione in sicurezza dei droni nello spazio aereo europeo
• L'U-space è un insieme di servizi, forniti in modo digitale e automatizzato, all'interno di alcune porzioni dello spazio aereo.
• Consentirà l'integrazione in sicurezza dei droni con gli aeromobili con equipaggio in Europa a partire dal 2023
Rete di rotte UAS nello spazio aereo U-space
U-space
GEOZONA 1
GEOZONA 2
GEOZONA 3
GEOZONA 4
GEOZONA 5
USSP 1
USSP 2
Codice a colori per le zone geografiche
Si raccomanda agli Stati membri di utilizzare questo codice colori per rappresentare le proprie Geozone sulle mappe.
Le operazioni UAS sono vietate in generale
Le operazioni UAS sono limitate e soggette al soddisfacimento di una serie di condizioni imposte per le zone pertinenti
Operazioni UAS soggette ad altri requisiti più semplici
Non rappresentato per semplificare lo schema
Spazio aereo U-space
Servizi dei prestatori di servizi U-space (USSP U-Space Service Provider)
Autorizzazione di volo UAS
Consapevolezza delle geozone
Identificazione elettronica della rete
Informazioni sul traffico
Informazioni meteo
Monitoraggio della conformità


A
TRANSPORT STYRELSEN
Hur U-space öppnar för en säker integrering av drönare i det europeiska luftrummet
• U-space är en uppsättning digitala och automatiserade tjänster som till-handahålls i en del av luftrummet.
• Från 2023 kommer U-space att möjliggöra en säker samordning mellan drönare och bemannad luftfart i Europa.
Nätverk av UAS-flygvägar i U-space-luftrummet
U-space
GEO-ZON 1
GEO-ZON 2
GEO-ZON 3
GEO-ZON 4
GEO-ZON 5
USSP 1
USSP 2
Färgkoder för geografiska zoner
Medlemsstaterna rekommenderas att använda de här färgkoderna för att åskådliggöra sina geo-zoner på kartor
Allmänt förbud mot UAS-drift
UAS-drift begränsad och måste uppfylla ett antal villkor som gäller i de aktuella zonerna
Lättnader i kraven för UAS-drift
Har utelämnats i illustrationen för att den ska bli mer överskådlig
U-space-luftrum
Tjänster från leverantörer av U-space-tjänster (USSP)
UAS-flygförbuds-tjänster
Geomedvetenhets-tjänst
Nätverksidentifier-ingstjänst
Trafikinformations-tjänst
Väderinformations-tjänst
Tjänster för övervakning av överensstämmelse


dgac
direction générale de l'Aviation civile
DSAC
Comprendre l'U-space, la nouveauté pour insérer en toute sécurité les drones dans le ciel européen
• L'U-space est un ensemble de services numériques et automatiques fournis à l'intérieur de certaines parties de l'espace aérien.
• Il va aider l'intégration en toute sécurité des drones avec l'aviation habitée partout en Europe dès 2023
Réseau de routes pour UAS dans un espace U-space
U-space
GEOZONE 1
GEOZONE 2
GEOZONE 3
GEOZONE 4
GEOZONE 5
USSP 1
USSP 2
Code couleur pour les zones géographiques
Les couleurs suivantes sont recommandées aux États membres pour symboliser les zones géographiques UAS sur les cartes
L'exploitation des UAS est interdite de façon générale
L'exploitation des UAS est limitée et soumise au respect de conditions imposées pour les zones correspondantes
L'exploitation des UAS est soumise à d'autres spécifications moins contraignantes
Non représenté sur l'illustration pour des raisons de simplification
Espace aérien U-space
Les services des prestataires de services U-space (USSP ou U-space service providers)
Autorisation de vol UAS
Géovigilance
Identification du réseau
Informations sur la circulation
Informations météorologiques
Contrôle de la conformité

EASA

EASA
European Union Aviation Safety Agency

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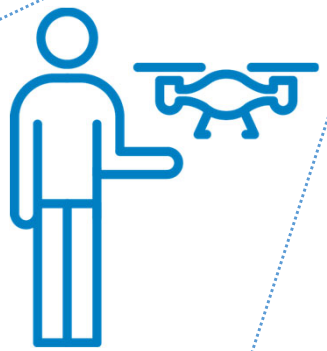
Roles and Responsibilities in the U-space
- #0 - Introduction

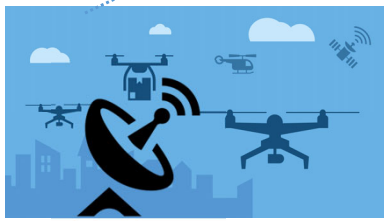
Stéphane VAUBOURG, EASA
Drones Project Manager – U-space

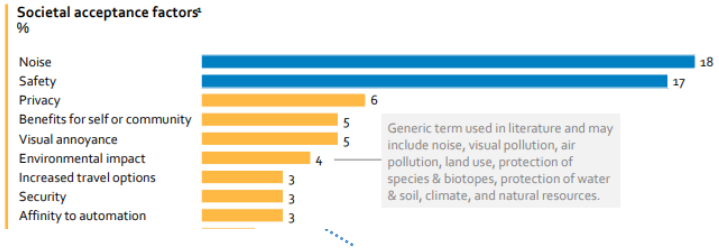
U-space stakeholders

Authorities at national, regional and local State services (e.g. law enforcement and emergency services, ATM)

Competent Authorities



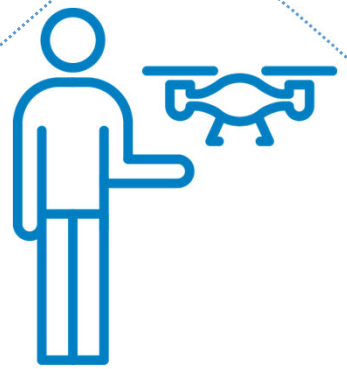




Safety, Roles and Responsibilities in U-space

MS & Competent Authorities

ATM/ANS & ATC



CISP, s-CISP, USSP

U-space : Not a single, but multiple/shared responsibilities

Roles and Responsibilities

- → #1 – MS, CA, EASA, Industry
- → #2 - Competent Authorities, coordination mechanism (Art. 18(f))
- → #3 - Member States, Airspace Risk Assessment (Art. 3)
- → #4 - Common Information Service (Art. 5)
- → #5 - ATM/ATC, Dynamic Airspace Reconfiguration (Art. 4)
- → #6 - USSP (Art. 7)
- → #7 - UAS Operators (Art. 6)
- → #8 - Manned aircraft, e-conspicuity (SERA.6005c)
- → #9 - Joint responsibilities, data quality and continuity of services

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Roles and Responsibilities in the U-space

#1 - Member States and Competent Authorities

Stéphane VAUBOURG, EASA
Drones Project Manager – U-space

R&R: Member States 1/2

- Member states do not have to transpose the content of the U-space regulatory in their own legislation, as the (EU) regulation are directly applicable

- Member states have to translate tARM1space framework into their system, and to task the relevant entities (e.g. relevant CA)

- Member states are sovereign to manage the access to their airspace, and may establish conditions and limitations for that

Member States regulate funding, costs, prices

Slide 28

ARM0 Regulation?
ALGAR RUIZ Maria, 2023-06-20T13:30:01.300

ARM1 Implement?
ALGAR RUIZ Maria, 2023-06-20T13:30:13.520

R&R: Member States 2/2

- Member states designates the U-space airspace
- Member states performs an ARA to support the U-space airspace designation
- Member states ensures that common information are made available with the necessary data quality, latency and protection requirements
- Member states ensures that operational information, e.g. aeronautical information, operators registration are made available
- Member states select the most effective architecture for their own system and may designate a single common information service provider
- Member states may require specific technical or operational constraints (e.g. cyber security, noise, flight authorization management)

R&R: Competent Authorities

- Roles and responsibilities are defined in Articles 17 and 18
- The core duty of the Competent Authorities are:
  - The establishment of the coordination mechanism, and nomination of a “U-space coordinator”
  - The certification and oversight of the U-space organizations (s-CISP/USSP)
  - The operational performance assessment
  - The determination of the data to be recorded to ensure adequate monitoring the operational and financial performances
  - The monitoring of safety events, and the assessment of the safety performance

- The CAs may need to coordinate between them:
  - To harmonize the safety levels and ensure level playing field
  - To support the certification, on-boarding, and oversight of USSP

ARM1

R&R: EASA

- EASA answers to the mandate given by the EU Institutions
- Accordingly, EASA directly supports and contributes to the U-space regulatory framework, and develop the associated AMC/GM
- EASA is proactively involved in research and development projects to ensure the feasibility of the regulation and to anticipate its evolutions
- EASA collaborates with the EU and non-EU civil authorities and ICAO to support the UTM/U-space implementation
- EASA provides support to the EU Member States
- EASA fosters harmonization over EU and ensure standardisation of Member States
- EASA is involved in Standard Organisation Development (e.g. USCG)
- EASA is in charge of the occurrence reporting scheme and monitor safety events
- EASA is also a Competent Authority in charge of the certification and oversight of the non-EU organization (e.g. USSP)

Slide 31

ARM0 This is done together with CA and also the operational stakeholders..
ALGAR RUIZ Maria, 2023-06-20T13:35:27.274

ARM1 Participation in SDO activities
ALGAR RUIZ Maria, 2023-06-20T13:36:33.048

R&R: “Industry”

- → The “Industry” is responsible to ensure safe provision of the services
- → The “Industry” is also in charge to manage, assess, and report occurences
- → The “Industry” actively contributes to the development of the U-space framework
- → Accordingly, the “Industry” is in charge to develop technical standards enabling an harmonised implementation (through standardization bodies e.g. EUROCAE, ASTM)

EASA is responsible of the harmonisation, the “Industry” of the standardisation

We need YOU to complement the U-space technical framework!

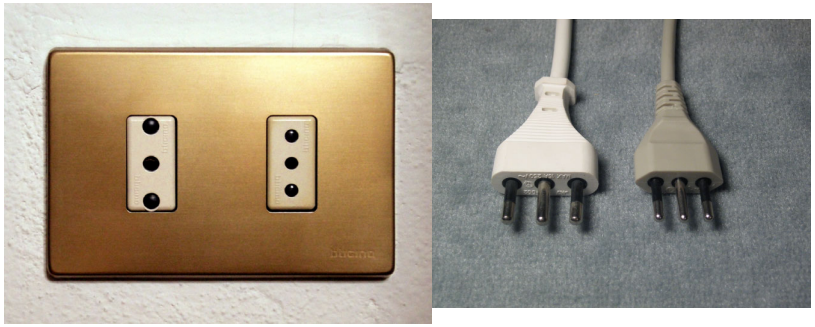
(or to propose concerted alternatives)

R&R: “Industry” standards convergence…

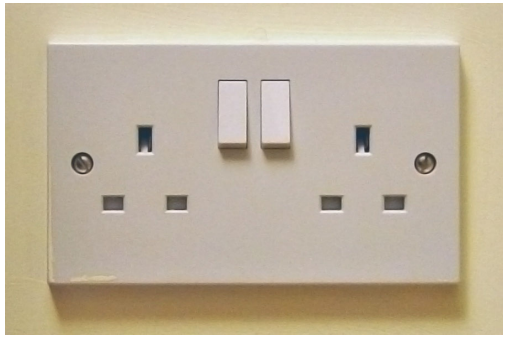
International Commission on the Rules for the Approval of Electrical Equipment (IECEE) CEE 7/5

IECEE CEE 7/3

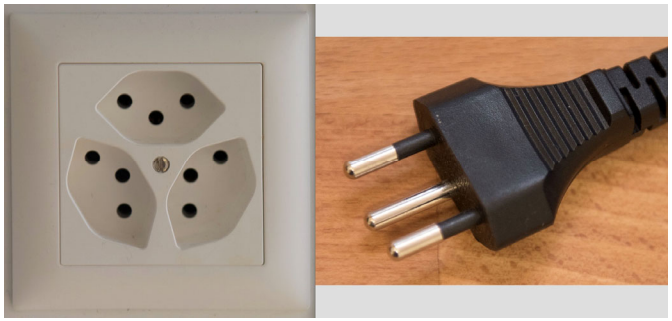
Danish Plug Equipment Section 107-2-D1 Standard sheet (SRAF1962/DB 16/87 DN10A-R)



CEI 23-50 - *Italy*



British Standard 1363 (G)



SN 441011 type 12 - *Switzerland*

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Roles and Responsibilities in the U-space

- #2 - Coordination mechanism (Art. 18(f))

Vassilis AGOURIDAS

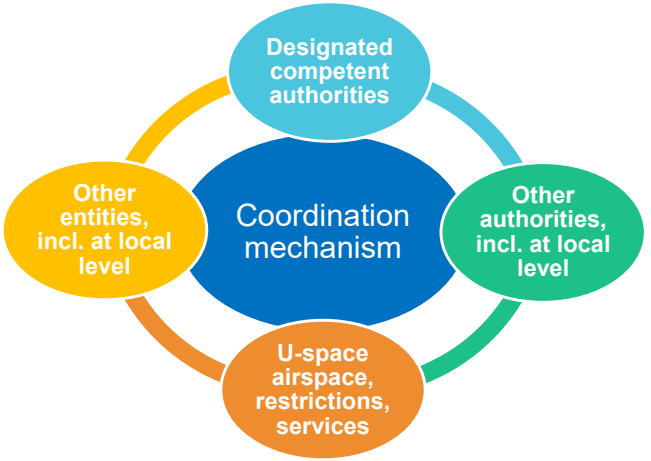
AIRBUS Urban Mobility – Head of EU Public Co-Creation & Ecosystem Outreach

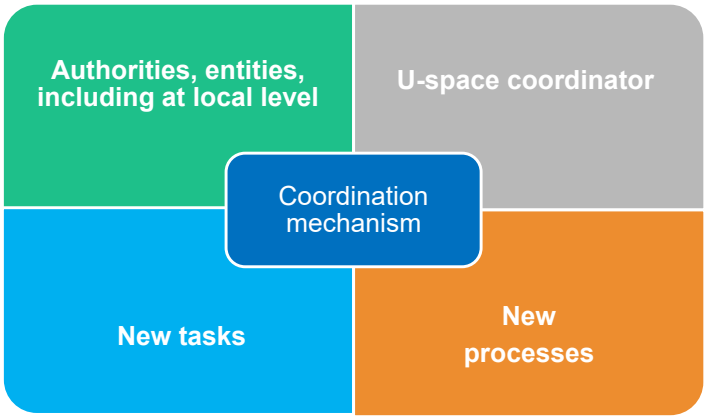
UIC2-UAM Initiative Cities Community (EU's CIVITAS Initiative) – Leader of UIC2

Art. 18(f) – Coordination Mechanism (CM) 1/10

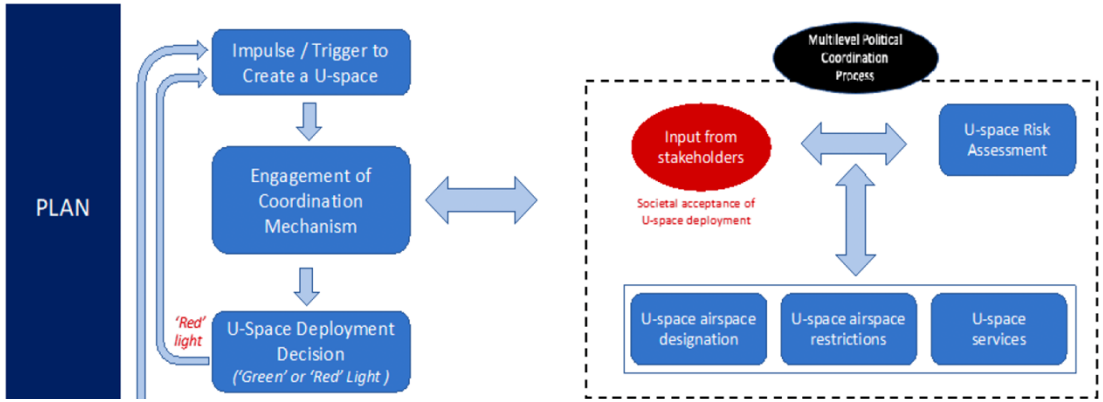
A novel concept and approach for nurturing societal acceptance

- The coordination mechanism is considered a high-level framework for managing the coordination and alignment activities **throughout the life cycle phases** of the U-space deployment.
- CM aims for **engagement of diverse stakeholders** *(aviation and non-aviation multi-party participation)* at different levels of governance *(local, regional, national)* **so that** the designated and deployed U-space airspace fits the regional and local well-being needs, local traffic infrastructure and complements it.
- CM is **evidence- and consultation-driven** and delivers recommendations; not decisions.

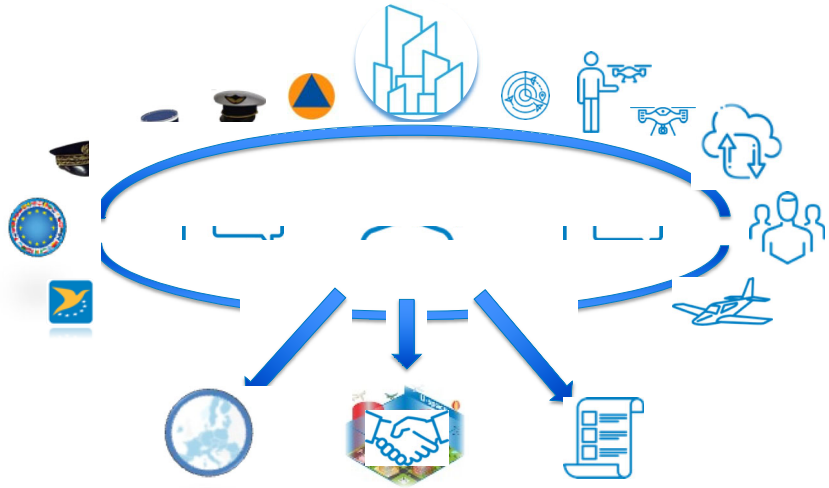




Art. 18(f) – Coordination Mechanism (CM) 2/10



U-space Coordinator

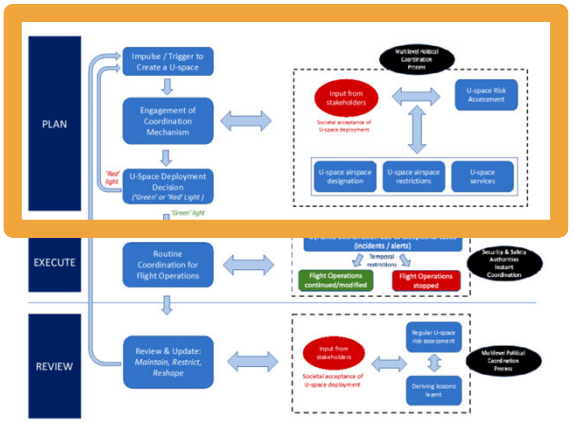


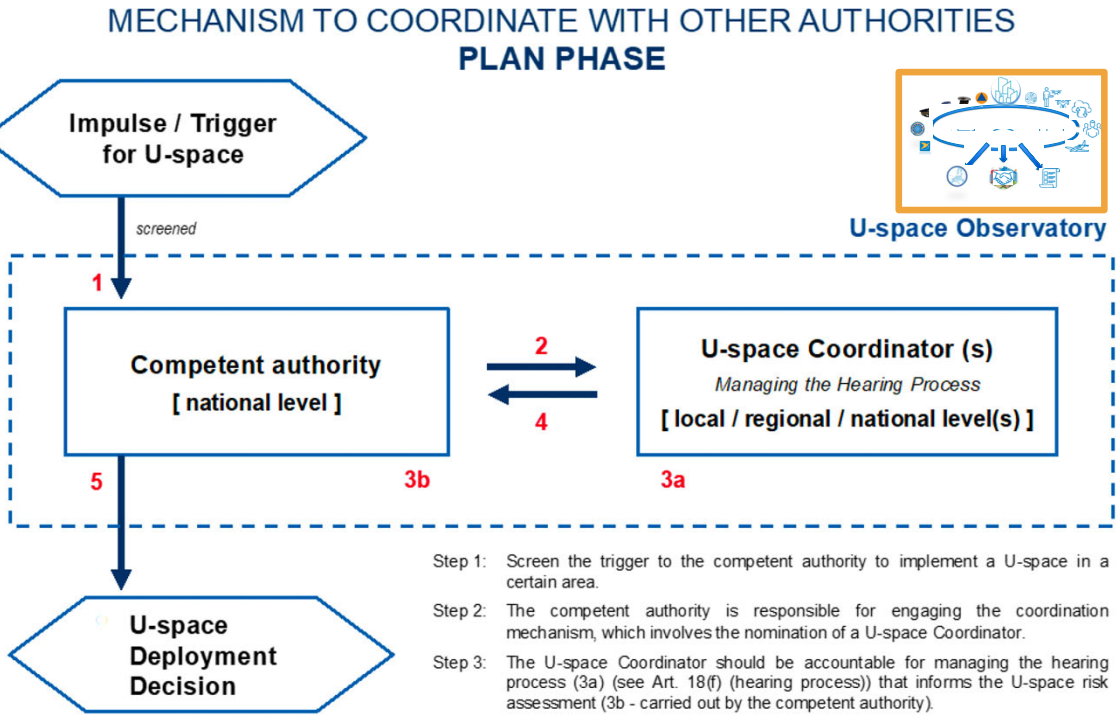
A central and key role for:

- → collecting information/evidence at all layers of governance, throughout the U-space life cycle phases (Plan, Execute, Review)
- → supporting ARA (stakeholder identification),
- → providing recommendations,

in order to seek agreement on the U-space airspace deployment

Art. 18(f) – Coordination Mechanism (CM) 3/10





Step 1: Screen the trigger to the competent authority to implement a U-space in a certain area.

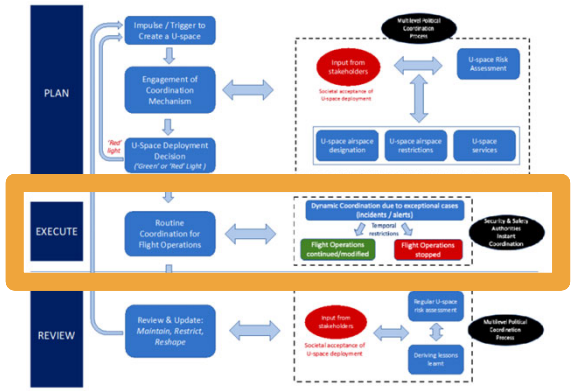
Step 2: The competent authority is responsible for engaging the coordination mechanism, which involves the nomination of a U-space Coordinator.

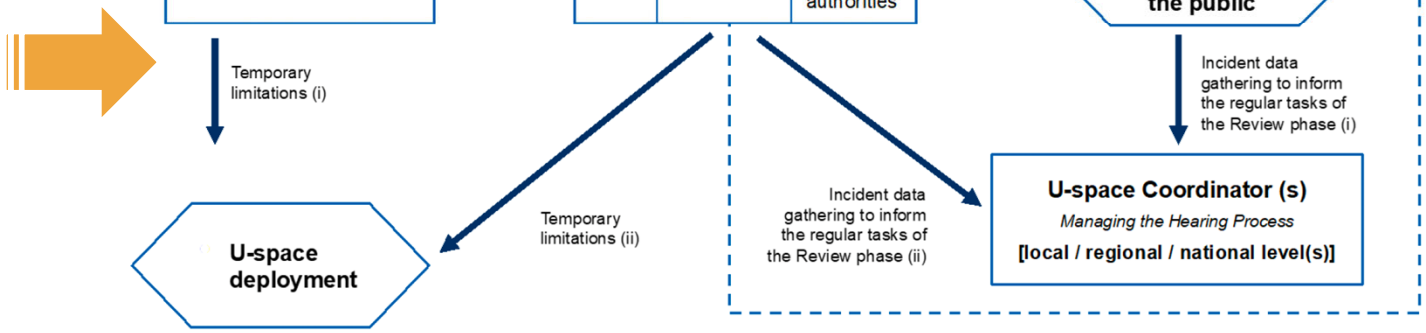
Step 3: The U-space Coordinator should be accountable for managing the hearing process (3a) (see Art. 18(f) (hearing process)) that informs the U-space risk assessment (3b - carried out by the competent authority).

Step 4: The U-space Coordinator should be accountable for submitting an initial U-space deployment recommendation to the competent authority based on the combined results of the hearing (3a) and U-space risk assessment (3b) processes.

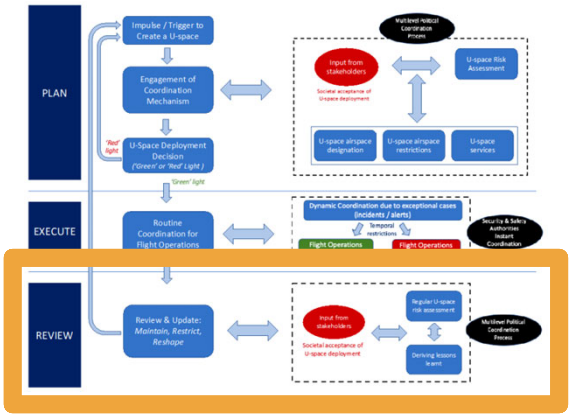
Step 5: The competent authority, based on the recommendation of the U-space Coordinator (any deviation has to be justified), should be responsible for making a final recommendation to the Member State, who makes the final decision on the U-space airspace designation, establishment of airspace restrictions and determination of the U-space services.

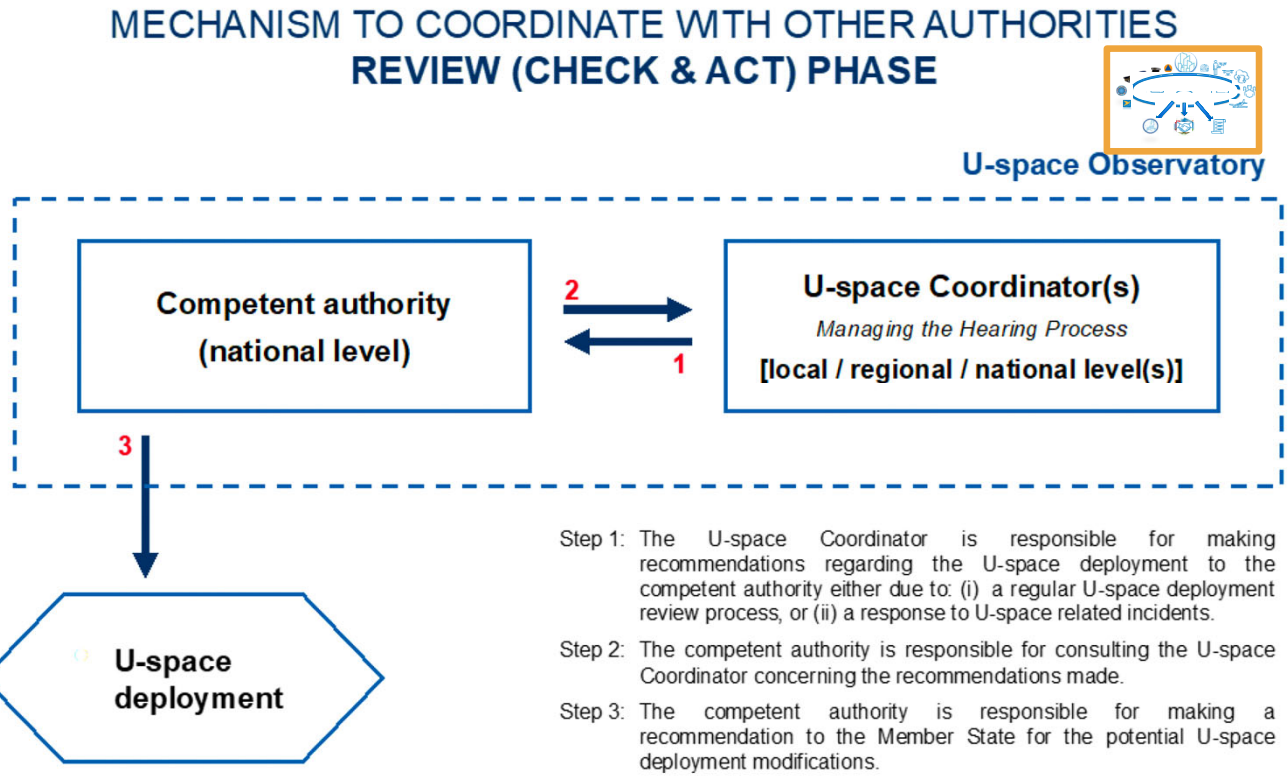
Art. 18(f) – Coordination Mechanism (CM) 4/10





Art. 18(f) – Coordination Mechanism (CM) 5/10





Step 1: The U-space Coordinator is responsible for making recommendations regarding the U-space deployment to the competent authority either due to: (i) a regular U-space deployment review process, or (ii) a response to U-space related incidents.

Step 2: The competent authority is responsible for consulting the U-space Coordinator concerning the recommendations made.

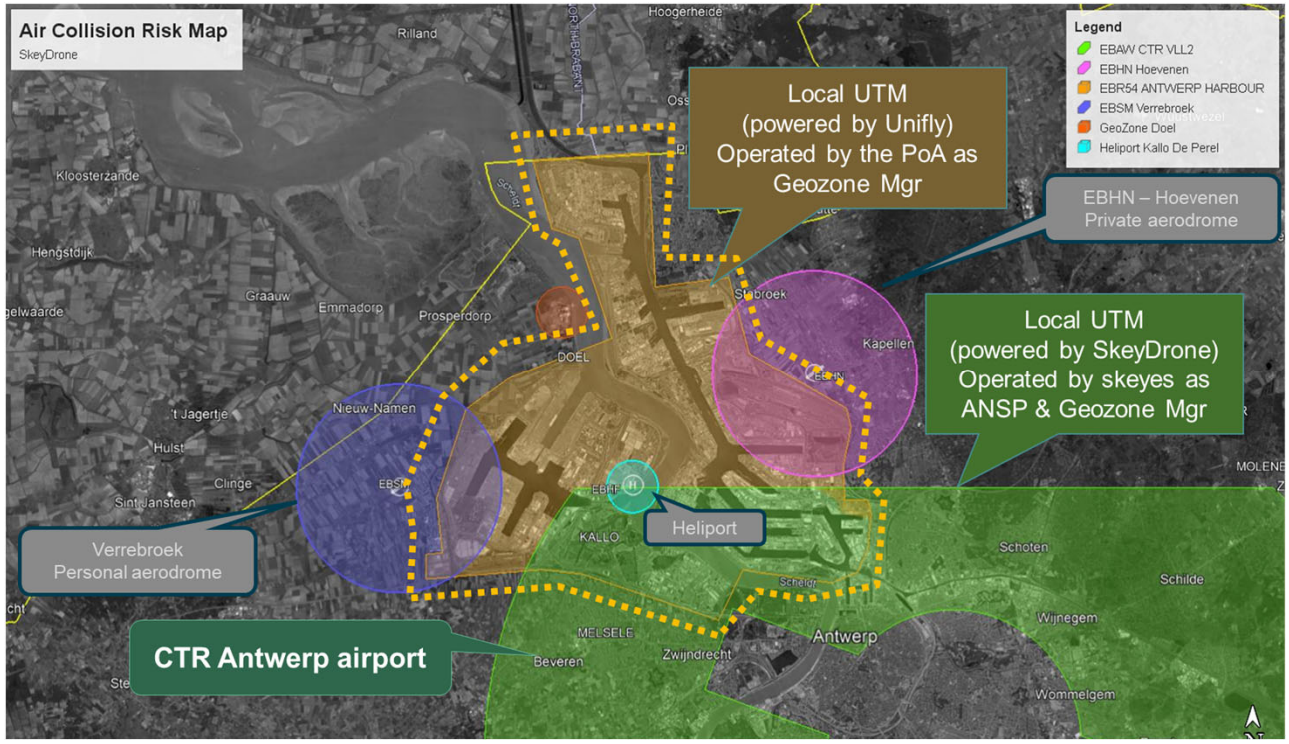
Step 3: The competent authority is responsible for making a recommendation to the Member State for the potential U-space deployment modifications.

Art. 18(f) – Coordination Mechanism (CM) 7/10

Example from the field: The **BURDI Project** (CINEA / SESAR JU)

BURDI

Port of Antwerp-Bruges areas



- AMC/GM Reg.(EU) 2021/664 on a regulatory framework for the U-space
- Plenty of concrete guidelines **but confusing step-by-step order of execution**:
  - *p. 135 Fig. 2:* Coordination mechanism comes first and its hearing process is used as input to the ARA
  - *p. 140 Table 1:* ARA comes before hearing process, HOW: by consultation, WHEN: after ARA

Art. 18(f) – Coordination Mechanism (CM) 6/10

Example from the field: The **BURDI Project** (CINEA / SESAR JU)

BURDI

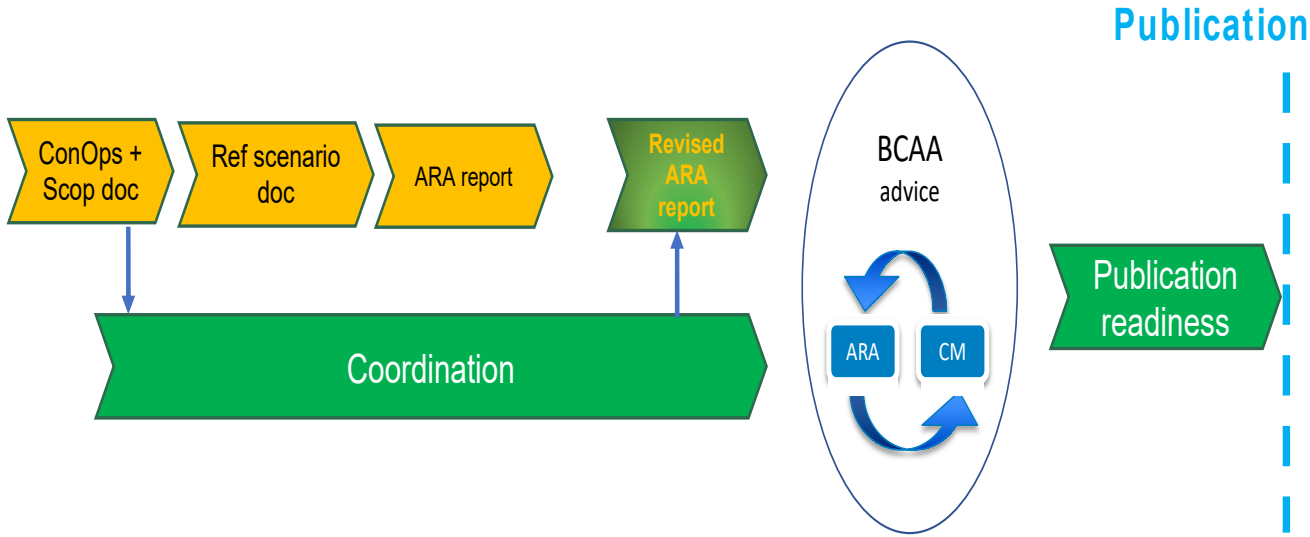
Very recent Belgian legislation defining roles and responsibilities with regard to:

- Competent authority
- Execution of Airspace Risk Assessment (ARA). Coordination Mechanism outcomes could trigger revision/adaptation of the ARA
- Establishment and implementation of Coordination Mechanism (focus on consultations per se)
- Elaboration of an advice by competent authority, based on ARA and Coordination Mechanism outcomes
- Decision of the MoT (Ministry of Transport)

BURDI's approach

a wider scope Airspace Risk Assessment (ARA)* with room for Member State's own ConOps

**In alignment with Eurocontrol workshop material & U-space "Airspace Risk Assessment Method and Guidelines - Volume 1"*



EASA

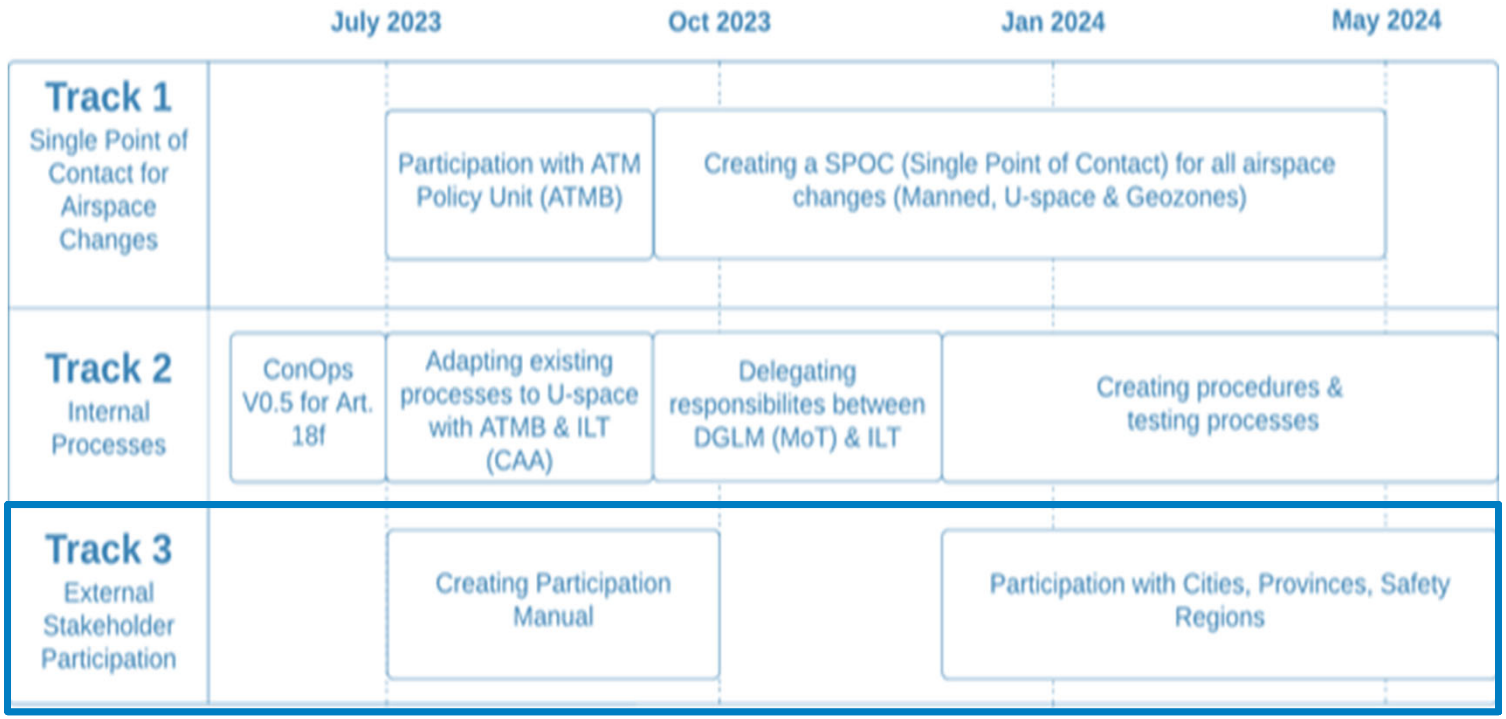
Art. 18(f) – Coordination Mechanism (CM) 10/10

Example from the field: Developments in the Netherlands – *Ongoing emphasis*

Source: Ministry of Infrastructure and Water Management, NL

Emphasis on:

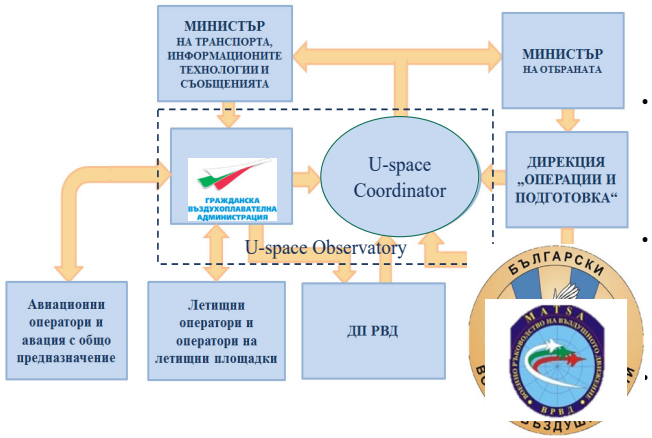
- → Well-structured participation
- → Transparency, accessibility and societal support
- → Making use of existing processes to cope with future U-space upscaling



Art. 18(f) – Coordination Mechanism (CM) 8/10

Example from the field: Developments in Bulgaria – *Ongoing progress & challenges*

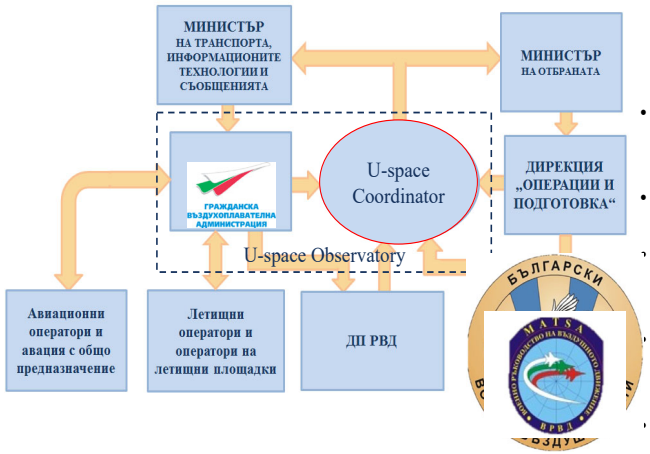
National System for Civil-Military Cooperation - Ordinance 19 + Instructions 24/25 (FUA)



- Will it duplicate Airspace Management Council (ASMC)? Strategic Level
- Will it duplicate the functions of Air Space Management Cell (AMC - ЦПРВП)? Pre-tactical Level
- Will it go all the way down to Airspace Use Coordination Centre (AUCC - ЦКИВП)? Tactical Level
- All of the above?

2023 Unmanned Systems Bulgaria

National System for U-space Cooperation



- Who gives the nomination? – Minister of T&C? Premier Minister? Ministry Council? Parliament?
- Who appoints it? – President?
- How?
- What will be the support of this new role?
- Personnel | Administration | Office
- Supervision & KPIs

2023 Unmanned Systems Bulgaria

Art. 18(f) – Coordination Mechanism (CM) 9/10

Example from the field: Developments in Bulgaria – *Nomination of U-space Coordinator & First Public Hearing*

REPUBLIC OF BULGARIA

DEPUTY MINISTER OF TRANSPORT AND COMMUNICATIONS

10-01-73
16.02.23

TO WHOM IT MAY CONCERN

Dear Ladies and Gentlemen,

I have the pleasure to inform you that a Task Force for a coordination mechanism fo deployment of U-space was established by Order RD-08-499/29.09.2022 of the Minister o Transport and Communications of the Republic of Bulgaria regarding the implementation o Commission Implementing Regulation (EU) 2021/664 of 22 April 2021 on a regulator framework for the U-space. U-space airspace ensures safe flights with unmanned aircraf systems – drones.

Following the Order mentioned above a Coordination Body was determined with the followin members:

- Prof. Dimo Zafirov PhD;
- Prof. assistant Dimitar Ginchev PhD;
- Stefan Hristozov.

The main scope of the Coordination Body covers public consultations and hearings on th potential U-space deployment in the Republic of Bulgaria.

I am addressing this letter for your kind attention in order to cooperate and to assist the above mentioned Coordination Body to carry out its assigned tasks for the benefit of establishing high level of Safety in aviation.

Sincerely,

Nikolay Naydenov
Deputy Minister of Transport and Communications

The first hearing – town of Rakovski

EASA
European Union Aviation Safety Agency

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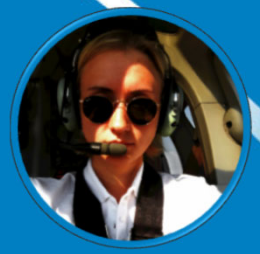
Roles and Responsibilities in the U-space

- #3 – Airspace Risk Assessment (Art. 3)



Elina MILLERE, EUROCONTROL
Project Manager (U-space)

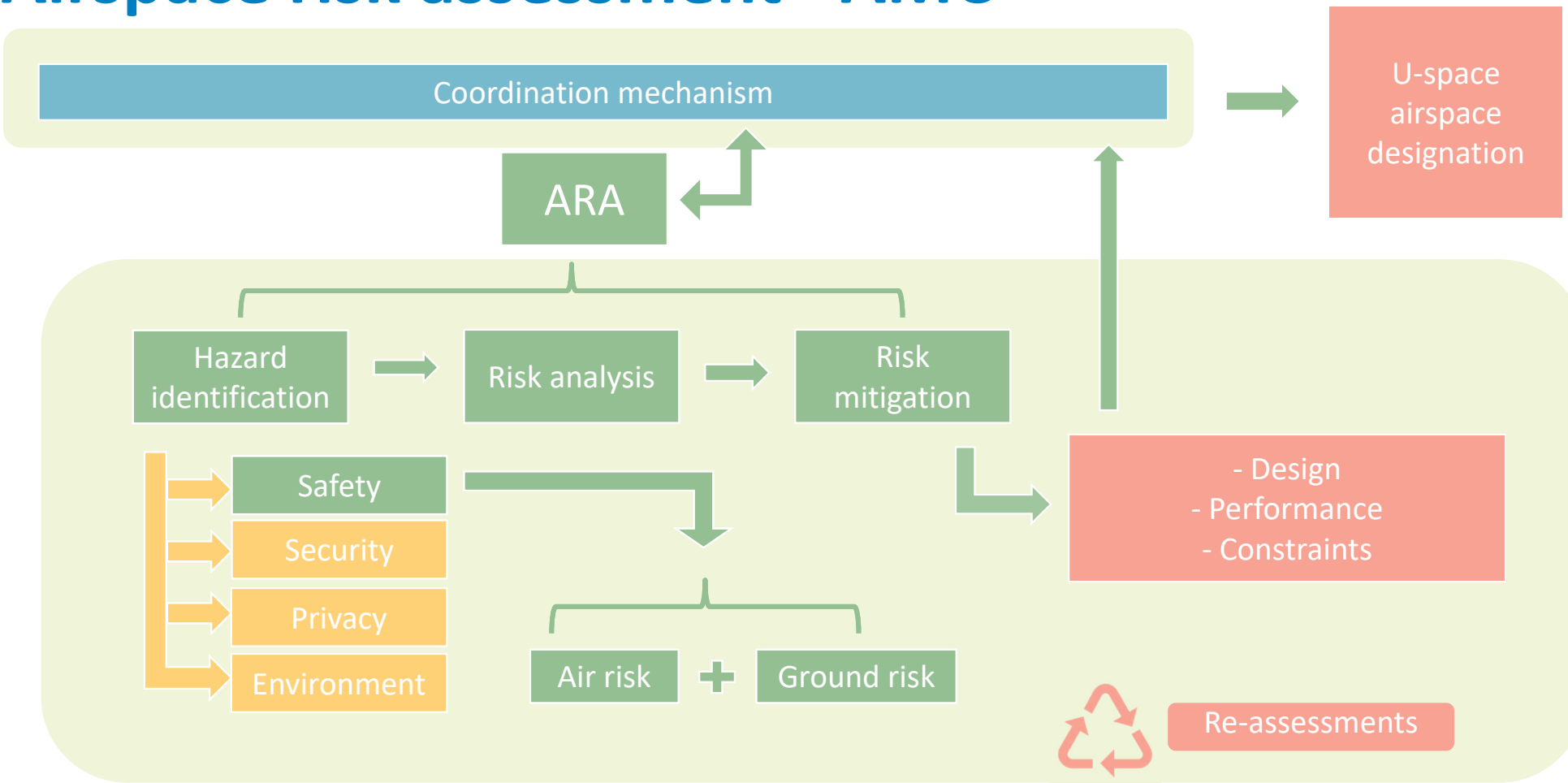
David MARTIN MARRERO, EUROCONTROL
UAS/U-space Safety Specialist

Reasons for designation U-space airspace

- → Enable complex airspace VLL environments
  - → Ensure safety continuum (manned aviation)
  - → Enable increased drone capacity of the airspace
  - → Support BVLOS flights
- → Enable a new fair open market
  - → Drone-based services
  - → Multiple USSPs
- → Encourage sustainability
- → Ensure better surveillance
- → Ensure a better understanding of privacy concerns
  - → Achieve social acceptance

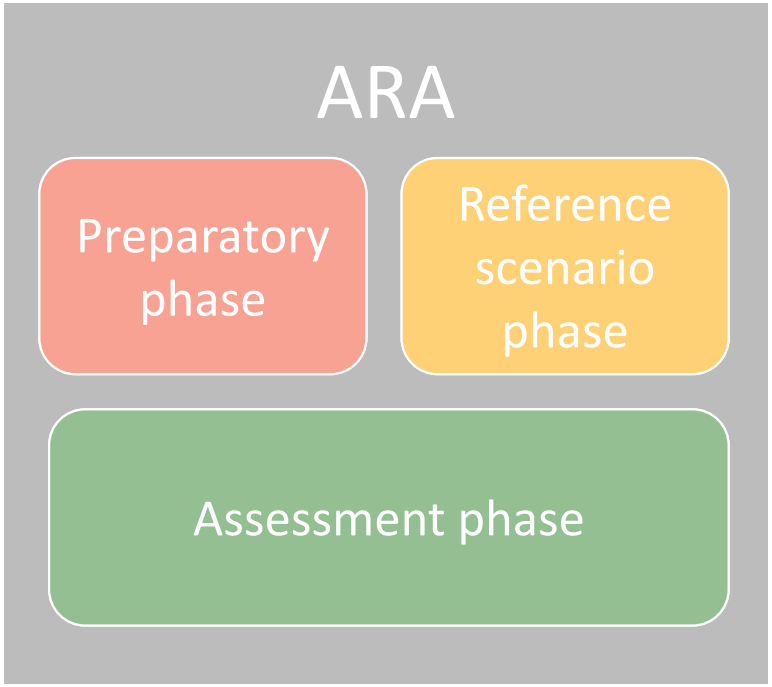
- Safety
- Security
- Economical
- Environmental
- Privacy related

Airspace risk assessment - AMC

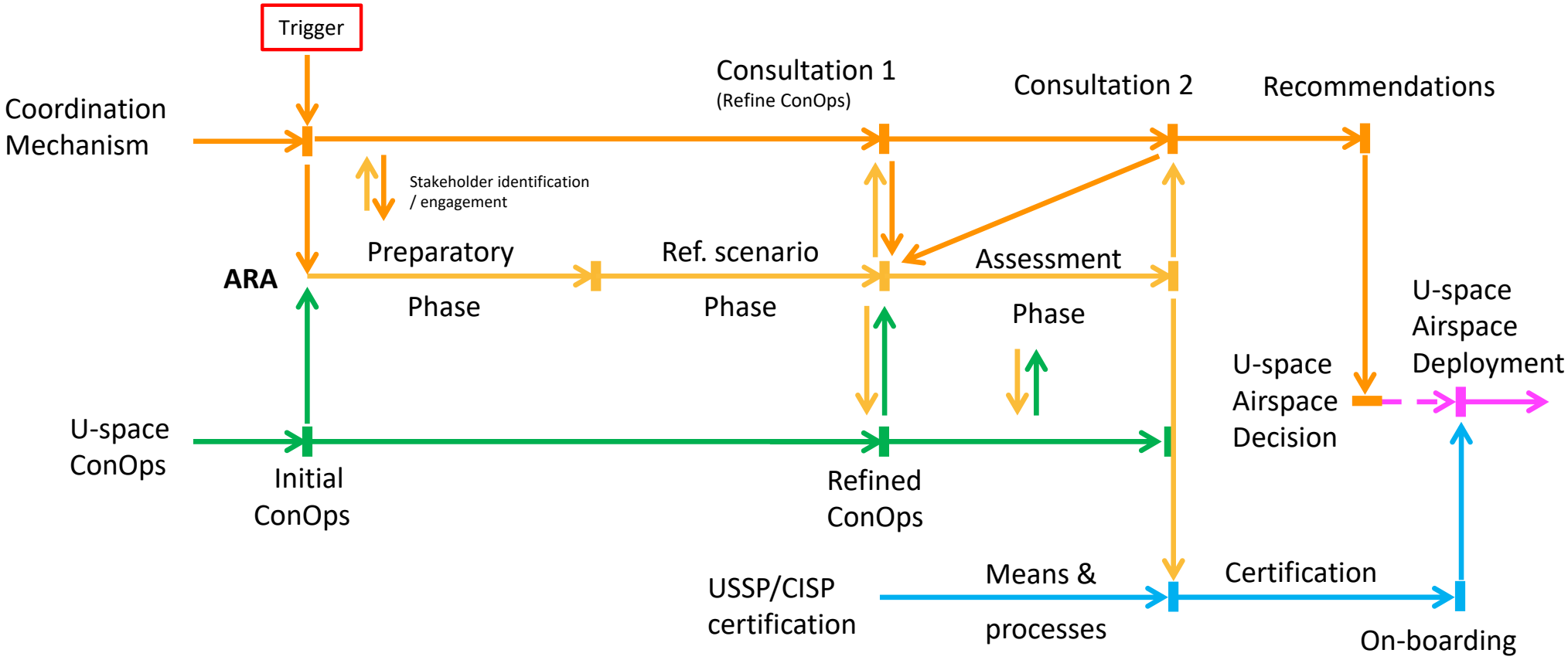


ARA phases

- Preparation phase
  - Set the scope
  - Set the geographical limits and the adjacent airspace
  - Identify involved stakeholders
- Reference scenario phase
  - Understand the current airspace
  - Technical coordination with stakeholders
  - Provide a basis for evaluating change
- Assessment phase
  - Make sure the future airspace is safe
    - For drones, manned aircraft, and people and property on the ground
  - Also ensure security, privacy, and environment



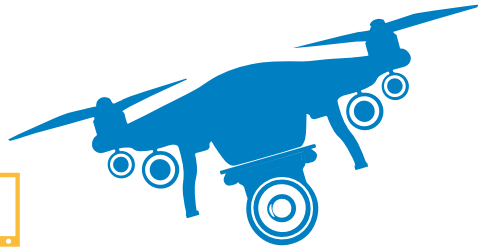
ARA lifecycle & other processes



U-space Designation and Importance of Safety Assessment

OBJECTIVE: U-SPACE DESIGNATION

Safe management of numerous UAS operations, ensuring safety for manned aviation and people on ground.



HIGHLIGHTING SAFETY ASSESSMENT'S IMPORTANCE

Key process for determining hazards in the airspace, analyzing risks and finding mitigations.

MAIN STEPS OF THE PROCESS

It includes hazard identification, risk analysis, and mitigation planning.

WHAT IS THE END RESULT?

The assessment ensures acceptable or tolerable risk levels in the U-space airspace.

Key Aspects in the Safety Assessment Phase

Meteorological information, among others.

Traffic density

Mapping information related to population density and obstacles

(Not replacing the ground risk assessed by operators through SORA)

Consequences of mid-air collision between unmanned aircraft.

In-depth assessment of encounters with manned aviation.

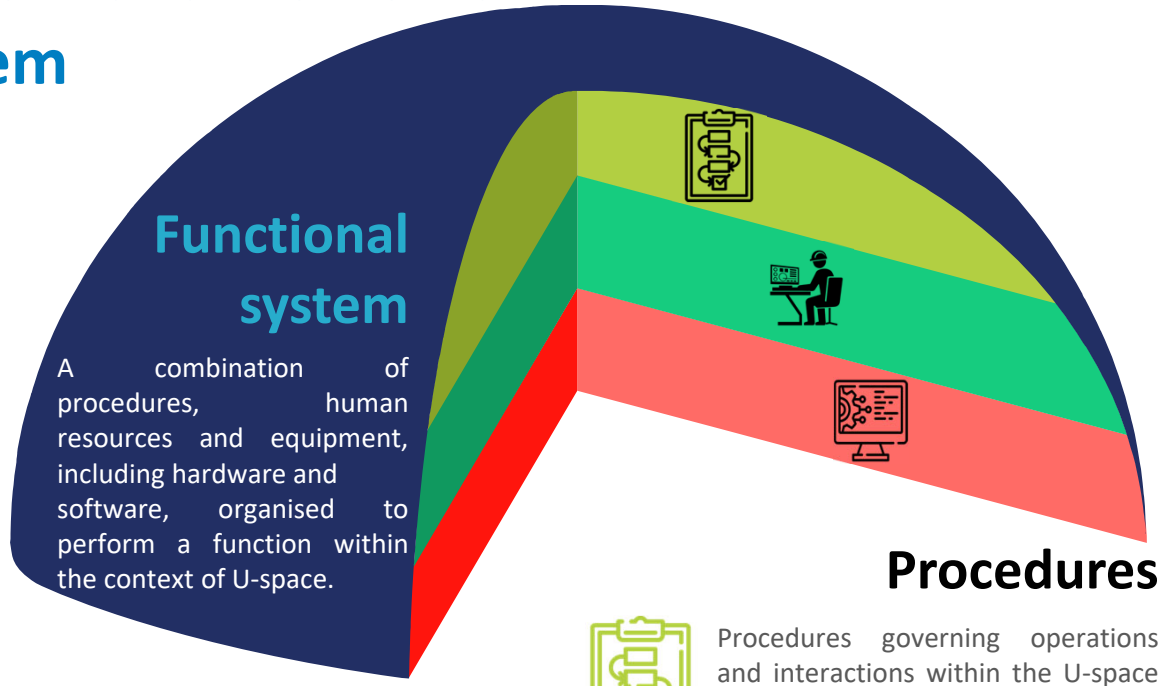
Purpose of the Safety Assessment and Elements of the U-space Functional System

1. Describe safety activities to be conducted during the life cycle.

2. Identify main safety issues associated with the airspace.

3. Preparatory process to address safety concerns early on.

USSP certification process (Safety support assessment conducted by USSPs).



Procedures

Procedures governing operations and interactions within the U-space environment.

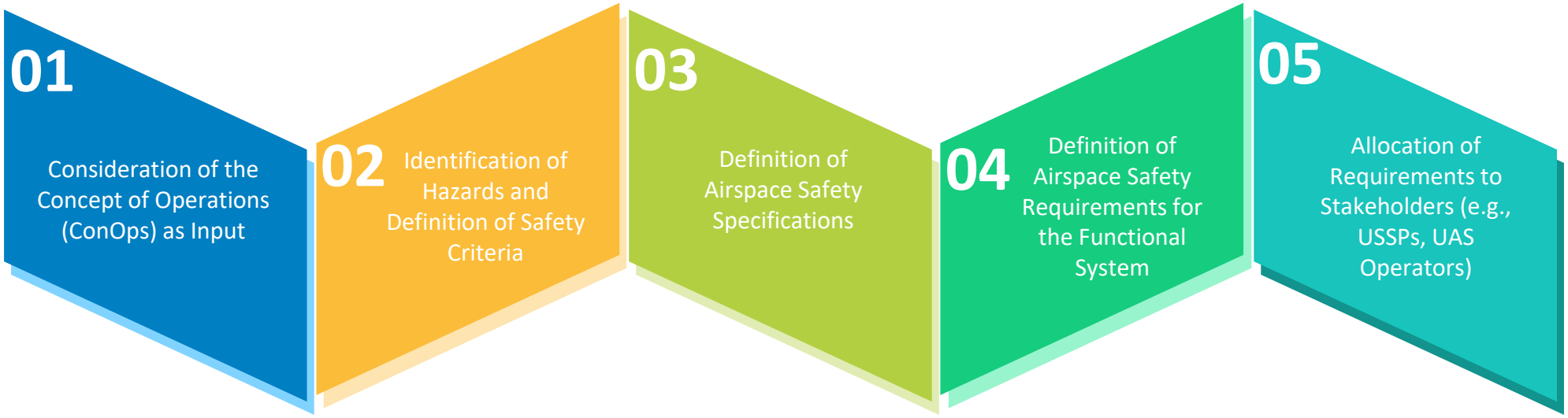
Human Resources

Skilled professionals responsible for managing and operating the U-space system.

Equipment

Physical tools, devices, and technology infrastructure utilized in the U-space system.

Elements of the Safety Assessment Methodology



E

Description of key properties of the operational environment and operational activities relevant to the airspace.

C

Identify potential risks and establish measurable safety criteria as benchmarks to ensure acceptable levels of safety in U-space airspace.

D

Defining the specific actions and procedures that need to occur at the operational level to satisfy the Safety Criteria.

B

Identify safety requirements for the functional system's components, architecture, and procedures to ensure compliance with the defined Safety Specifications.

A

Allocate the identified requirements to relevant stakeholders based on their respective roles and responsibilities.

U-space Airspace Hazards Identification

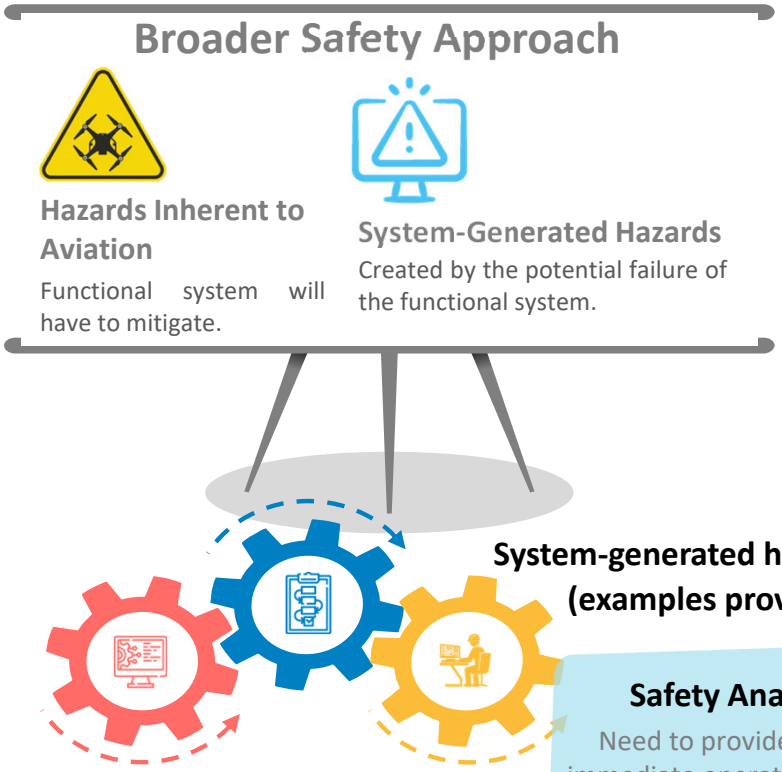
Link with Regulation (EU) 2017/373

By the fact of sharing the same airspace.

Hazard definition

'Hazard' refers to any condition, event, or circumstance that could cause harm.

Hazards inherent to aviation:



System-generated hazards (examples provided):

Airspace Infringement
Unmanned aircraft exiting U-space airspace volume

U-space Service Failure
Flight authorization services fails to ensure free intersection between UAS.

Safety Analysis
Need to provide assessed immediate operational effects, mitigation measures, severity classification, and airspace safety specification for system-generated hazards.

EASA

Acceptable Level of Safety, Safety Criteria and Airspace Safety Specification

Safety Levels, Units of Measure and Safety Requirements

Maintaining Safety Levels

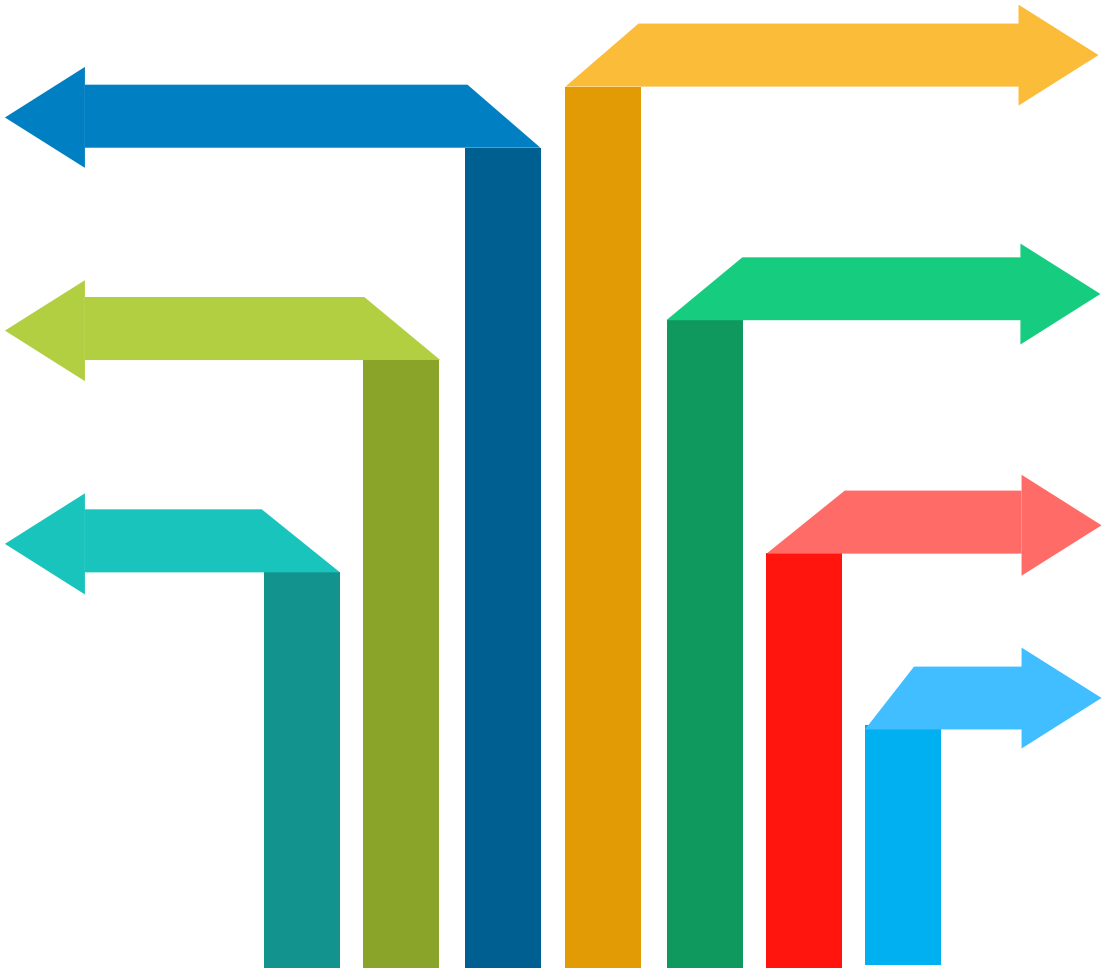
Goal is to maintain safety levels achieved in manned aviation, but specificities of UAS operations may result in a higher rate of mid-air collisions.

Different Risk Apportionment

Mitigation measures ensure no casualties in mid-air collisions between unmanned aircraft, but ground risk may be higher in populated areas.

Units of Measurement

To pay attention to the units of measurement based on the type and phase of the operation: Considering 'per flight hour' for the en-route phase and 'per operation' for the approach to vertiports or in other appropriate cases.



Airspace Safety Requirements

Acceptable level of safety materialized through U-space airspace safety requirements → Allocation of safety requirements on functional system components, to satisfy safety specification.

Meeting Safety Specification

Ensuring the functional system operates as specified, meeting the airspace safety specification at operational level.

Completeness and Correctness

Providing evidence of adequate and complete risk identification and mitigation.

Presenting Evidence

Recommendation to prepare a safety assessment report to present sufficient evidence of actions to be taken → Importance of documenting safety assurance activities.

EASA

Challenges and Ongoing Development in U-space Safety

Limited Experience

At this early stage of U-space implementation, limited experience with assessing UAS operations' safety and uncertainty on acceptable risk levels.

Quantitative Figures

Simplified assumptions and approximations used to establish quantitative safety figures.

Operational Experience

As operational experience grows, more accurate numerical examples can be provided to propose an acceptable level of safety.

Additional Material

Possible additional material or amendments might be proposed.

Ongoing taskforce

Additional complementary work is being developed by the current active taskforce responsible for developing material for the certification of USSPs and CISPs.

EASA
European Union Aviation Safety Agency

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czkgxo

Roles and Responsibilities in the U-space

- #4 - Common Information Service (Art. 5)

Angela KIES, DFS
Head Unmanned Aircraft Systems

Antoine MARTIN, DGAC/DSAC
Advanced ATM officer

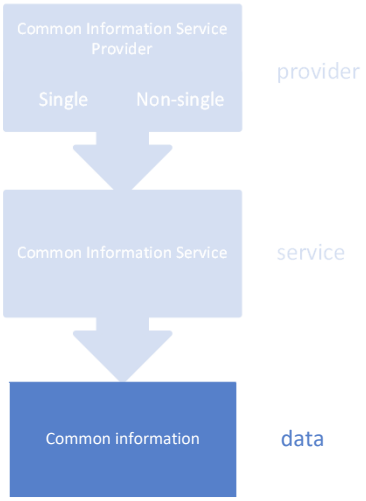
Common information?

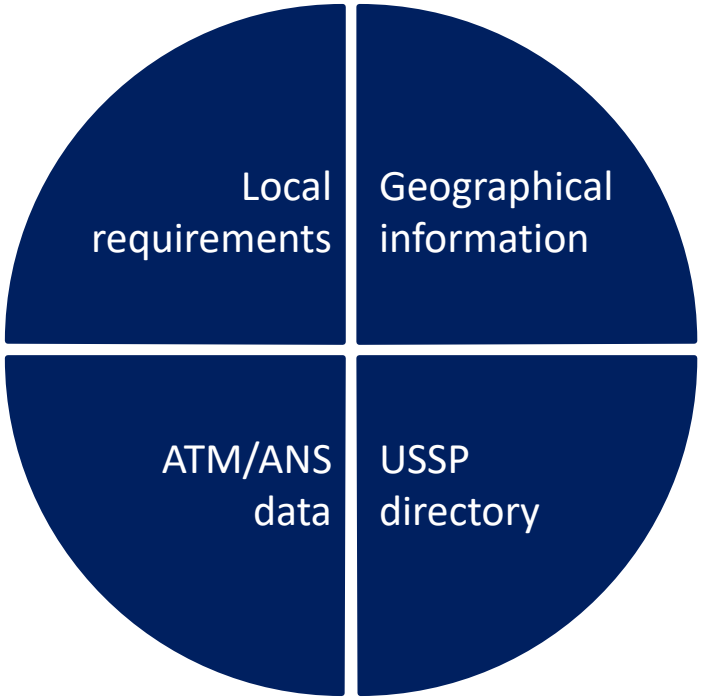
 Information

 Safe  Fair

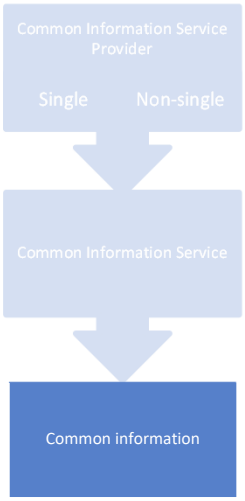
 USSP operations

Common information





Common information – Typical data

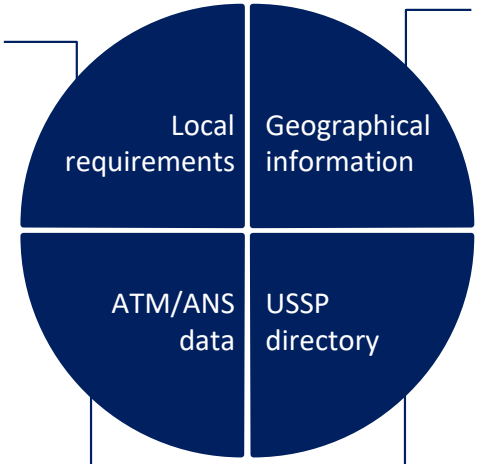


provider

service

data

- Hours of operations
- Maximum UAS traffic density
- Maximum U space airspace capacity
- UAS operator minimum equipment
- UAS operators' contingency procedures minimum requirements
- Manned aviation requirements for e-conspicuity
- Occurrence reporting scheme
- USSP requirements

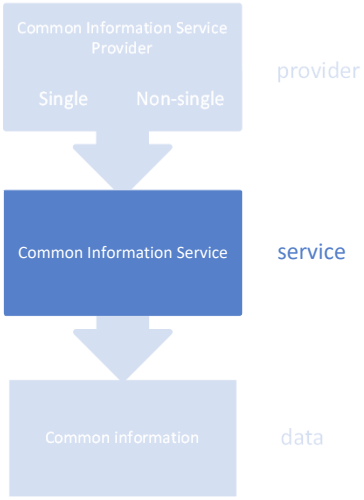


- U-space airspace geometry
- Adjacent U-space airspace(s)
- Other relevant UAS geographical zones
- Static airspace restrictions of the U-space airspace
- Dynamic airspace restrictions and limitations of the U-space airspace (uncontrolled airspace)
- Classification of airspace

- Traffic data
- Dynamic airspace reconfiguration information (DAR) – controlled airspace
- Notam

- Commercial designation of USSP
- Registered/legal name of the USSP company
- Address of the USSP company (legal seat)
- Email address (customer relation)
- Email address (corporate)
- Email address (DPO)
- Terms and conditions of the U-space services
- Registry of U-space services
- Registry of operational interfaces
- U-space services provided
- Certification limitation(s)

CIS: Common Information Service[s]



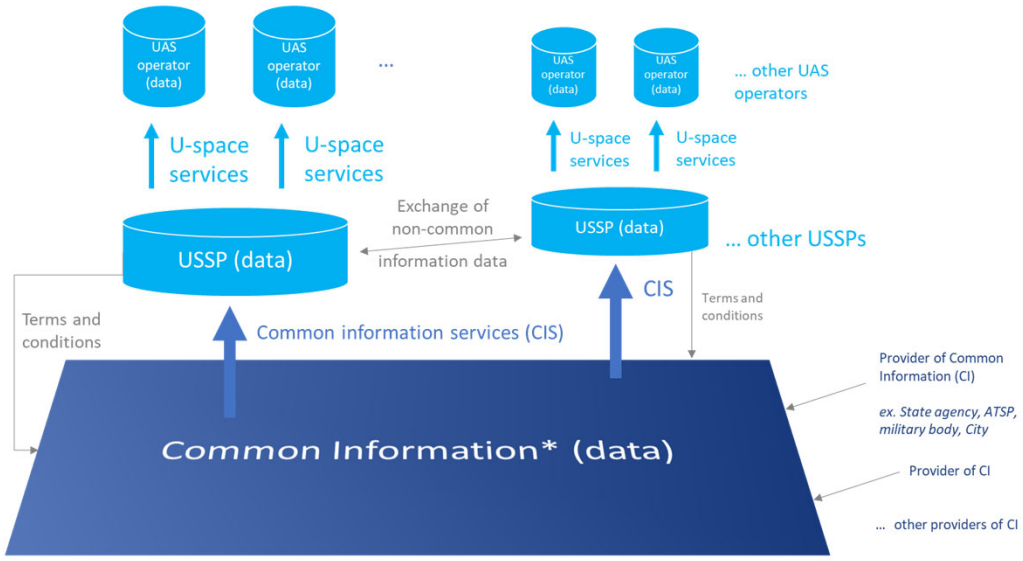
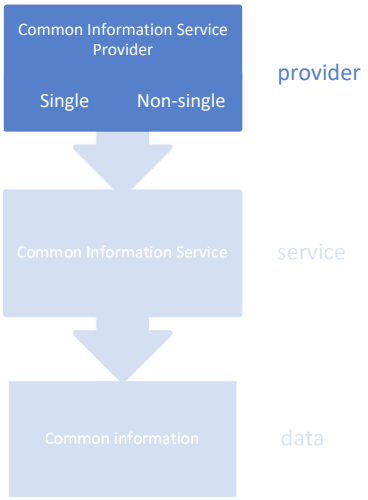


Illustration of any given U-space airspace, irrespective of the architectural and technical solutions

CISP: Common Information Service Provider



Any common information is provided by a CISP

Complying with Annex II and Annex III of (EU) 2021/664

Non-single CISP

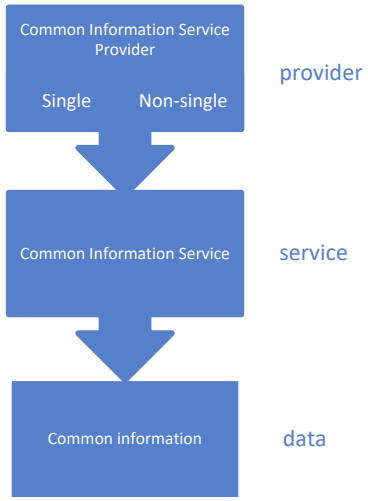
Normally also source* of the common information

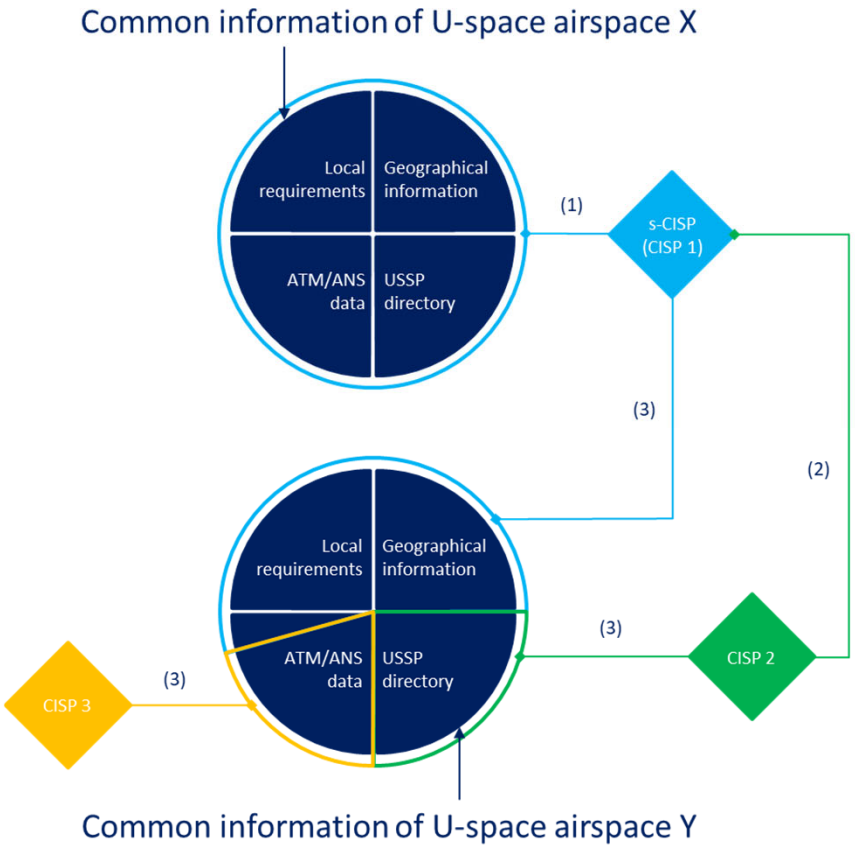
*trusted/certified

Single CISP

2021/664 certificate holder

Indicative illustration





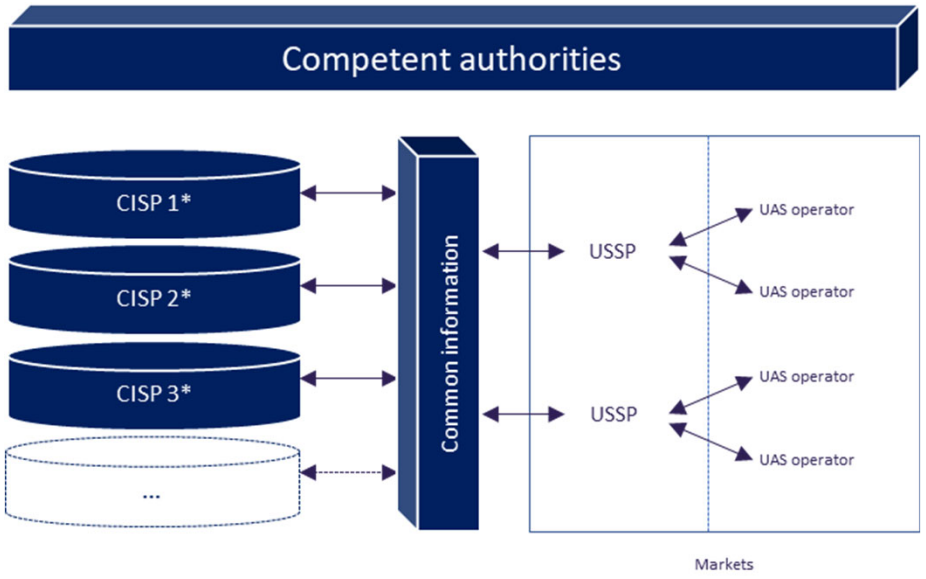
1) If designated as such by the Member State(s), CISP 1 is single CISP for U-space airspace X
2) For U-space airspace X, CISP 2 is a provider of common information and not a CISP
3) CISP of U-space airspace Y (non single CISP)

Requirements, AMC, GM and recommended specifications

- ANNEX II of (EU) 2021/664
  - EUROCONTROL ‘Specification for SWIM Technical Infrastructure (TI) Yellow Profile’

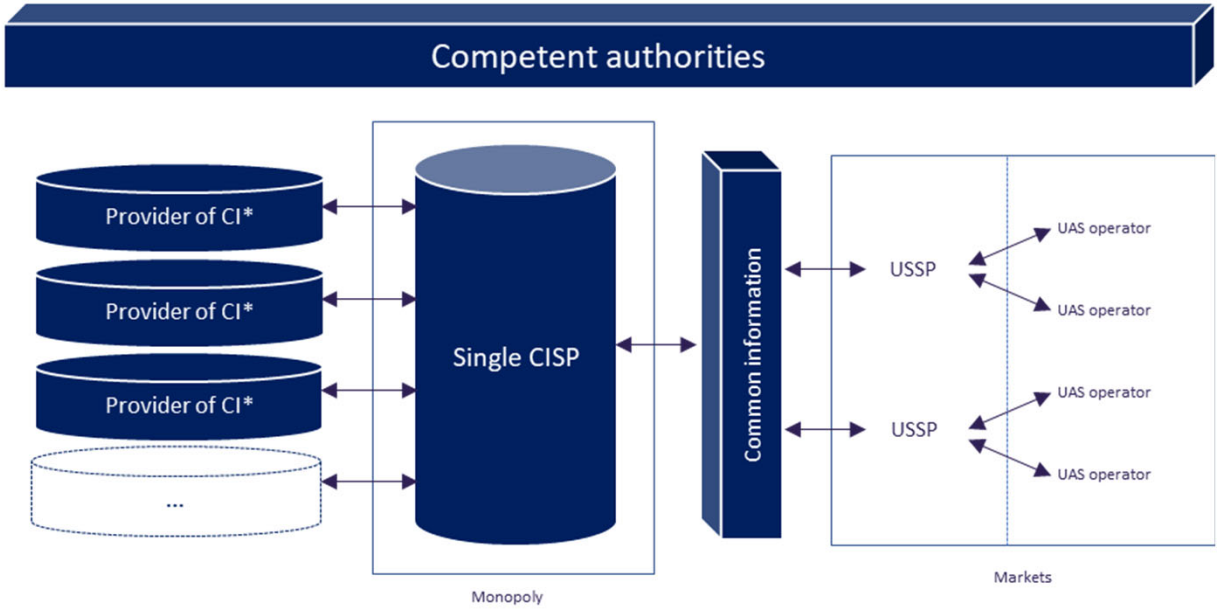
- ANNEX III of (EU) 2021/664
- AMC and GM to (EU) 2021/664
- EUROCAE ED-269
- JSON format RFC 7159
- EUROCONTROL ‘Specification for SWIM Service Description (SD)’
- Transport layer security version 1.2
- AIXM standard version 5.1 or higher
- EUROCONTROL ASM Handbook (AUP/UUP messages)

Overview of the Distributed or Decentralised model architecture



*Such as an ATSP, a USSP or a local authority

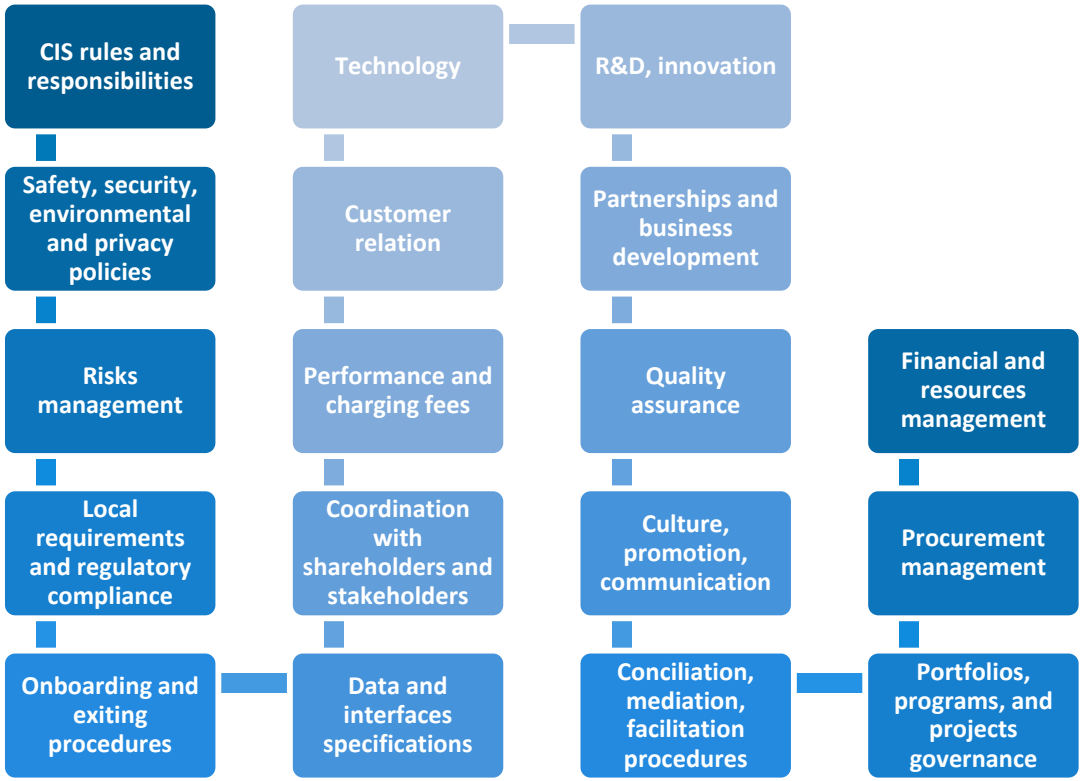
Overview of the centralised model architecture



*such as an ATSP, a USSP or a local authority

Governance of CIS

- ✓ Safe, secure, environmentally-friendly, privacy-friendly, fair and sustainable operations
- ✓ Principles of legitimacy, competency and transparency



Best practices

EASA
European Union Aviation Safety Agency

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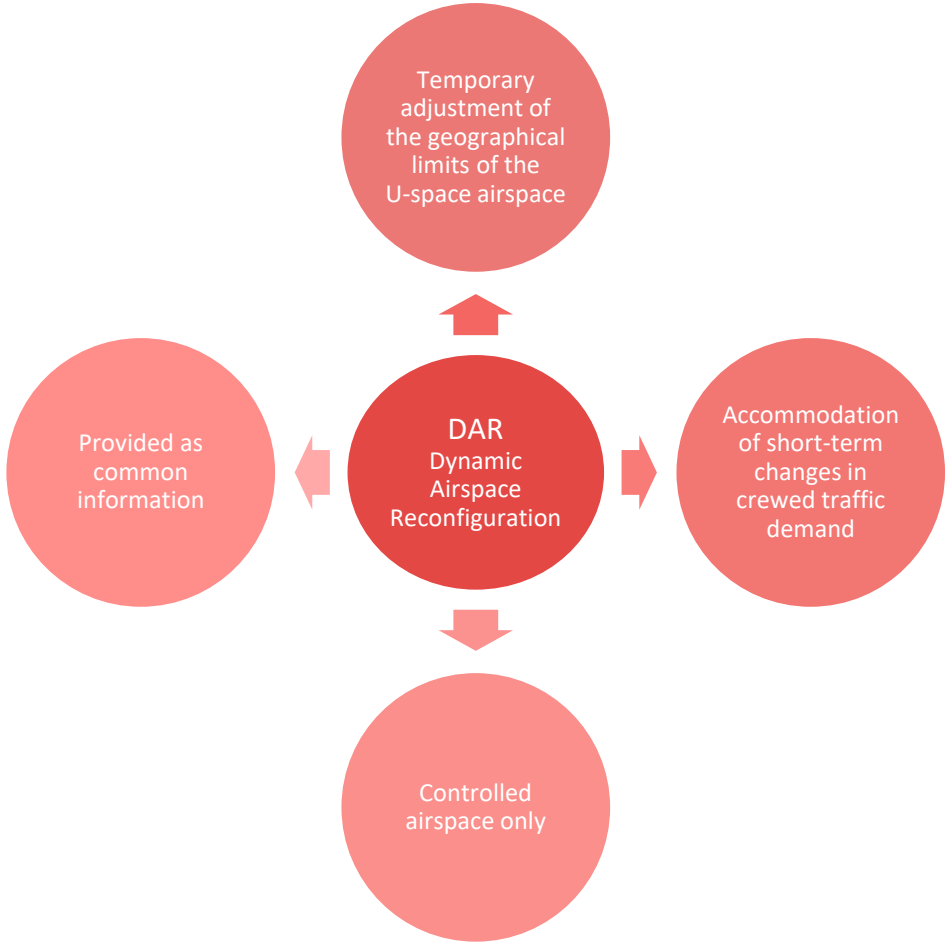
Roles and Responsibilities in the U-space

- #5 - Dynamic Airspace Reconfiguration (Art. 4)

Alberto IOVINO, ENAV
Head of Operational Support

Antoine MARTIN, DGAC/DSAC
Advanced ATM officer

Main Features – the DAR principles



UAS Operators shall take action:
Revised flight authorisation
Authorized flight outside U-space
Landing

Enablers

U-space airspace design:

- → to ensure segregation
- → to not excessively activate the reconfiguration

Predefined scenarios and/or precut portions of airspace:

- → to allow efficient use
- → To minimize the disturbance on the operations

STRATEGIC

Impact on UAS

→ UAS Operators must comply
→ Safe landing / Vacate to an active piece of U-space airpace
→ Forced landing as last resort

PREPAREDNESS

CONTINGENCY

Priority

→ Special Operations *crewed* / *uncrewed*

COORDINATION

Proportionate response

→ Vertical / Lateral / Full

3D MULTI-PHASED

Coordination

→ ATC / USSP coordination ahead of operations (no ATC coordination)

→ Smooth Start/End vs. Immediate implementation

→ Alert to UAS Operators sent ahead of DAR.

→ As far as practicable, sufficient time for UAS to complete/adjust their operations

ANTICIPATE

SAFE

Termination of DAR

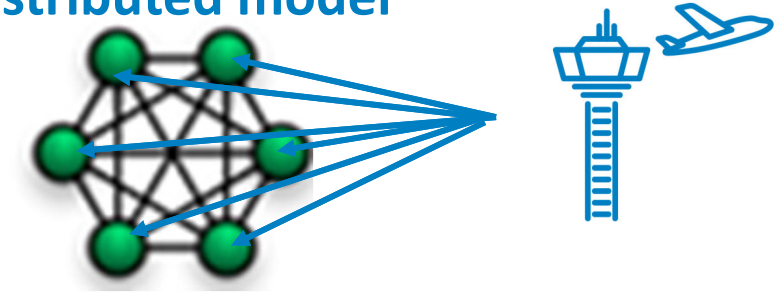
→ Back to normal,

→ Flight authorisation/flight activation can be resumed

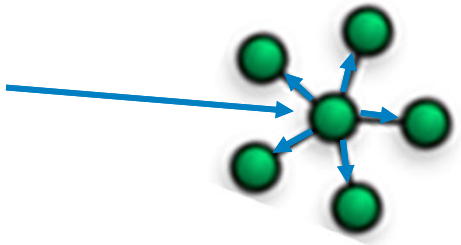
FLT AUTH

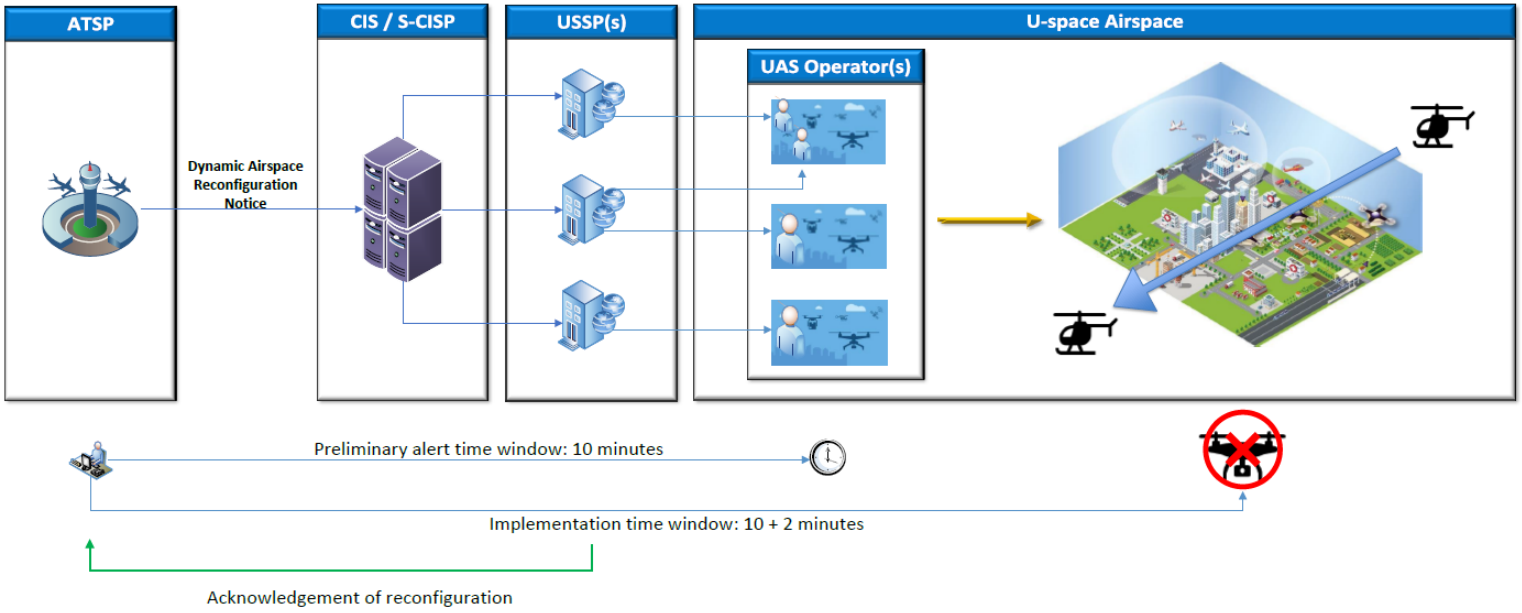
Information / data flow

Distributed model



Centralised model

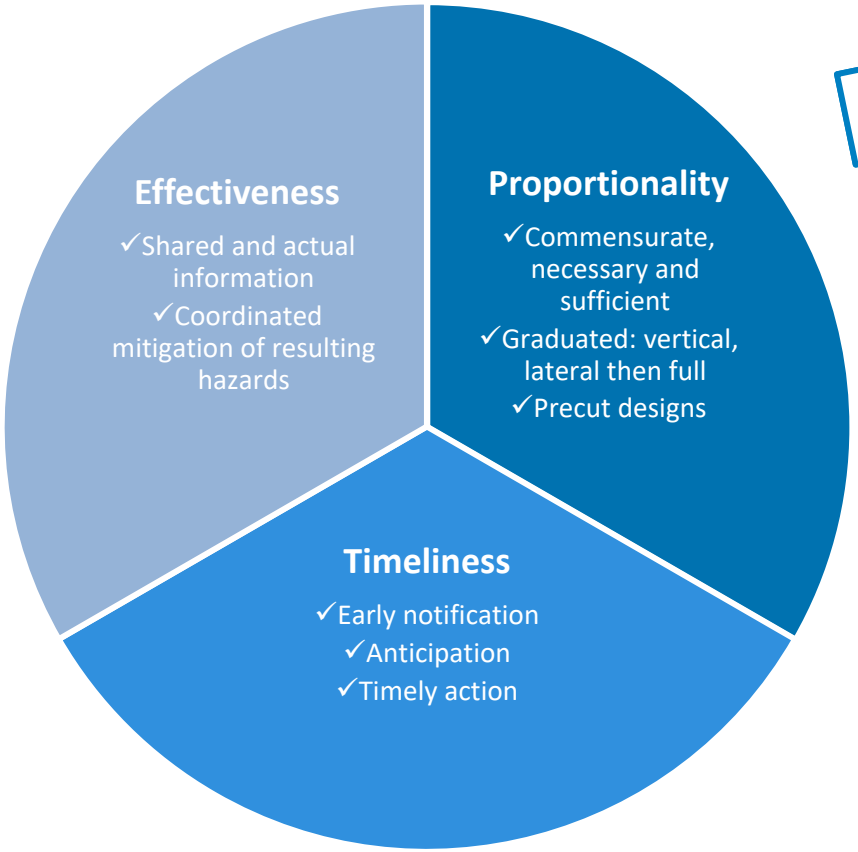




HUMAN IN THE LOOP

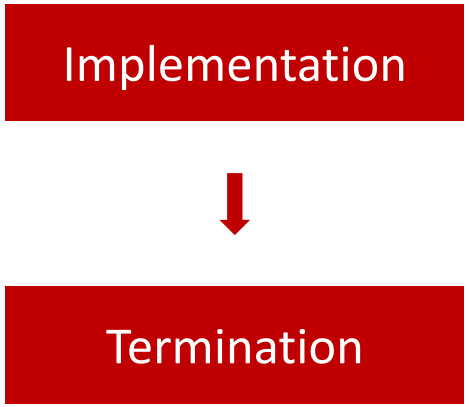
AUTOMATION

Guiding Principles

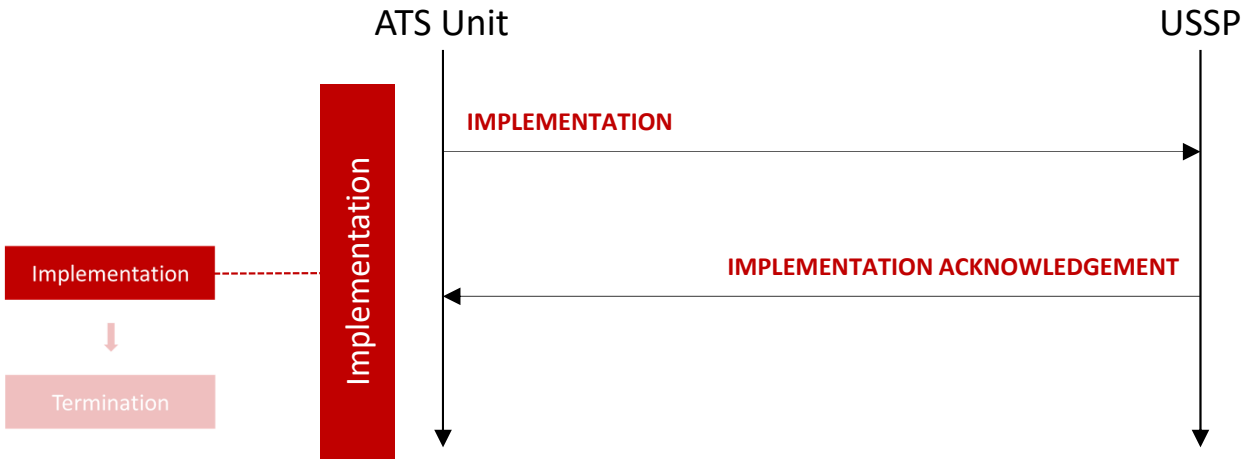


BALANCED APPROACH

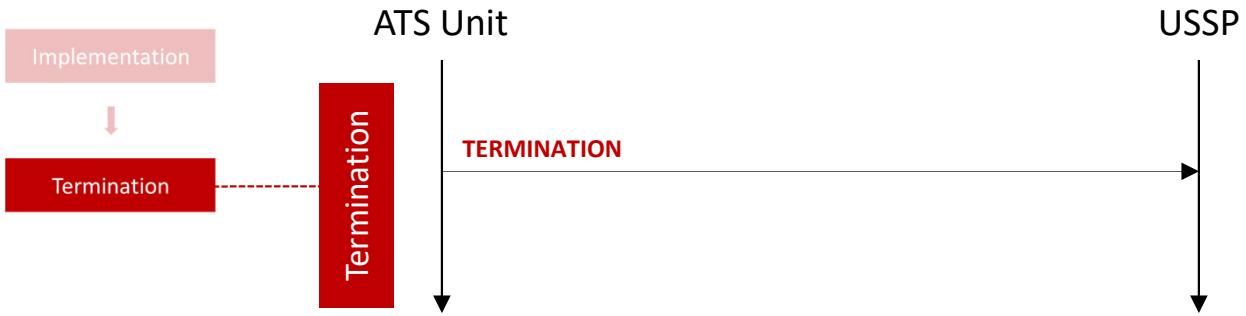
Overview of a typical DAR sequence



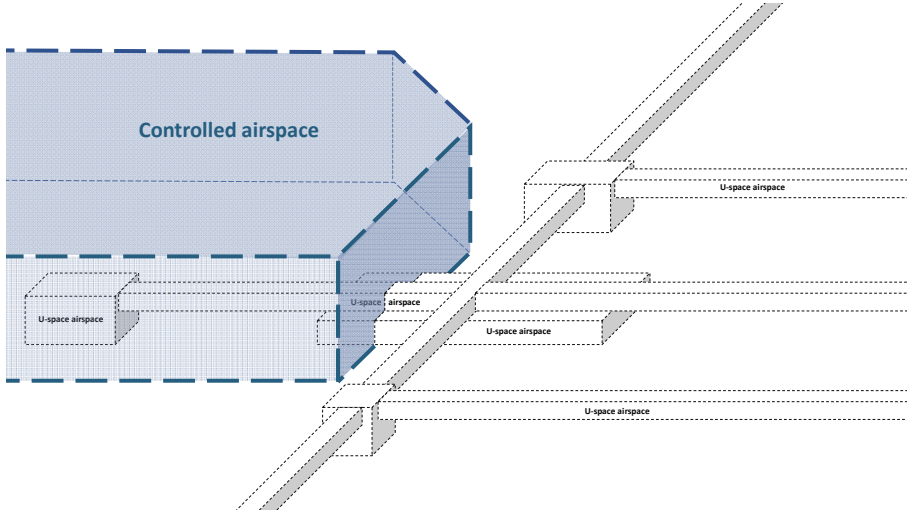
Overview of a typical DAR sequence - Cont'd

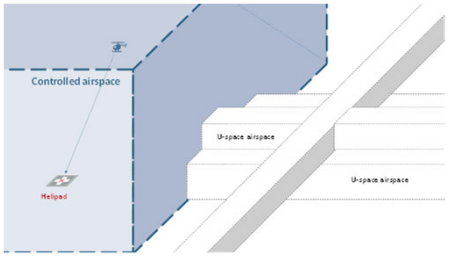


Overview of a typical DAR sequence - Cont'd

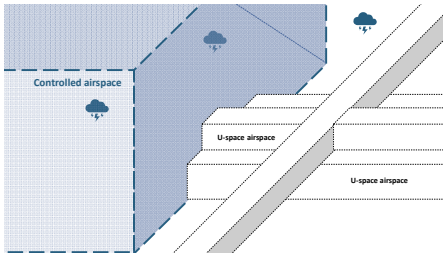


DAR example use cases (illustrative airspace fictional configuration)

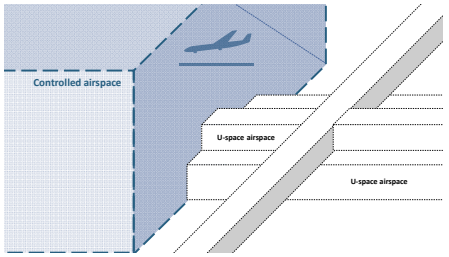




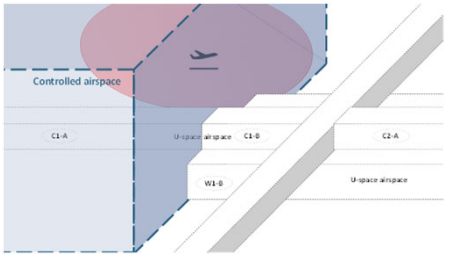
Example A.
Medevac Helicopter Emergency Medical Service (HEMS) landing at hospital



Example B.
Drop in airspace capacity due to adverse conditions



Example C.
Emergency landing of a crewed aircraft



Example D.
Unplanned specialised operation (SPO)

Best practices

EASA
European Union Aviation Safety Agency

#USPACE
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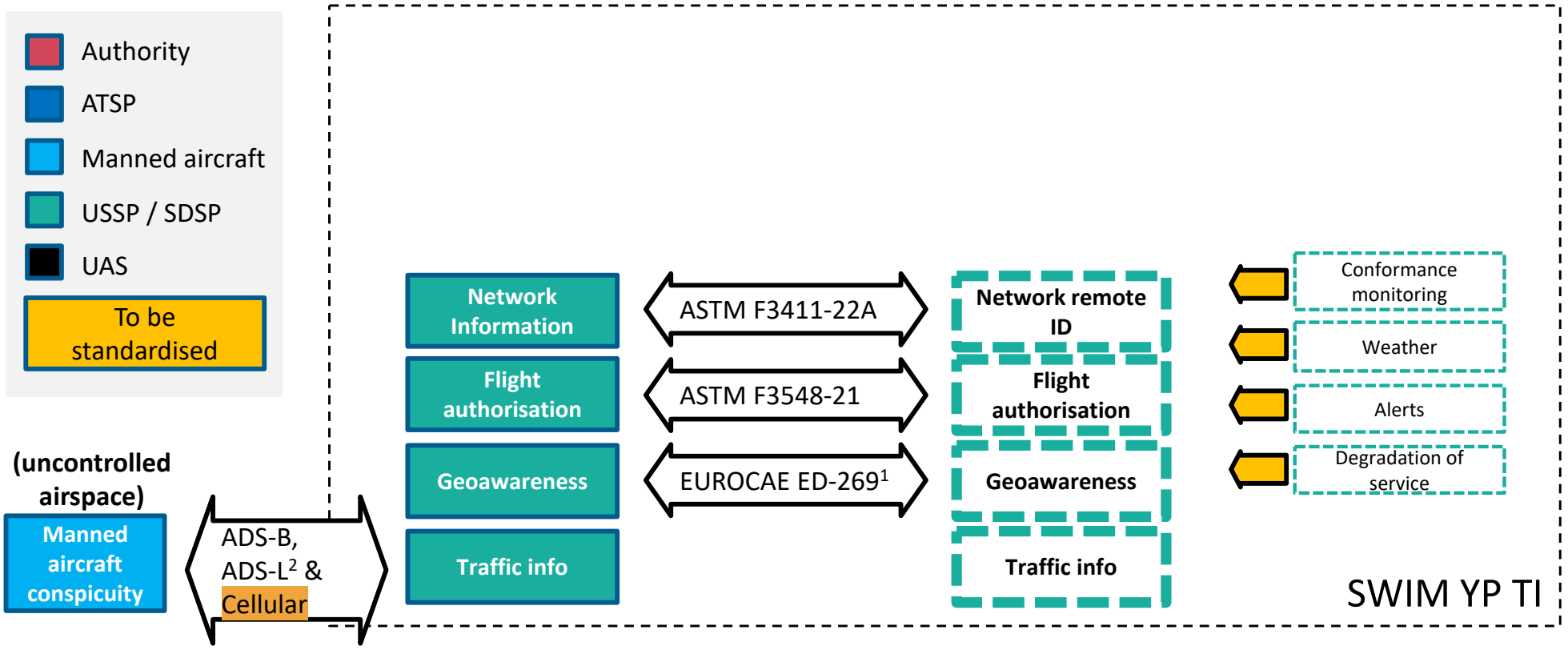
Roles and Responsibilities in the U-space

- #6 - USSP (Art. 7)

Jonas STJERNBERG, robots.expert
Senior Vice President, Partner

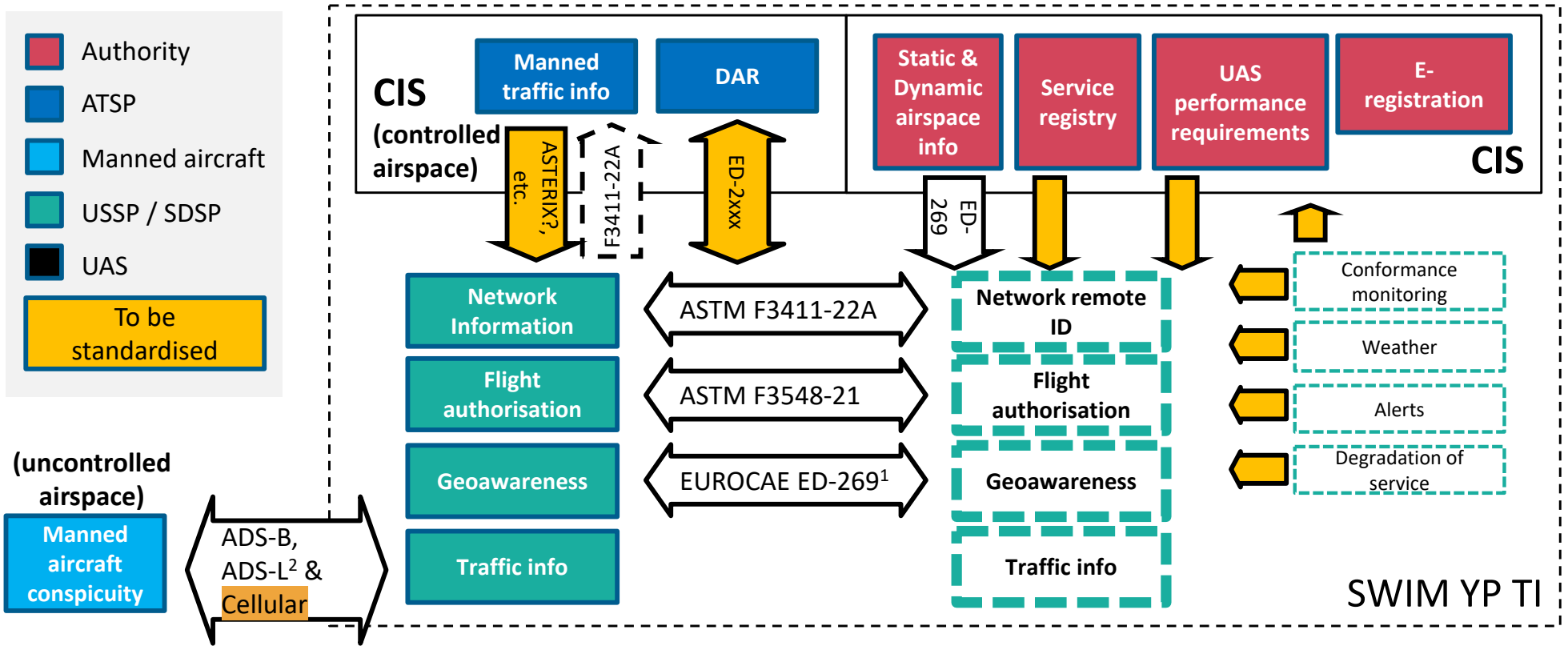
https://www.linkedin.com/in/jonas-stjernberg-496624/

Interface standards partially work in progress



1. ED-269 will be updated to ED-2xxx during 2023; 2. ADS-L 4 SRD860 published Jan, 2023

Interface standards partially work in progress



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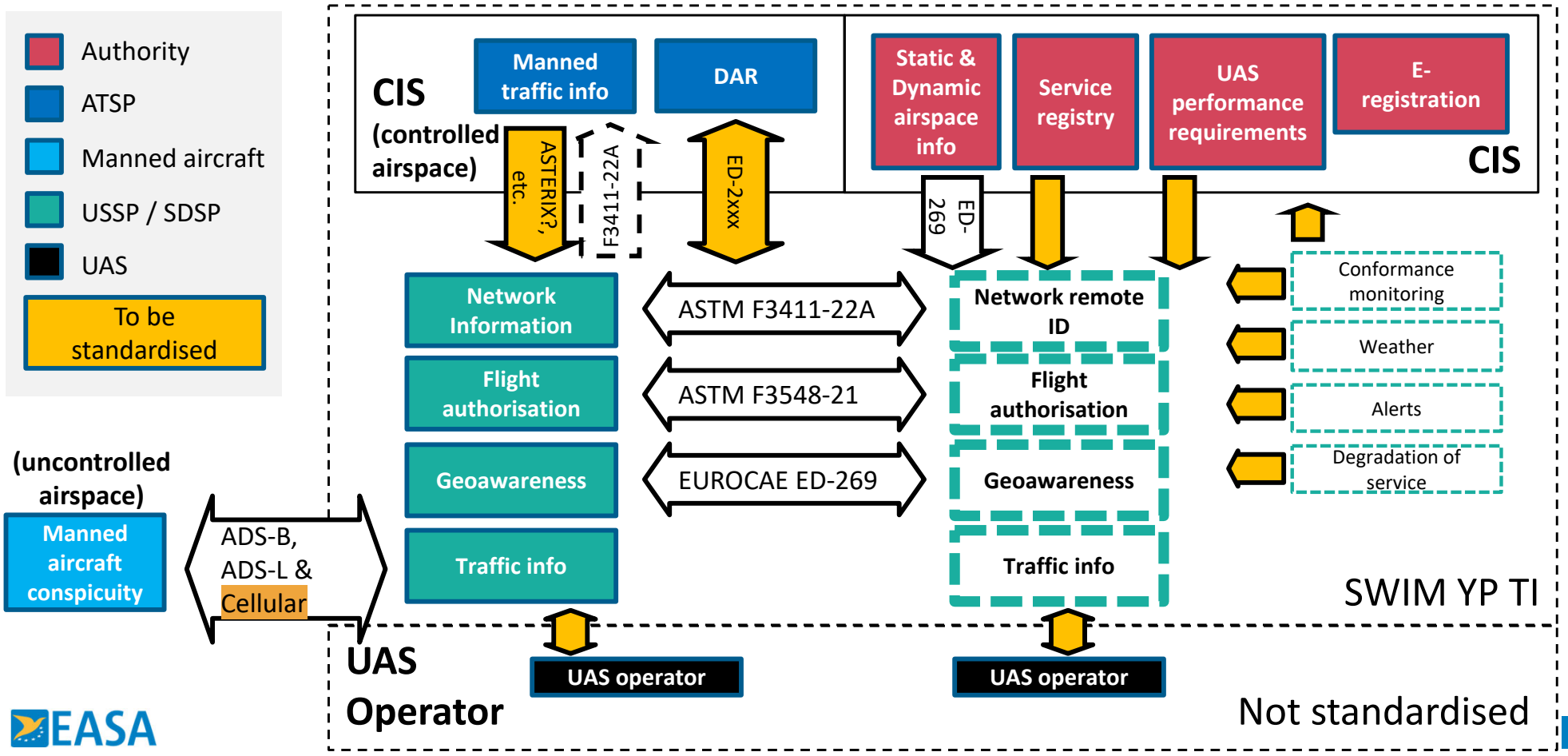
Interface standards partially work in progress



USSP – USSP – CIS information exchange

<table>
<tr><th>U-space service</th><th>Data model & format</th><th>Latency</th><th>Standard</th></tr>
<tr><td>Network Remote ID</td><td>Annex 4 to ASTM F3411-22A</td><td>Smaller than the latency necessary for the proper functioning of the traffic information service, this at least 99 % of the time.</td><td>ASTM F3411-22A</td></tr>
<tr><td>Flight authorization</td><td>GM1 Annex IV UAS flight authorisation request</td><td>Activations of the flight authorisations are confirmed within 5 seconds, 95 % of the time.</td><td>ASTM F3548-21</td></tr>
<tr><td>Traffic information</td><td>ADS-L for compliance with SERA.6005(c)
Not specified for ATS traffic → ASTERIX likely</td><td>latency for distributing traffic information that is smaller than 5 seconds, this at least 99 % of the time.</td><td>ED-102B (ADS-B), ASTERIX, ADS-L (to be published)</td></tr>
<tr><td>Weather information</td><td>Variants of MET products (such as METAR or aerodrome local report).</td><td></td><td>ICAO Annex 3, partly no standards</td></tr>
<tr><td>Conformance monitoring</td><td></td><td>Alert the UAS operators within 5 seconds, 99 % of the time</td><td></td></tr>
<tr><td>Geo-awareness service

Dynamic reconfiguration of U-space airspace</td><td>• ED-269/2xxx; Chapter 8 and Appendix 2; JSON format (rfc7159)
• If F3548-21 is used, it is expected to be compatible with ED-269/2xxx</td><td><table><tr><th>Data type</th><th>CIS update cycle</th><th>Geo-awareness service update</th></tr><tr><td>Static geographical zone</td><td>Based on the AIRAC cycle</td><td>Daily</td></tr><tr><td>Planned dynamic airspace restriction or limitation</td><td>Several times a day</td><td>Every 30 minutes</td></tr><tr><td>Unplanned dynamic airspace reconfiguration</td><td>On demand of the ATC unit</td><td>Within 5 seconds</td></tr></table>30 seconds at least 99 % of the time</td><td>EUROCAE ED-269/2xxx
ASTM F3548-21 for dynamic restrictions</td></tr>
</table>

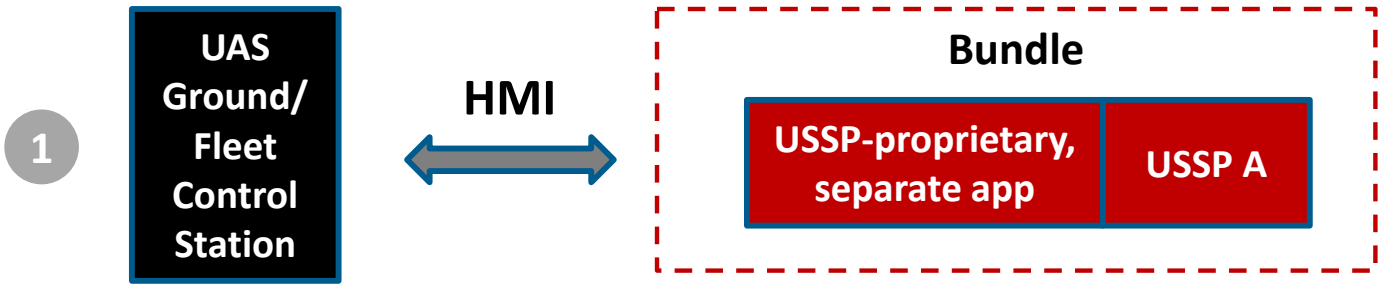
Coordination between USSP and ATS provider

- Coordination of activities
  - Emergency management plan (aircraft / UAS emergency, system degradation, …)
  - Expecting (mostly) same coordination procedures for all in a single U-space airspace
- Exchange of relevant operational data and information
  - ATSP → USSP
    - Relevant manned traffic information (ATS.OR.127(a))
    - DAR requests
    - Contingency / emergency of manned aircraft in U-space airspace
  - USSP → ATSP
    - DAR acknowledgements
    - UAS special operations ongoing in U-space airspace
    - When relevant, non-conformance detected in U-space airspace
    - Contingency / emergency of UAS in U-space airspace
    - (Optional: Network Identification information – ATSP is an authorized user)
  - Both ways
    - System or service shortages / degradation or Inability to exchange with the USSP
    - Alerts

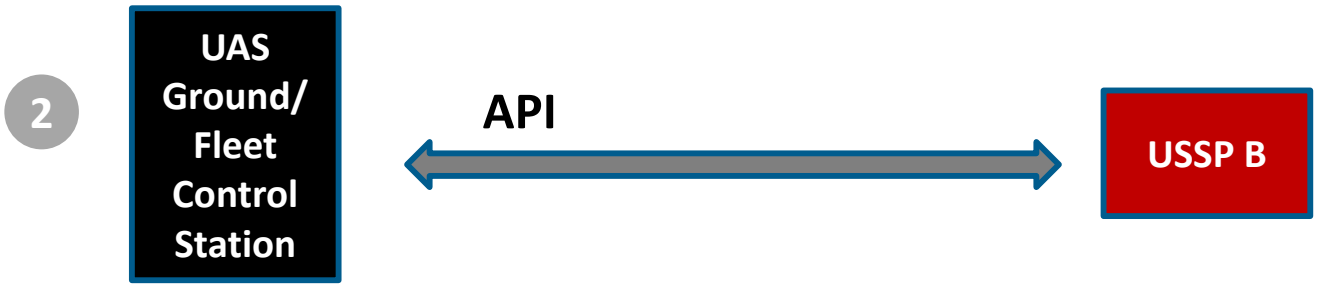
USSP - USSP

- All USSP's need to use the same interfaces and procedures in a single U-space airspace
- Recommend industry to cooperate to promote pan-European standardisation of interfaces using publicly available Service Descriptions

Two ways for UAS operators to connect to USSP



The likely way for a majority of VLOS flights, until UAS manufacturers have integrated with USSP's through API



Likely the preferred way for BVLOS operations and other advanced flights

USSP to provide clear user guides on how to configure and use USSP services, including security

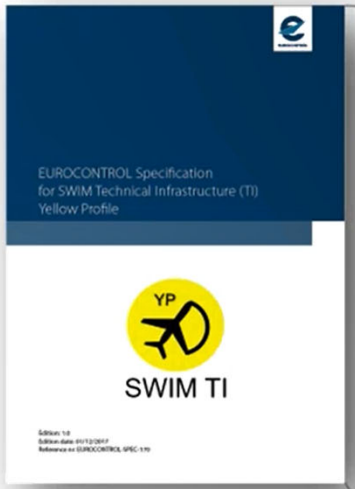
Service Level Agreements with UAS Operators

- "One-stop-shop": USSPs will provide all (the bundle) of U-space services (4, 5 or 6) required in a U-space airspace
  - A USSP may subcontract some or all several U-space services, as long as the USSP is responsible for all provided services
- USSP will provide:
  - All information in machine readable form
  - Interfaces to U-space services with instructions (AMC2 Article 7(2))
  - Information on degradation of USSP services (within 30 seconds), and related contingency procedures (AMC3/AMC4 Art. 7(2))
  - Operating instructions for the U-space airspace and the U-space services, including normal, contingency and emergency procedures related to the U-space services (AMC5 Article 7(2))
  - Safety-critical information and alerts to support situation awareness and decision making
- To be settled in an SLA, in addition to the points above include:
  - How UAS operators stay connected with the USSP, when required
  - How the UAS operator interfaces with the USSP: HMI, API or both
  - How UAS operators report service degradation if they connect to the USSP via API (Article 6)
  - UAS performance requirements (Article 6)
  - Requirements for UAS operators to maintain required level of performance of U-space services throughout flight (Article 6)
  - UAS operator contingency measures and procedures (Article 6)
- In uncontrolled airspace USSP's will acquire e-conspiquity information (not necessarily for free) to be able to provide Traffic Information on manned aircraft to UAS operators

SWIM Technical Infrastructure Yellow Profile

- → Causes confusion and some misunderstandings
- → Interfaces should conform to requirements in Annex A
- → Is interoperable
- → Addresses security
- → ANSP's in Europe are in the process of adopting it
- → Has sufficiently low latency for U-space operations

SWIM TI YP supports many different bindings



Interoperability Requirements
One size does not fit all

	MEP		Performance		Security			
	Pattern Supported[4]	Pattern Specified [7]	Messaging QoS Capability	Bandwidth Efficiency	Confidentiality	Integrity	Authentication	Binding
HTTP	R/R	R/R	No	++	Transport	Transport	Transport (X.509 Server or X.509 Mutual)	WS Light
SOAP WS	R/R	R/R	Yes	+	Transport	Transport	Transport (X.509 Server or X.509 Mutual)	WS SOAP
					Transport	Transport	Transport (X.509 Server or X.509 Mutual) Message (Username/ Password)	WS SOAP with Basic Message Security
					Message (Optional)	Message	Message (X.509)	WS SOAP with Message Security
					Message (Optional)	Message	Message (X.509 or SAML)	WS SOAP with Federated Security
SOAP WS-N	P/S	P/S	Yes	+	Transport	Transport	Transport (X.509 Server or X.509 Mutual)	WS-N SOAP
					Transport	Transport	Transport (X.509 Server or X.509 Mutual) Message (Username/ Password)	WS-N SOAP with Basic Message Security
					Message Optional	Message	Message (X.509)	WS-N SOAP with Message Security
					Message Optional	Message	Message (X.509 or SAML)	WS-N SOAP with Federated Security
AMQP	(a)R/R, P/S, FF	FF	Yes	+++	Transport	Transport	Transport (X.509 Server with SASL Client or X.509 mutual)	AMQP Messaging

Popular

Popular

Picture: EUROCONTROL, REX modified

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SWIM Service Descriptions and interoperability

- Requirement to create SWIM Service Descriptions ensures that U-space service interfaces do not become proprietary ‘black boxes’ (GM4 Article 7(5))
  - Operational and business context of the service
  - (Information exchange) Service description (interfaces, payload, data types, enumerations, …)
  - Service performance level and validation aspects
- Allows the industry to collaborate and keep information semantically compatible (e.g., how altitude is encoded)
- EUROCAE ED-269 is an example, which establishes a conceptual definition and its implementation in a standard data encoding
- No requirement to push SD’s to the SWIM registry – only to make them public

Short term “pain” to write an SD for the first time
– long term “pain” if not done at all

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Roles and Responsibilities in the U-space

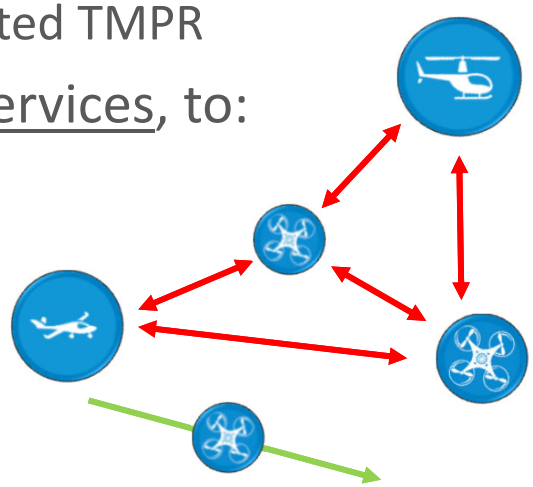
- #7 - UAS Operators (Art. 6)

Stéphane VAUBOURG, EASA
Drones Project Manager – U-space

UAS Operators

- Operators are responsible for the safety of the operations
- Even in U-space, Operators have to submit a SORA per the (EU) 2019/947, and get approval of their competent authority when required
- In U-space:
  - The SORA, Air Risk Class should be determined by the ARA
  - The operators have to complete their SORA, to consider the GRC directly induced by their operations, and to satisfy for the related TMPR
- All Operators must subscribe and use the U-space services, to:
  - Allow their access to the U-space airspace
  - Mitigate the risk of MID-AIR COLLISION

    by common structure and rules
- The Operators' SORA may be facilitated…



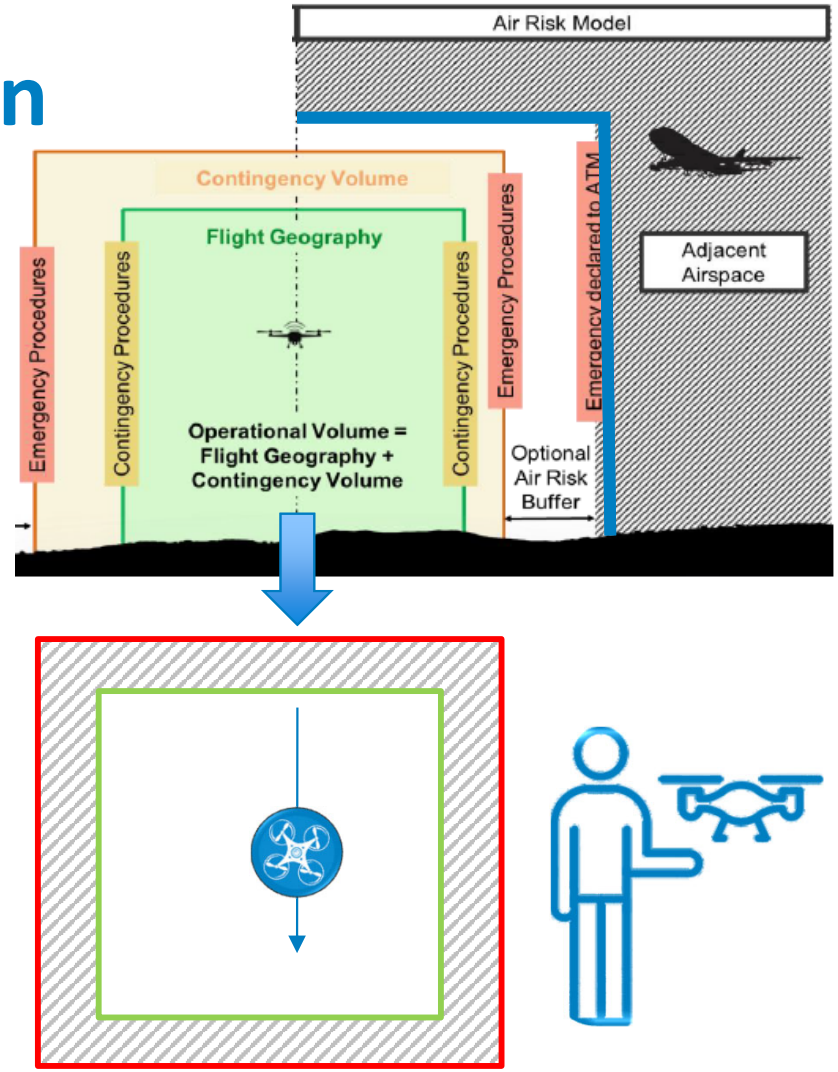
U-space & SORA (EU) 2019/947 - ARC

U-space

SAIL determination				
	Residual ARC			
Final GRC	a	b	c	d
≤2	I	II	IV	VI
3	II	II	IV	VI
4	III	III	IV	VI
5	IV	IV	IV	VI
6	V	V	V	VI
7	VI	VI	VI	VI
>7	Category C operation			

Flight preparation and execution

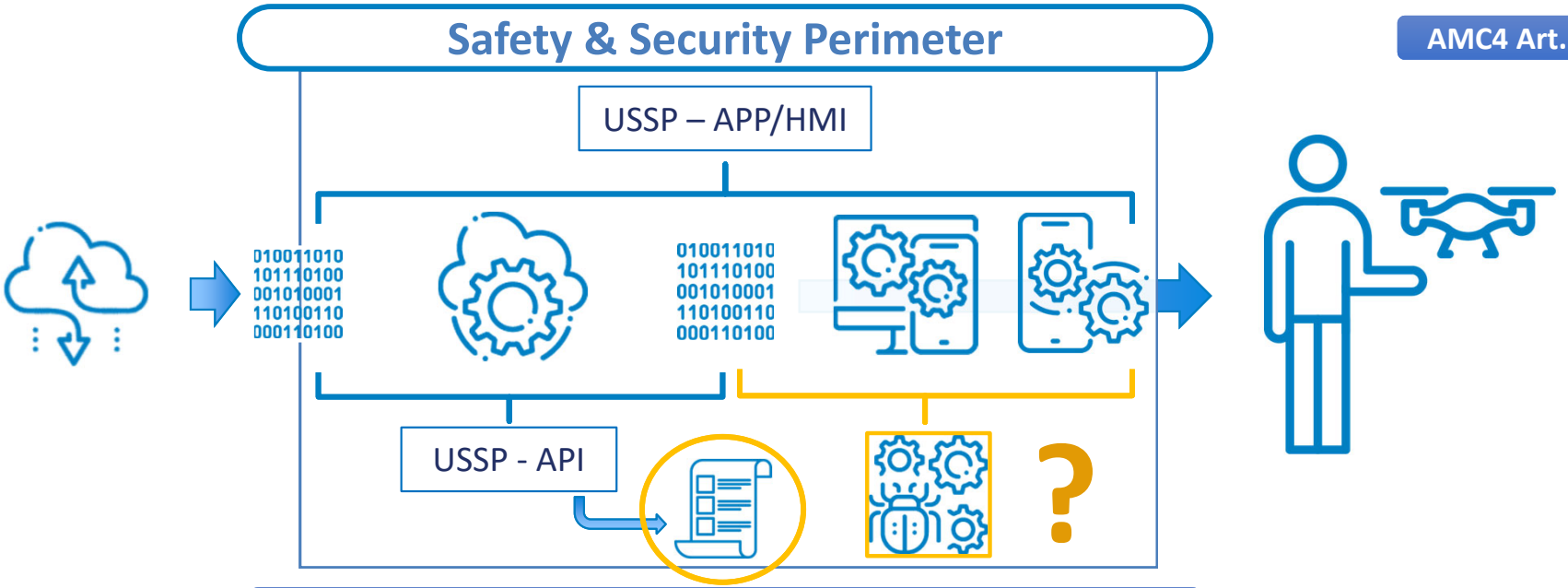
- Operators must properly plan their flight, considering:
  - The U-space geography
  - The required "Flight Geography" or UA trajectory
  - The nearby prohibited, or restricted geo-zones
  - **The contingency plan(s)** (e.g. in case of DAR)
- Flight preparation, Operators:
  - Submit and obtain a flight authorization
  - Select/use the UAS to comply with the UAS performance requirements and USSP "Terms and Conditions"
  - Ensure that deviation thresholds can be satisfied
  - Obtain the relevant authorization to restricted geo-zones
- Flight execution, Operators:
  - Activate the flight prior take-off
  - Safely conduct the flight within the authorized volume
  - Answer to the dynamic changes in the U-space airspace *(DAR, TR, NC, changes to the flight authorisation…)*
  - Deactivate the flight after landing



Authorised 4D volume

Situational awareness and installation

- → The Operator's installation should ensure proper usage of the U-space services (e.g. connectivity, visibility,…) and to maintain efficient continuous situational awareness
- → Operator's may develop/integrate the API in their environment but…



Continuity of performance requirements and security/safety has to be satisfied

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Roles and Responsibilities in the U-space

- #8 - e-conspicuity (SERA.6005c)

Vladimir FOLTIN, EASA
Project Manager / PCM / ATM Expert

e-conspicuity - constraints and boundaries

Aircraft (manned)

- **Affordability** (to end users)
- Technology **available now** (aviation & other)
- **Single device policy**
- Simple installations

- *Enable airborne collision risk mitigation for manned aircraft*

USSP

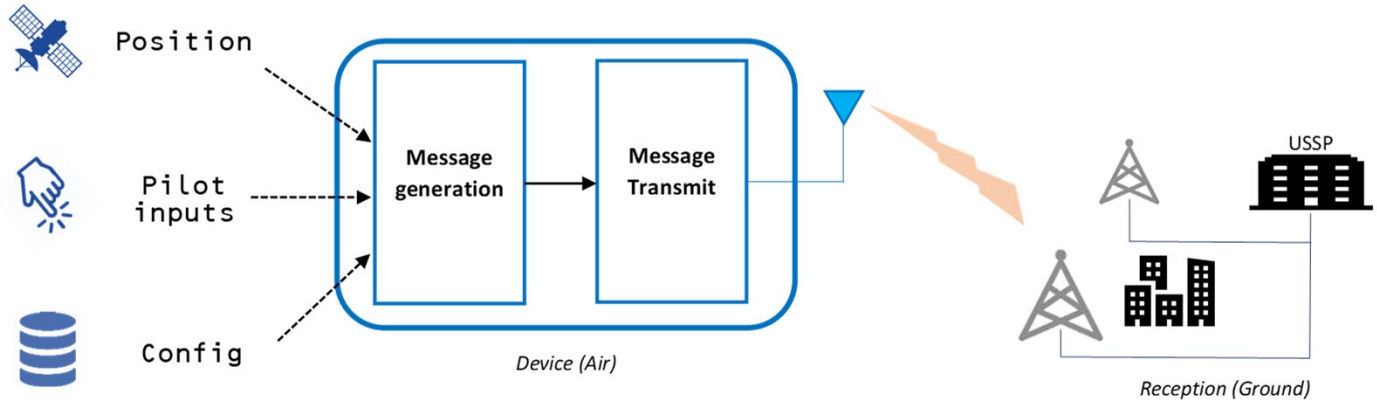
- Minimum necessary position information
- **Affordable infrastructure** (ideally compatible with UAS needs)
- Minimum performance meeting U-space objectives

Resources

- Existing international standards (aviation & other)
- **Pan-European applicability**
- ITU regulated spectrum
- **Machine readable**
- Open standards (non-proprietary or free)
- **Saturation of frequency** (1090MHz)

Suitable for urban and low level environments

Introducing ADS-L



- **Minimum standard** for making manned aircraft in U-space conspicuous to USSPs
- **Automatic Dependent Surveillance (ADS) Principle: "-L" is for "Light"**
  - Compatible with **low-cost devices** and **mobile telephones**
  - **GNSS-based** parameters
  - Derived from **ADS-B** and **simplified**
- Should support possible **future applications** ( )

Means of Transmission

ADS-B Out (1090 MHz)

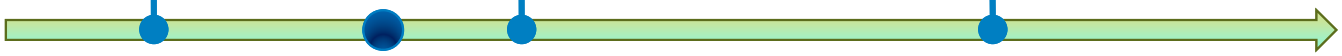
For certified aircraft, using the **existing certified technology** already installed on board

ADS-L (SRD-860)

Non-certified devices transmitting at low power on the licence-free band SRD-860, in compliance with ADS-L specifications

ADS-L (Mobile telephony)

Mobile telephony application transmitting in compliance with ADS-L specifications



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ED Decision 2022/024/R

Technical Specification
for
ADS-L transmissions using SRD-860 frequency band
(ADS-L 4 SRD-860)

ACCEPTABLE METHODS, TECHNIQUES AND PRACTICES FOR CARRYING OUT ADS-L TRANSMISSIONS USING SRD-860 FREQUENCY BAND AS PERMITTED PURSUANT TO AMC1 SERA.6005(c) POINT (a)(3)(i)

Issue 1
20 December 2022[1]

[1] For the date of entry into force of this Issue, please refer to Decision 2022/024/R at the Official Publication of EASA.

Page 1 of 30

Contributors

Mobile Telephony - Feasibility Study

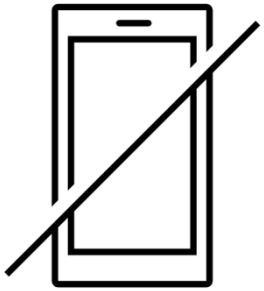
Aerial Mobile Telephony is now possible in Europe !

CEPT/ECC Decision (22)07 of 18 November 2022 on harmonised technical conditions for the usage of aerial UE for communications based on LTE and 5G NR in the bands 703-733 MHz, 832-862 MHz, 880-915 MHz, 1710-1785 MHz, 1920-1980 MHz, 2500-2570 MHz and 2570-2620 MHz harmonised for MFCN

Can existing mo… …ake aircraft … …SSPs today?

Legal certainty for aerial use

Standardization
(frequencies, services, roaming …)



Smartphones / Dedicated devices

Mobile Telephony – Next Steps

Expert group
Ad-hoc Group of Experts with background in aviation and mobile telecommunication networks
EASA, ACJA (GUTMA & GSMA) and relevant OEMs

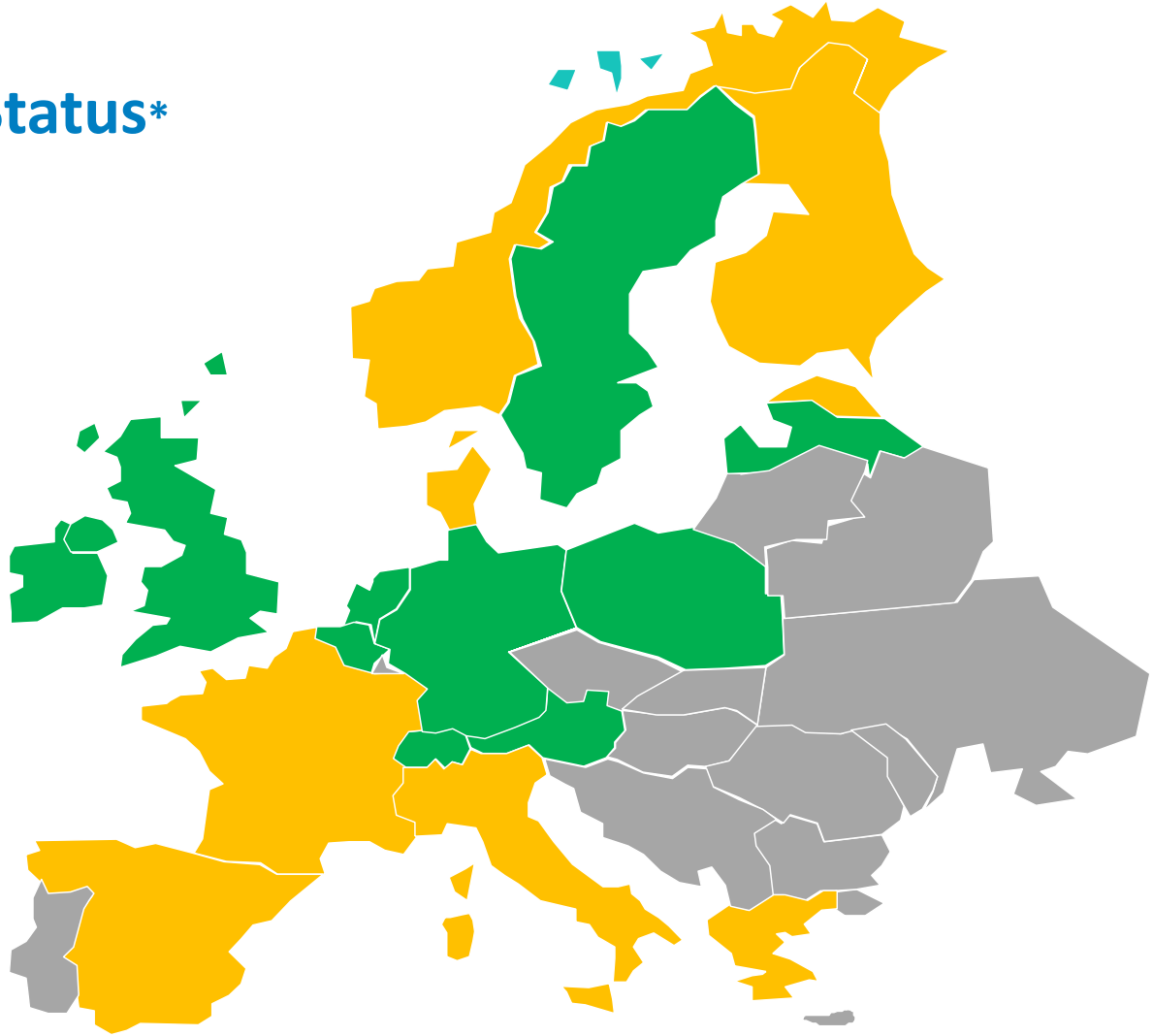
Existing Standards
Review of the CEPT/ECC decision and collection of existing and relevant mobile telecommunication network standards and specifications

EASA Specification
Drafting of EASA Technical Specification for ADS-L transmissions using (aerial) mobile telecommunication networks
(possible fusion with ADS-L 4 SRD860 specification)

ADS-L 4 MOBILE
(expected in 2023)

Aerial Mobile Services Status*

- Ready for commercial use
- Almost ready for deployment
- No information



* Overview based on industry feedback

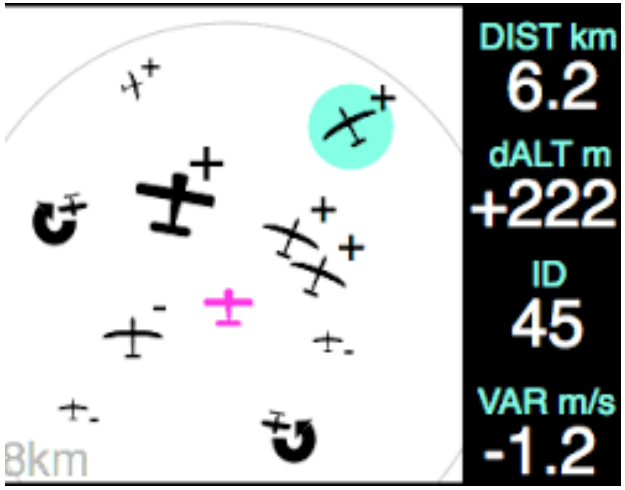
Summary: e-conspicuity means

Certified ADS-B out

- ✓ ICAO standard
- ✓ Already used
- ✓ All elements in place

SRD860

- ✓ Utilises past investments
- ✓ Affordable infrastructure
- ✓ **ADS-L 4 SRD-860** PUBLISHED



Mobile Telephony

- ✓ Existing infrastructure
- **Need for implementation**
- SOON **ADS-L 4 Mobile***

**expected in 2023*

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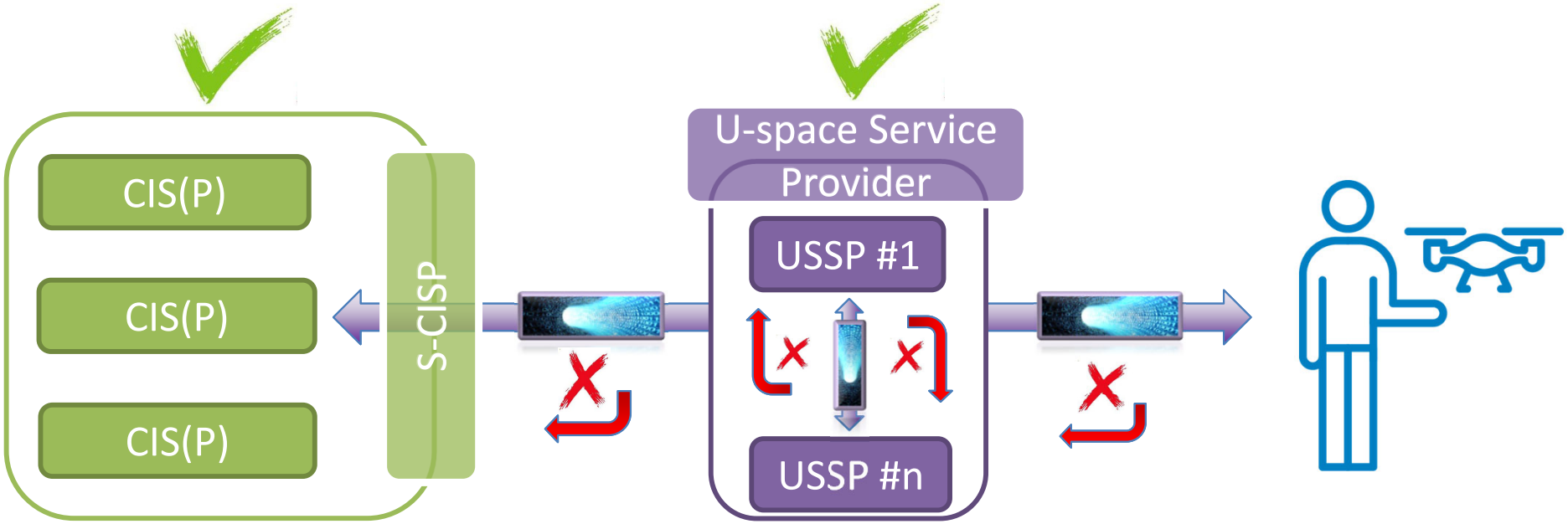
Roles and Responsibilities in the U-space

- #9 - Data quality and continuity of services

Stéphane VAUBOURG, EASA
Drones Project Manager – U-space

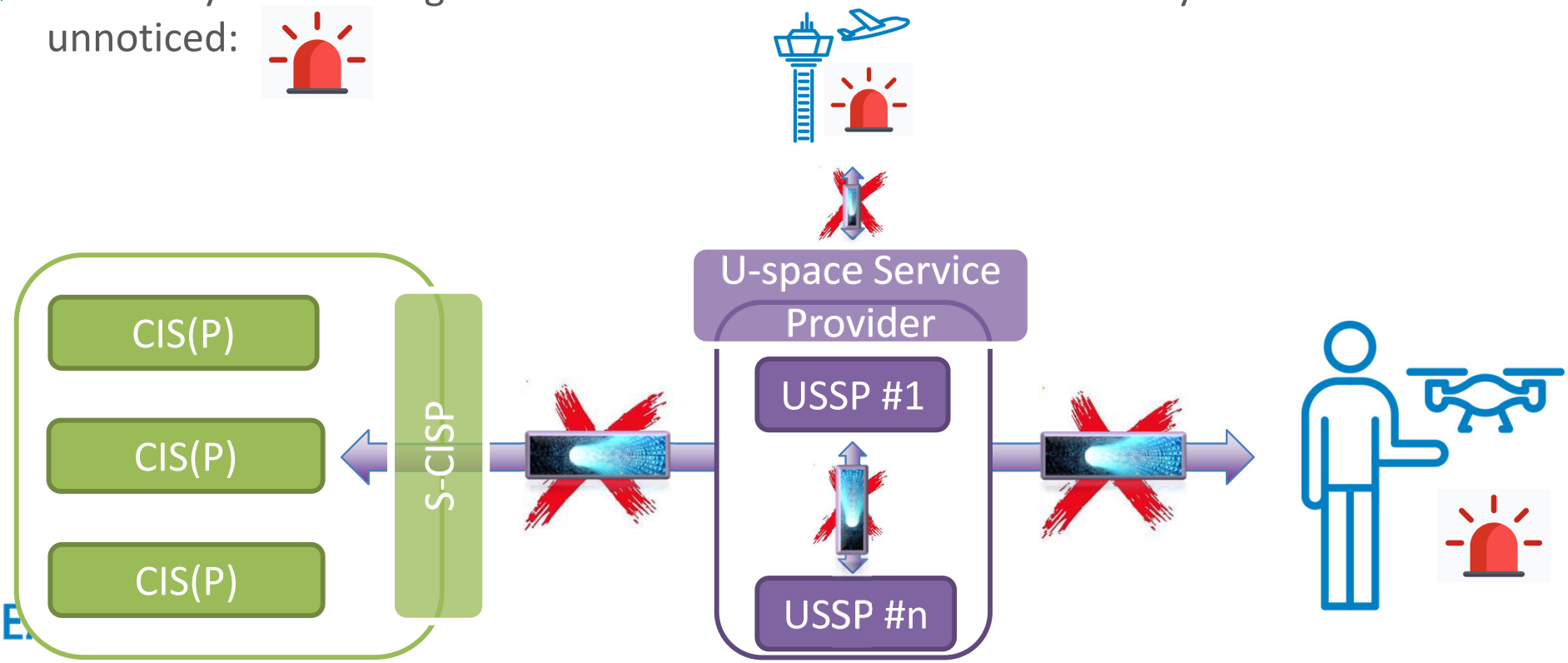
Data quality and Integrity

- Data quality and integrity must be ensured all along the processing(s)
- Data quality issues have to be reported



Continuity of services

- Interfaces and provision of services should be continuously monitored: s-CISP, USSP, Operators, ATC
- For safety reasons degradation of services or loss of connectivity should not remain unnoticed:



Workshop closure of the day

Maria ALGAR RUIZ, EASA
Programme Manager - Drones

EASA
European Union Aviation Safety Agency

U-space workshop

From the concept to the implementation

Cologne June 22, 23 2023

- Day 2 - Your safety is our mission.

An Agency of the European Union

Workshop agenda

Day 2	Friday, 23 June 2023
09:00 – 09:15	Day 2 opening
09:15 – 12:00	U-space services
09:15 – 09:25 *09:25 – 09:40* *09:40 – 09:55* *09:55 – 10:25* *10:25 – 10:40* *10:40 – 11:00* *11:00 – 11:15* *11:15 – 11:30* *11:30 – 12:00*	• *Introduction* • *Art 8 – Network Information* • *Art 9 – Geo-awareness* • *Art 10 – Flight Authorisation* • *~15 min break* • *Art 11 – Traffic Information* • *Art 12 – Weather Information* • *Art 13 – Conformance monitoring* • *Q&A*
12:00 – 12:30	Evolutions of the AMC/GM to the U-space regulatory framework
12:30 – 13:15	Lunch break
13:15 – 15:30	Single CISP & USSP certification framework and process
13:15 – 13:20 *13:20 – 13:50* *13:50 – 14:10* *14:10 – 14:30* *14:30 – 14:45* *14:45 – 15:00* *15:00 – 15:10* *15:10 – 15:30*	• *Introduction* • *Certification framework, tasks & effort, preliminary view on oversight* • *Organisation and SMS* • *Safety Assessment vs Safety Support Assessment* • *Software (+automated verification)* • *Cyber (+Part IS)* • *On-boarding process* • *Final Q&A*
15:30 – 16:00	Workshop closure

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U-space services

Network Information (Art. 8)

Benoit CURDY, FOCA
Head of Section - Strategy and Innovation

Amanda BOEKHOLT, FOCA
Deputy Head of Section - Strategy and Innovation

Network Identification service

Art. 8 Implementing Regulation (EU) 2021/664

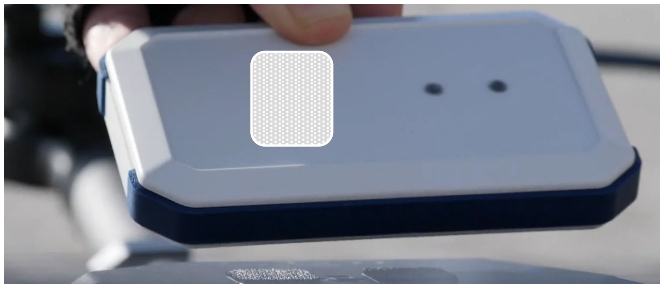
Real-time data ≠ tracking service

- The network identification service provides :
  - the registration number of a UAS operator
  - the serial number of an unmanned aircraft
  - live flight data of the UAS
- Authorised users:
  - USSPs
  - General public
  - ATSP
  - Single CISP
  - Other competent authorities (e.g. NAA/CAA, police,…)

Network Identification service

- Drone's built-in broadcast means (e.g. Bluetooth) have limited performances (e.g. range)
- Transmission may be (mostly) performed over GNSS-LTE (3G/4G) and ADS-B

Add-on devices

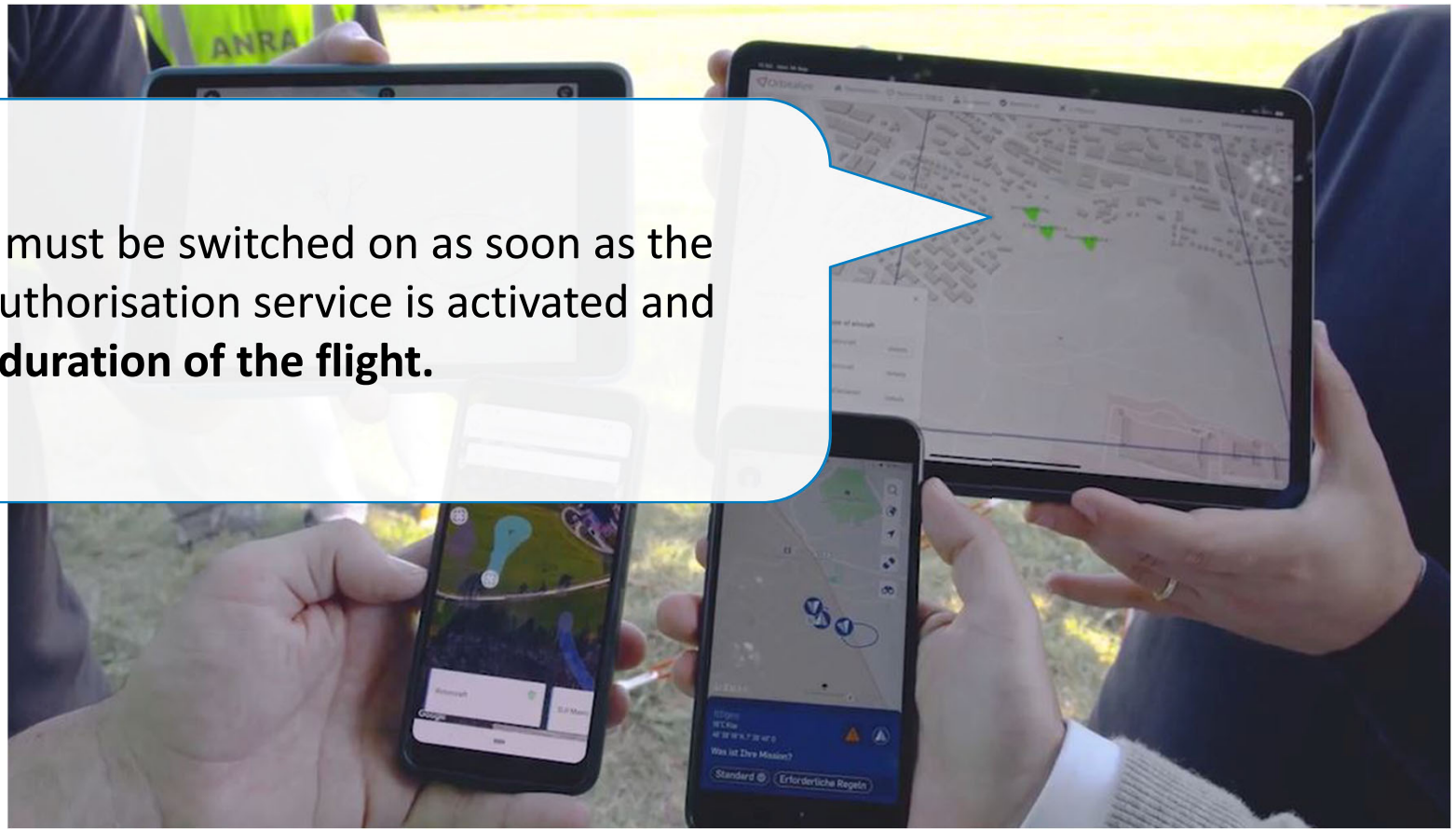


- Live data of the UAS :
  - Geographical position
  - Route course
  - Emergency status
  - Altitude/height
  - Type of UAS

When not built-in the Operators may trig the emergency status manually

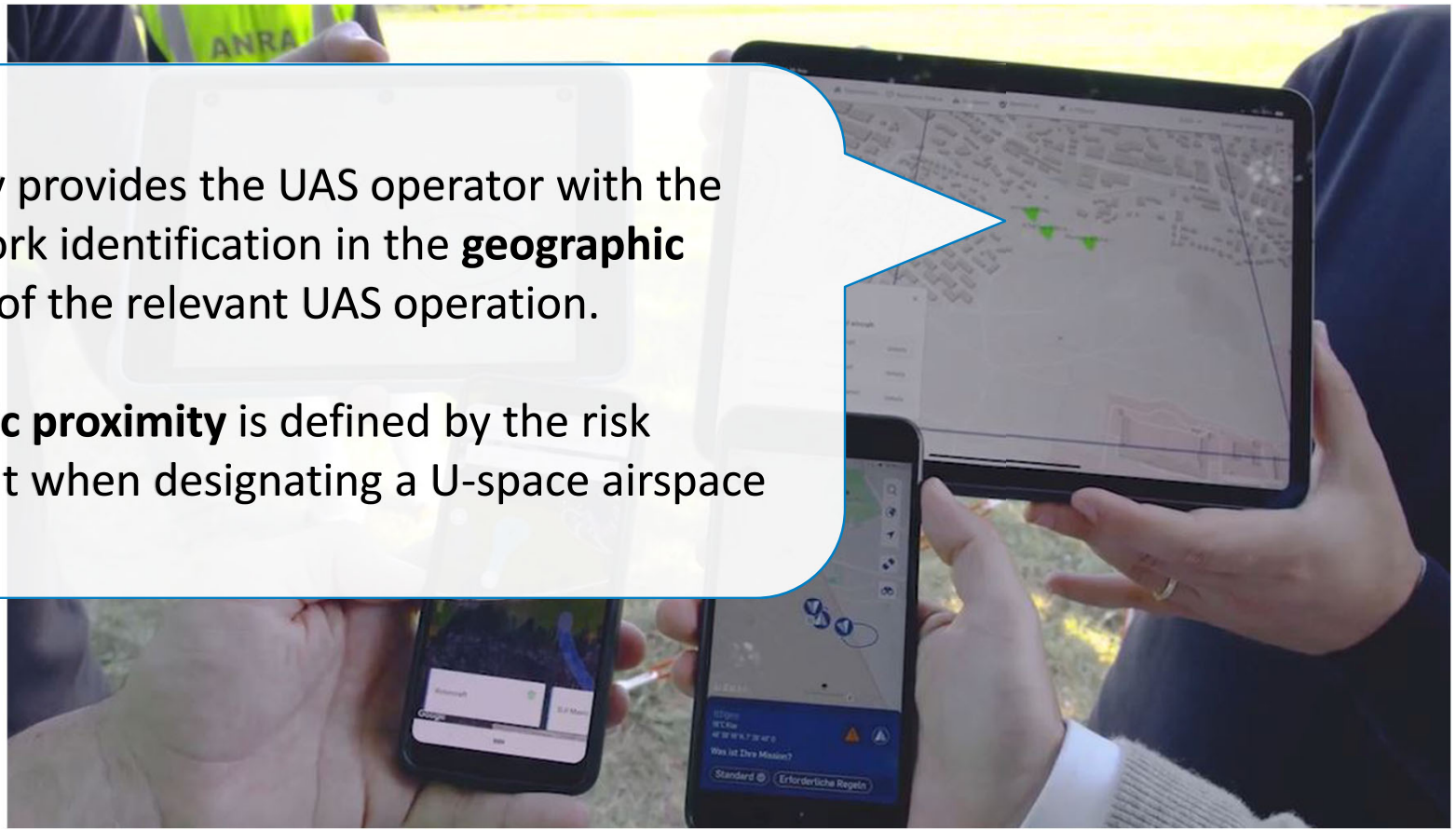
USSPs should convert the heights above the WGS 84 ellipsoid exchanged with the ASTM F-3411-22A standard to height above mean sea level (MSL)

Network Identification service



The service must be switched on as soon as the UAS flight authorisation service is activated and **last** for the **duration of the flight.**

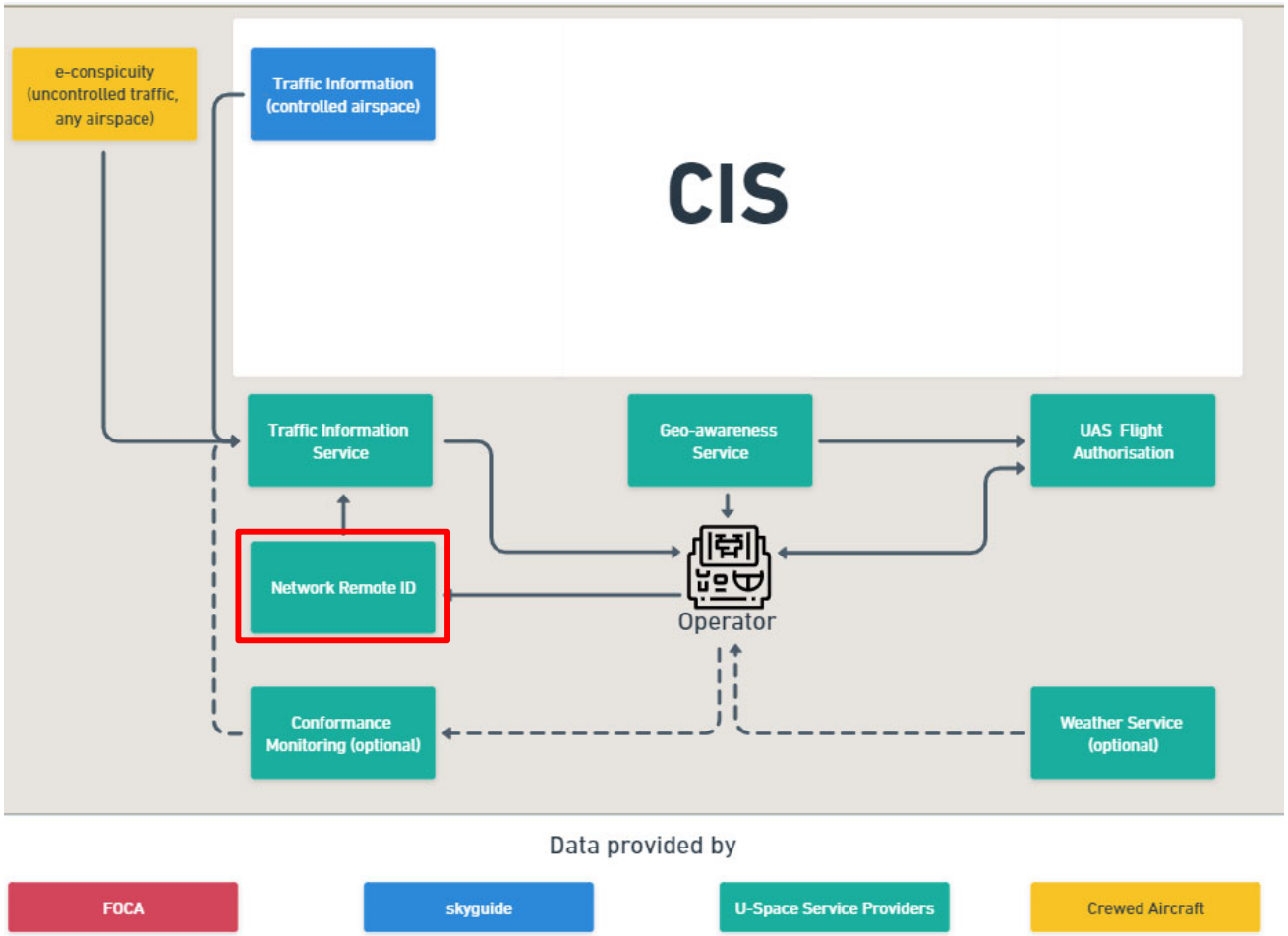
Network Identification service



USSPs only provides the UAS operator with the UAS network identification in the **geographic proximity** of the relevant UAS operation.

Geographic proximity is defined by the risk assessment when designating a U-space airspace

Data flow: Operator's view



Standard ASTM F3411-22A

- Data **exchange** interface: Data exchange between USSPs
- Data **access**: Provision of aggregated data to authorised users
- Interface **testing** : Verification of the U-space performance requirements

(automated testing)

Designation: F3411 – 22a

Standard Specification for Remote ID and Tracking[1]

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U-space services

Geo-awareness (Art. 9)

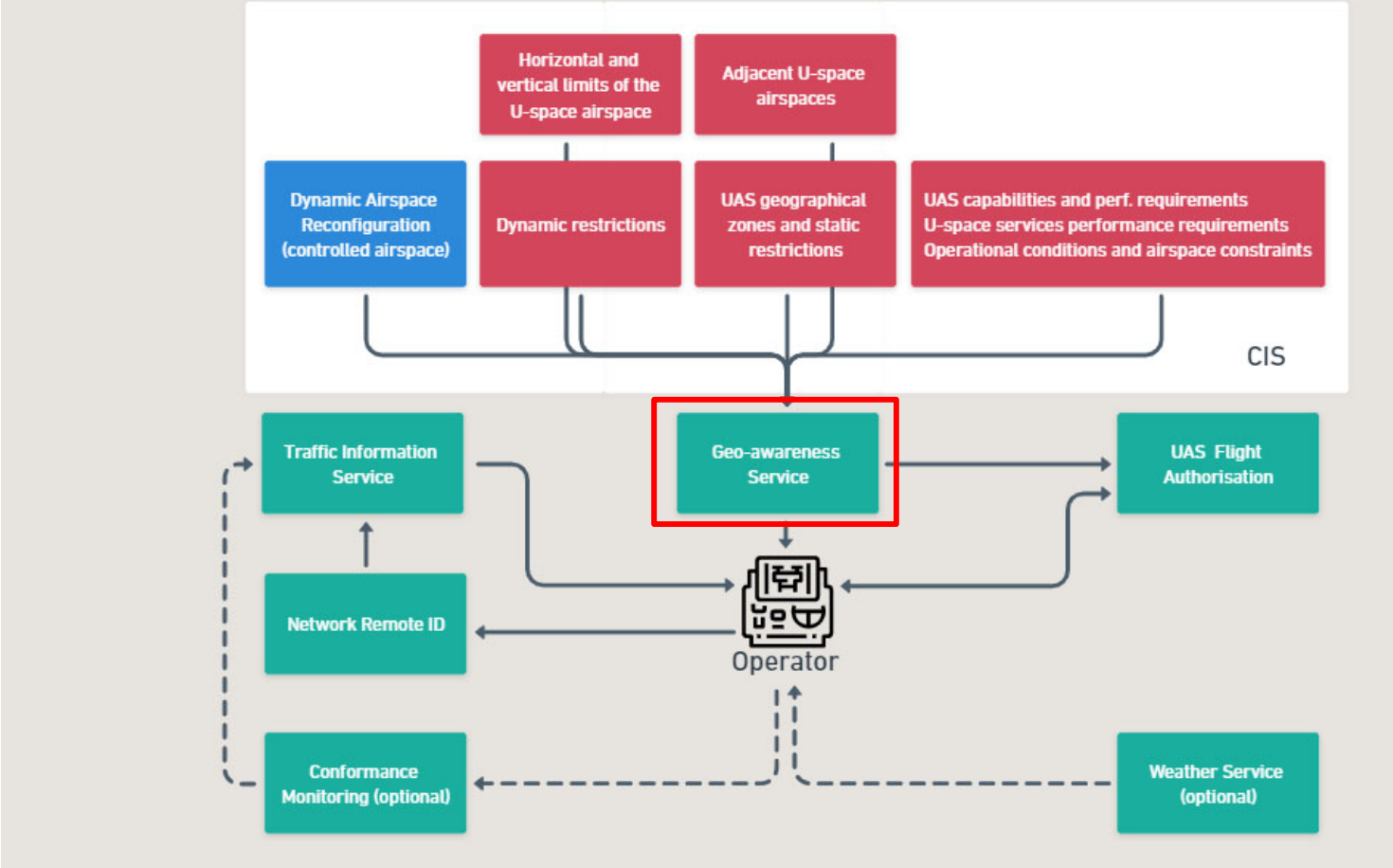
Benoit CURDY, FOCA
Head of Section - Strategy and Innovation

Amanda BOEKHOLT, FOCA
Deputy Head of Section - Strategy and Innovation

What is the Geo-awareness service ?

- Provides UAS operators with the information about the latest airspace constraints and defined UAS Geozone.
- The service can be used **prior** to the flight and **during** the flight.
- Tool to establish dynamic airspace restriction, providing privilege/delegation to authorized users (e.g. military, police, HEMS,…)

Data flow: Operator's view



What is not included in the Geo-awareness service ?

- Do not check whether the operator has the necessary authorisations to operate in a Geozone

- The service also does not allow the operator to obtain authorisations from the competent authorities in Geozones

Geo-awareness information and format

- Geo-awareness data must be available based on the data's update cycle and criticality level
- Time format and version number provided in EUROCAE ED-269 Standard
- ED 269 will be amended and separated in 2 standards (EDxxx):
  - The new ED-XXX will be the standard for geozone data (format, quality, etc.) useful for publishing geo-data for the Geowaraness service
  - A public consultation on EDXXX will be open until the end of August
  - ED269: will continue to exist but will only be used for applications linked to this data (e.g. geofencing)

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U-space services

Flight Authorisation (Art. 10)

Andrew HATELY, EUROCONTROL
Technical coordinator UTM ConOps

Flight Authorisation Service in the regulation

2021/664

→ Article 6: UAS operator obligations

→ *Already discussed*

→ Article 10: U-space Service Provider obligations

→ Annex IV: Flight authorisation request

The flight authorisation sequence

Setup

- UAS operator establish relationship with USSP

Pre-flight

- Build 'business' flight plan
- SORA (if needed)
- Obtain airspace access permission (if needed)

Flight Authorisation

- Validity check
- Deconfliction
- Unique ID
- Add to set of authorised flights

Active flight

- Activation
  - Start of tactical services
- *Aviation*
- *Contingencies*
- End
  - Cessation of tactical services

Post flight

- Recorded data stored in case of audit.

Not Article 10

Article 10 scope

The flight authorisation process

- → Every flight in U-space airspace shall be authorised
- → Authorisation checks:
  - → Valid request; timely, complete, correct, from registered operator
  - → Flight is compliant with Airspace and its capacity / maximum density
  - → Any weather minima/maxima are respected
  - → The flight does not intersect with any already authorised flight of equal or higher priority.
    - → The 4D trajectory + Deviation threshold of this flight should not intersect those of the other flight
    - → Contingency procedures that will be executed autonomously should not intersect *AMC 10(2)(a);(b)* (g)

Contingency procedures & pre-tactical deconfliction

- → Annex IV and AMC
- → If this will be a sequence flown without pilot intervention
  - → Due to absence of second channel, etc
  - → Then there will be no way for the pilot to act tactically in case of conflict
  - → Only possible deconfliction is pre-tactical (prior flight).

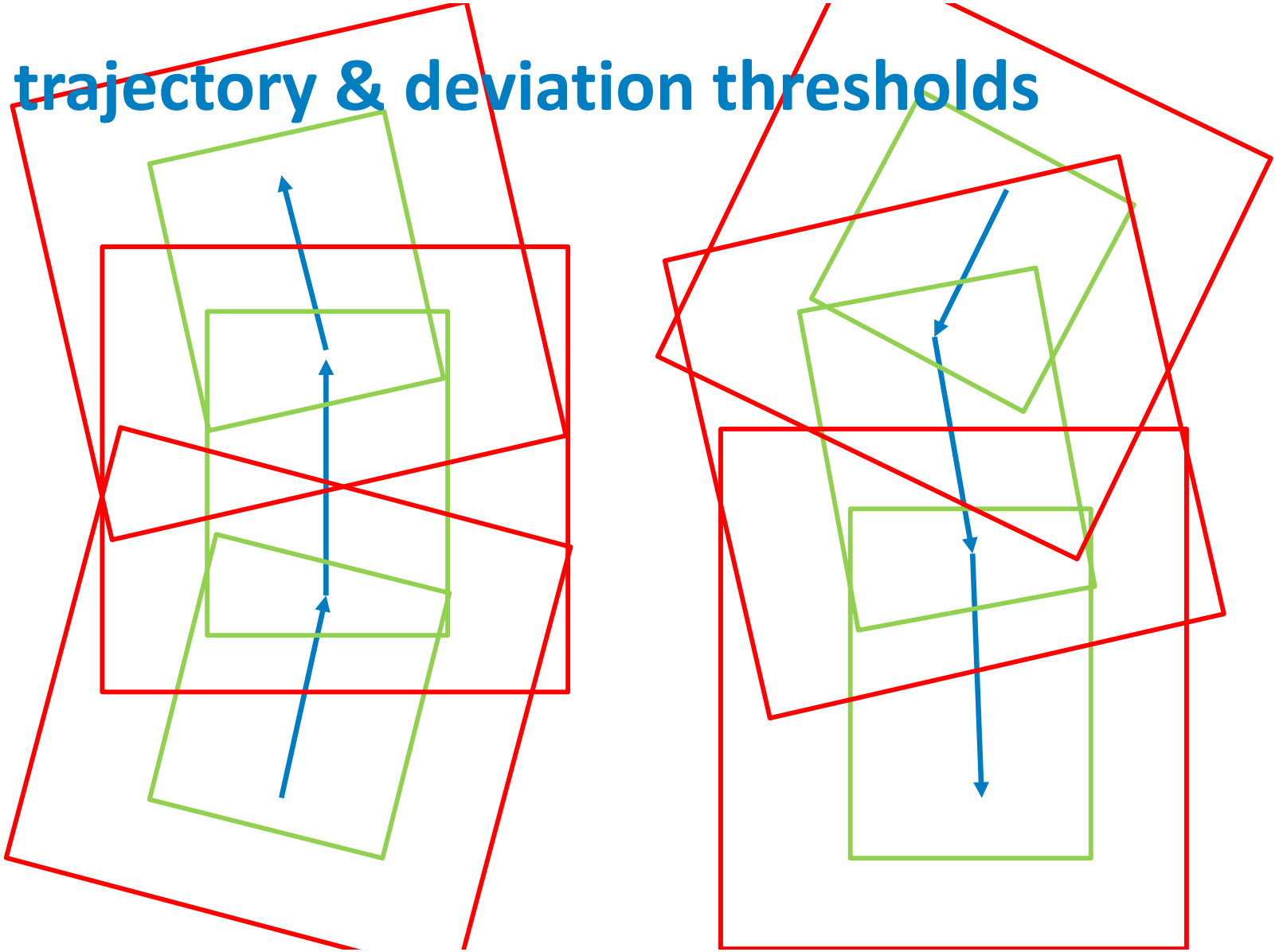
- → *To do: format of Annex IV (9)*

Necessary to pre-tactically deconflict the UAS autonomous contingency

4D trajectory

- 4D trajectory is a sequence of one or more 4D volumes
- Volume boundaries express the uncertainties of the flight:
  - E.g. earliest possible entry time, latest possible exit
  - The uncertainties are bounded at 95% probability
- Any U-space airspace may have maxima and/or minima for any dimension.
  - Part of the terms and conditions
  - Developed by competent authority
- U-space airspace also have *deviation thresholds*

4D trajectory & deviation thresholds



Ideal path

Requested 4D volumes

Deviation thresholds

Conflict detection with multiple USSP

- Article 10 (6):USSPs “shall establish proper arrangements to resolve conflicting requests…”
- AMC:
  - What constitute proper arrangements
  - USSP shall share authorised flight requests and their current states
- GM:
  - May use ASTM F3548-21
  - USSP may make agreements with each other to cover contingencies

Airspace restrictions & flight authorisation

- → Annex IV: no way to indicate flight has permission to enter airspace
- → Request to fly in Yellow
  - → USSP: Warning
- → Request to fly in Red
  - → Out of the scope of U-space
  - → USSP: reject

EASA

Non-authorisation, Priority

- A flight authorisation request is rejected when
  - it fails checks
  - or conflicts with any already authorised flight of equal or higher priority
- Rejection should be accompanied by an indication of the reason for rejection (AMC)

- There are two levels of priority: Normal, Priority

Authorisation output

- → The authorised flight is given a unique identifier
  - → AMC: The period of uniqueness should be more than 2 years
  - → GM: UUID Variant 1 Version 4 or Version 5
    - → UUID is 128 bits, hence 3.4 x 10^{38} different values
- → The UAS operator is informed of the authorisation & unique ID & Terms and Conditions

Terms & Conditions

- → U-space can have properties/requirements set by the Competent Authority
  - → Technical:
    - → Equipment fit, min/max performance
  - → Operational:
    - → Traffic maxima, noise maxima
    - → Planning constraints – largest, smallest dimensions of 4D volume
- → USSP also adds terms and conditions
  - → Methods / performance requirements / limits for tactical processes
    - → Authentication / identity
    - → Submission of Network ID, delivery of Traffic info
    - → Plan revision / update

After Authorisation, until Activation

- The USSP stores the flight authorisation in the state **Authorised**
- The UAS operator is informed if the authorisation is **Withdrawn** or if the authorisation is updated due to
  - Dynamic Airspace Reconfiguration
  - Conflict with a higher priority UAS flight authorisation request
  - Risk from other air traffic

- Proposed update to AMC1 Article 10(5)(f)(3)
  "e-conspicuous manned aircraft intersecting the planned UAS trajectory"
  - Intents of e-conspicuous manned aircraft are unknown.
  - "e-conspicuous manned aircraft too close to the UAS" (< spacing)

Activation

- → The UAS operator requests activation of an authorised flight
- → The USSP makes a final check all is well AMC1 Article 10(5):
  - → Activation request timing, dynamic airspace reconfiguration or restriction, weather, priority flights, unexpected air traffic
- → If not OK, the USSP signals the UAS operator and indicates the problem.
- → If OK, the USSP activates the flight.
  - → The state changes to **Active**

Flight, Contingency

- The Flight Authorisation is the basis of Conformance Monitoring
  - *Real implementations may use surveillance to refine the plan, replacing take-off-time window with actual, etc. This is out of the scope of the regulation*
- Exceptions can trigger activity in Flight Authorisation service:
  - dynamic airspace reconfiguration
  - manned aircraft traffic shared by relevant air traffic service units
    - in particular …in a state of emergency…
  - The Flight Authorisation service can withdraw / update the authorisation
- AMC/GM:
  - What is meant by “continuously check”
  - Recommendation to not withdraw the authorisation of an active flight

Ending flight

- → The UAS operator shall signal that the flight is **Ended**.
  - → The USSP is not expected to make this change automatically (GM)

- → The USSP stops providing on line services at this state change
  - → Network ID, Traffic Info, Conformance Monitoring

- → Ended flights cannot restart
  - → Ended flights are removed from the pool of authorised flight
  - → No longer considered as conflicting.

Open issues 1: Contingency plans & processes

- Article 6(8)
  - UAS operators shall … make their contingency measures and procedures available to the U-space service providers.
  - *Agreed process of sharing & format needed*
- Annex IV (9)
  - applicable procedure in case of a loss of C2 link, and planned manoeuvres, change of routes, automatic landing site, etc., which could be performed in case of contingency/emergency, and to be checked free of intersection by the USSP.
  - *Agreed format needed -> Extension of the flight operational volumes ?*
  - *How & to whom is loss of command & control link signaled?*

Open issues 2: Updating flights, Ending flights

- → Ended state only appears in AMC/GM
- → Revision is mentioned in places but process is not outlined
  - → Can the UAS operator revise any flight authorisation?
    - → What if it is active? - against what is this change de-conflicted?
- → What would lead to the USSP revising an authorisation?
  - → USSP revision has to be validated by UAS operator:
    who knows the capabilities of the aircraft to fly the revision

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U-space services

Traffic Information (Art. 11)

Kai Lothar JOHN, GLVI
Chief Engineer UrbanATM Systems

Content

→ Rationale for a traffic information service (TIS)

→ Operational authorisation and TIS

→ Use of TIS in UAS operations

Rationale

Rationale

→ U-space airspaces not restricted to drones only

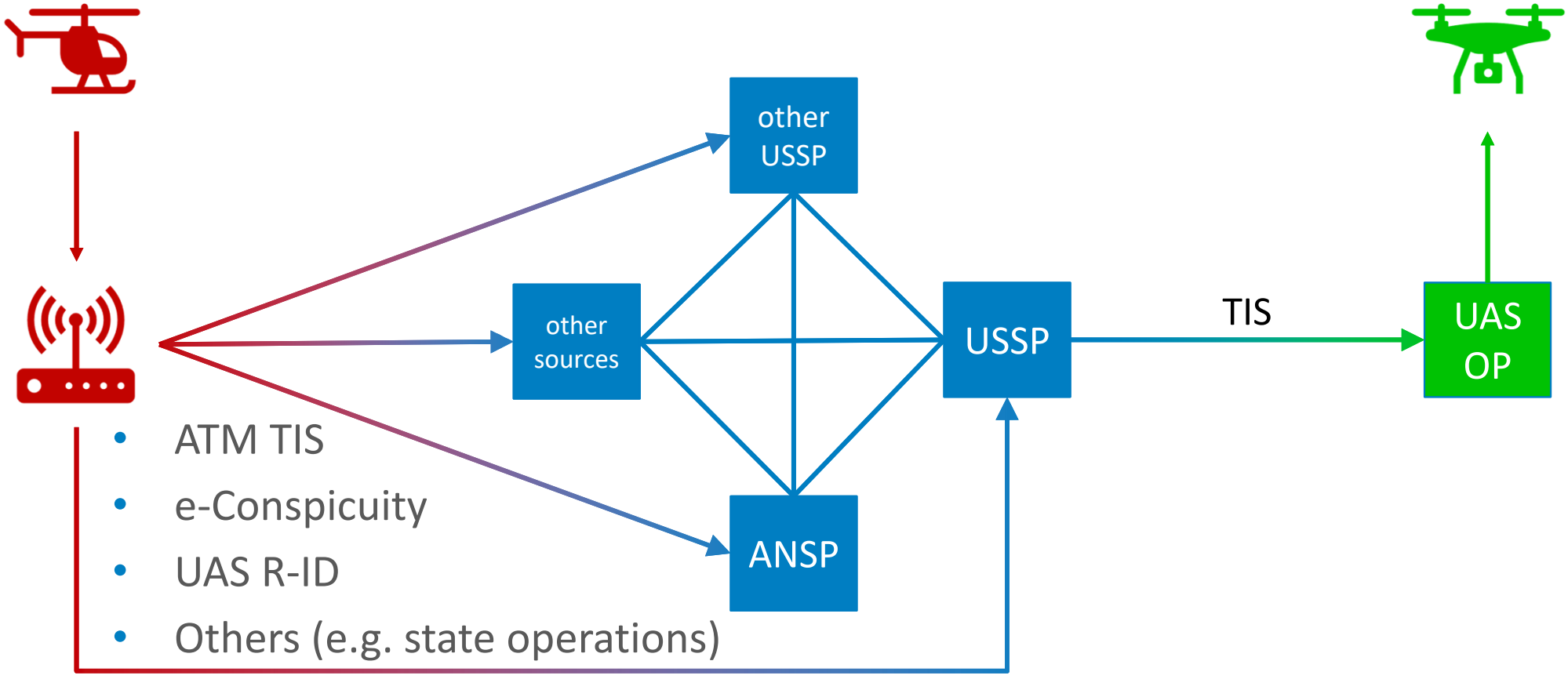
→ Manned aircraft are not aware of presence of drones

→ No on-board DAA available and required in U-space airspaces

→ UAS operators responsible for safety of their flights

Traffic Information Service ≡ Anti-collision

Flow of traffic information



Operational Authorisation
IAWREU 2019/947

UAS operations in U-space airspaces

	Open	Specific	Certified
Use of traffic information service mandatory	✓	✓	✓
Operational authorisation required	—	✓	—
Specific operations risk assessment (SORA) required	—	✓	—
Certification/licensing required	—	—	✓

SORA SAILs pertaining to U-space services

OSO	SAIL, Robustness						
	I	II	III	IV	V	VI	
10	L	L	M	M	H	H	Safe recovery from a technical issue
11	**L**	**M**	**H**	**H**	**H**	**H**	**Operational procedures re. DXSSUO**
12	**L**	**L**	**M**	**M**	**H**	**H**	**UAS design re. DXSSUO**
13	**L**	**L**	**M**	**H**	**H**	**H**	**XSSUO are adequate for the operation**
14	L	M	H	H	H	H	Operational procedures re. human error
21	L	M	H	H	H	H	Operational procedures re. adverse operating conditions

XSSUO = ”external systems supporting the UAS operation”
DXSSUO = “deterioration of XSSUO”

Use of Traffic Information Service in UAS operations

Using TIS in UAS operations

→ Continuously monitor traffic information for conflicts

→ Take appropriate action when necessary

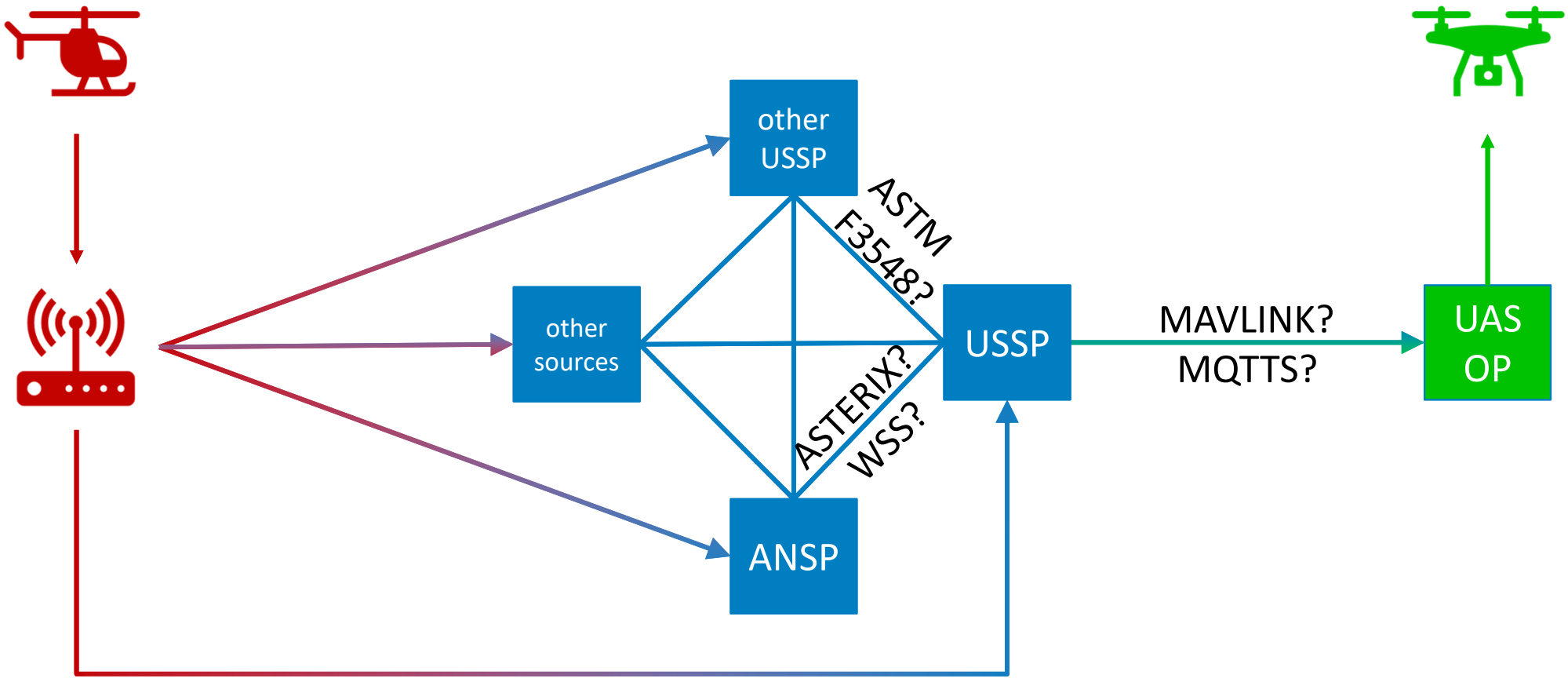
Using TIS in UAS operations may involve

→ Remote pilot

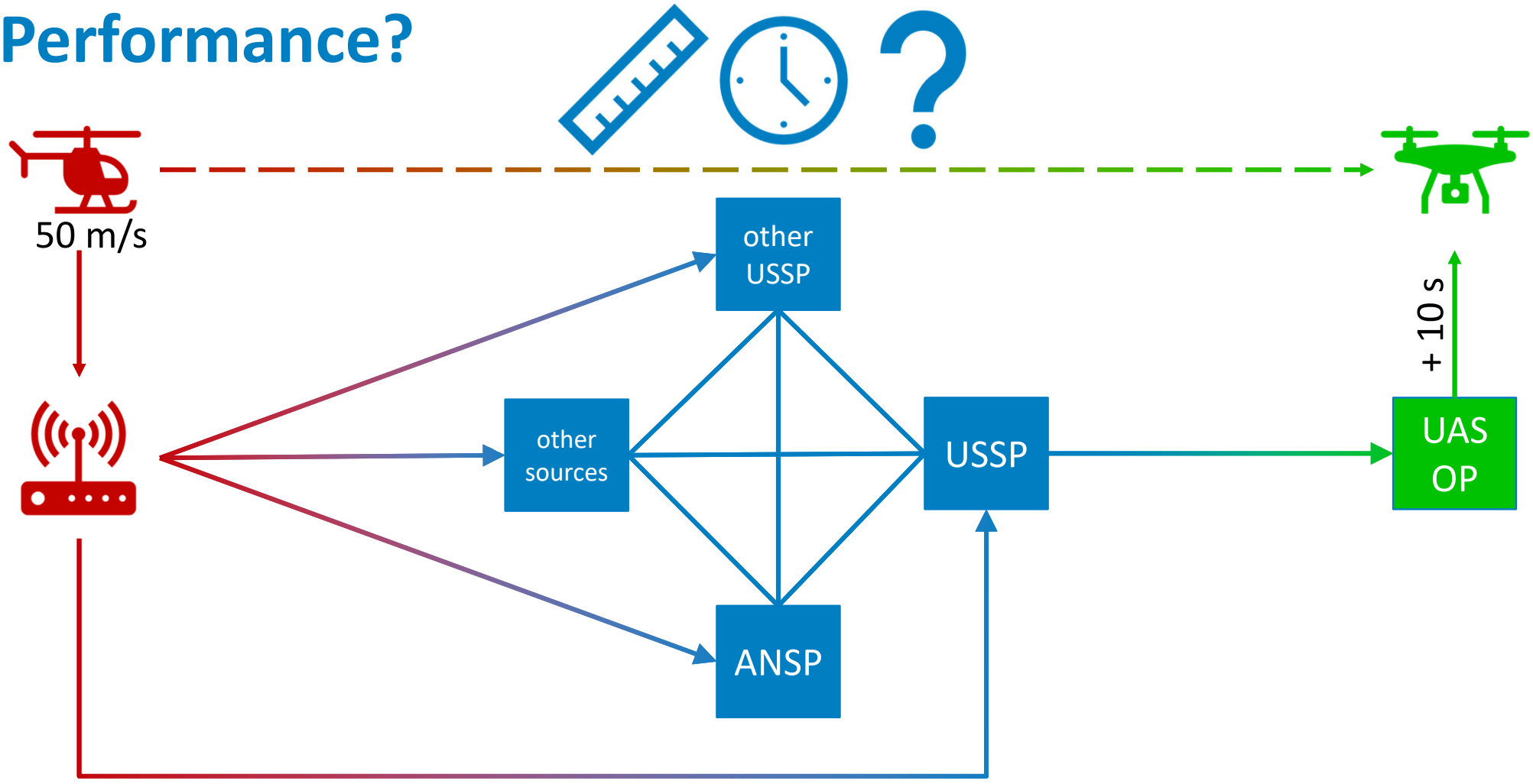
→ Observer

→ Software

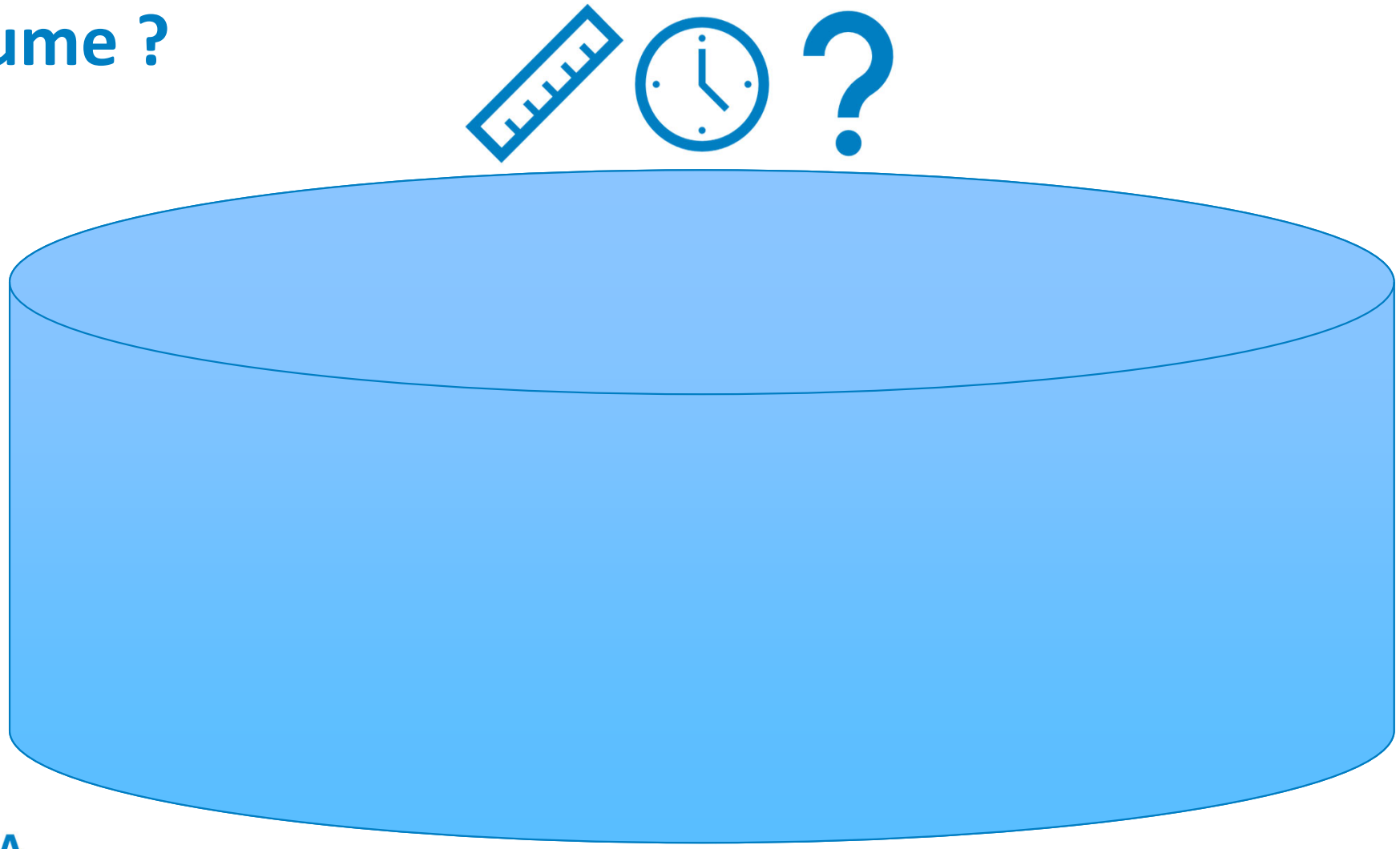
Interfaces?


other USSP
ASTM F3548?
other sources
USSP
MAVLINK? MQTTS?
UAS OP
ASTERIX? WSS?
ANSP

Performance?



Volume ?



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U-space services

Weather Information (Art. 12)

Stéphane VAUBOURG, EASA
Drones Project Manager – U-space

U-space & weather conditions

Airspace
Risk Assessment

Operational constraints

Weather minima/maxima

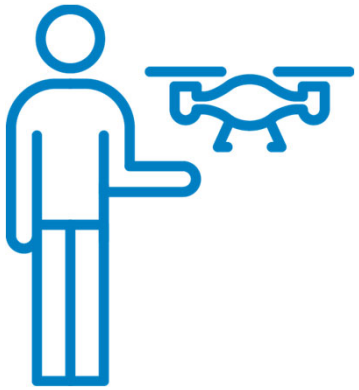
Flight
Authorisation

UAS Performance

Environmental conditions

Weather information service

Need of service
Data quality requirements



Satisfaction of operational constraints
Selection of appropriate UAS
Proper flight planning and execution
(satisfaction of the deviation thresholds)

Weather information, the goal

vs

→ Safety of operations may rely on local and accurate data

Weather information, standartisation

- → Technical baseline provided in Art. 12 of (EU) 2021/664, aligned with conventional weather information
- → Operational needs and required data-set to be consolidated
- → Standard(s) ensuring an harmonised approach and appropriate level of quality are <u>not (yet) available</u>

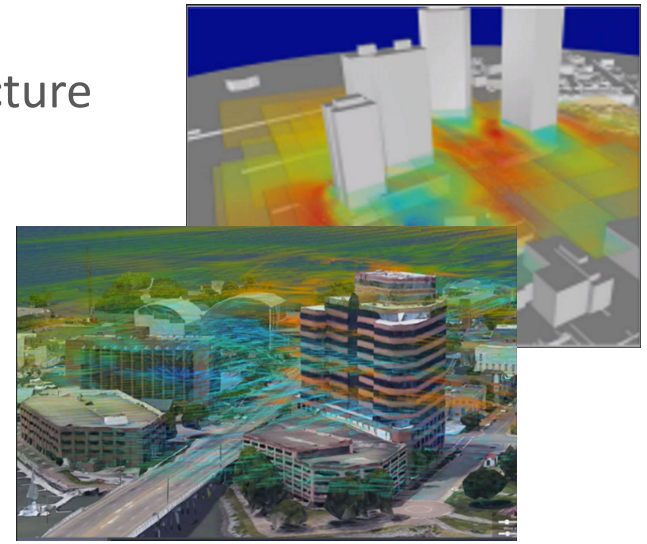
ASTM INTERNATIONAL

EUROCAE

?

Weather information, contraints

- UAS operators may not be aviation professional
  -> ergonomics to be revised
- Existing MET may not be sufficient to address the OPS needs
  -> data availability/coverage to be extended/more detailed
- Suitable service may require deployment of new infrastructure
  -> viability (practicality + cost effectiveness) to be ensured
- Balance between modelling and measuring
  -> data accuracy/representativeness to be ensured



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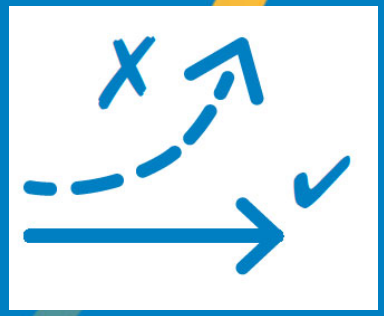
U-space services

Conformance monitoring (Art. 13)

Stéphane VAUBOURG, EASA
Drones Project Manager – U-space

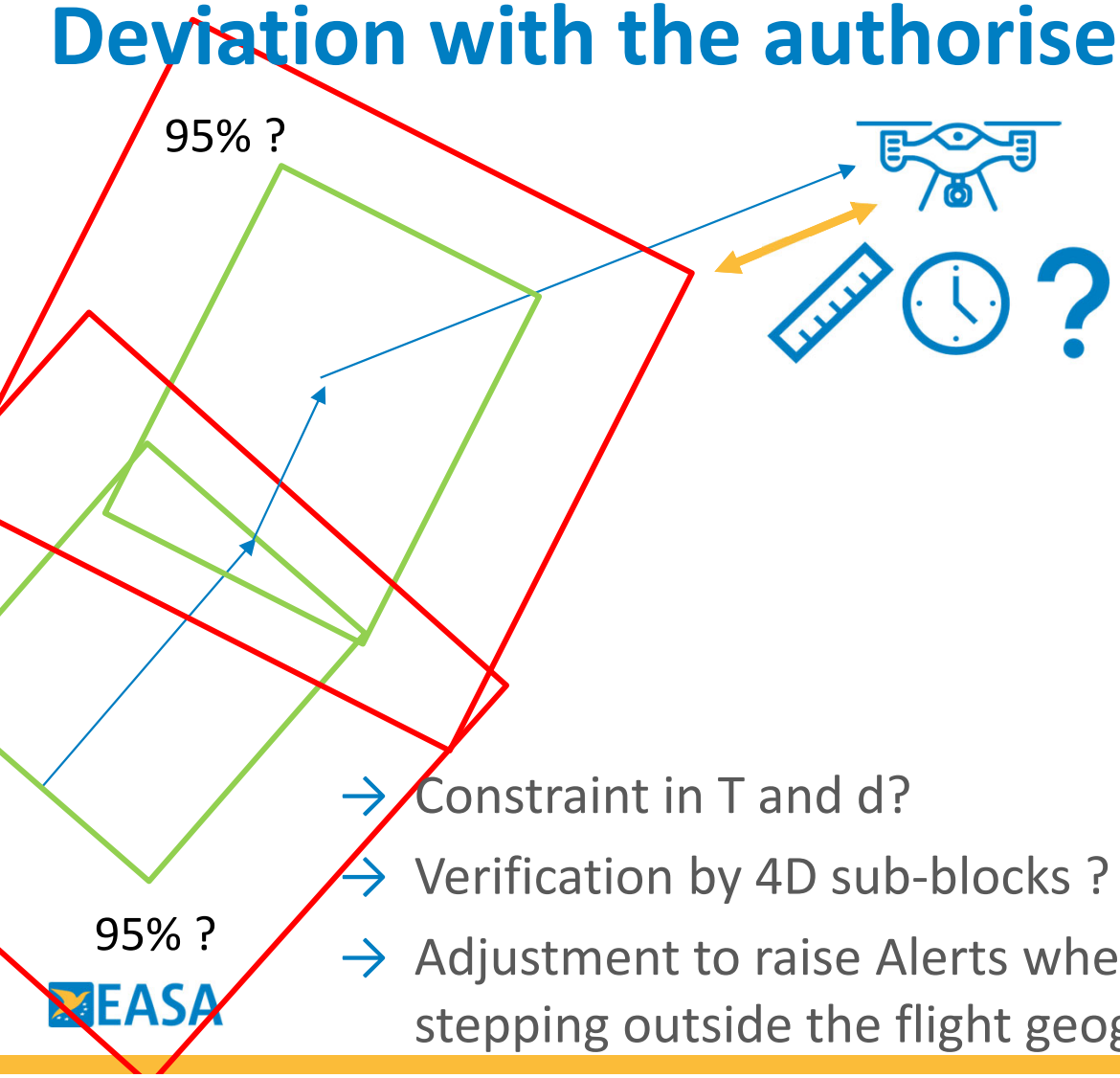


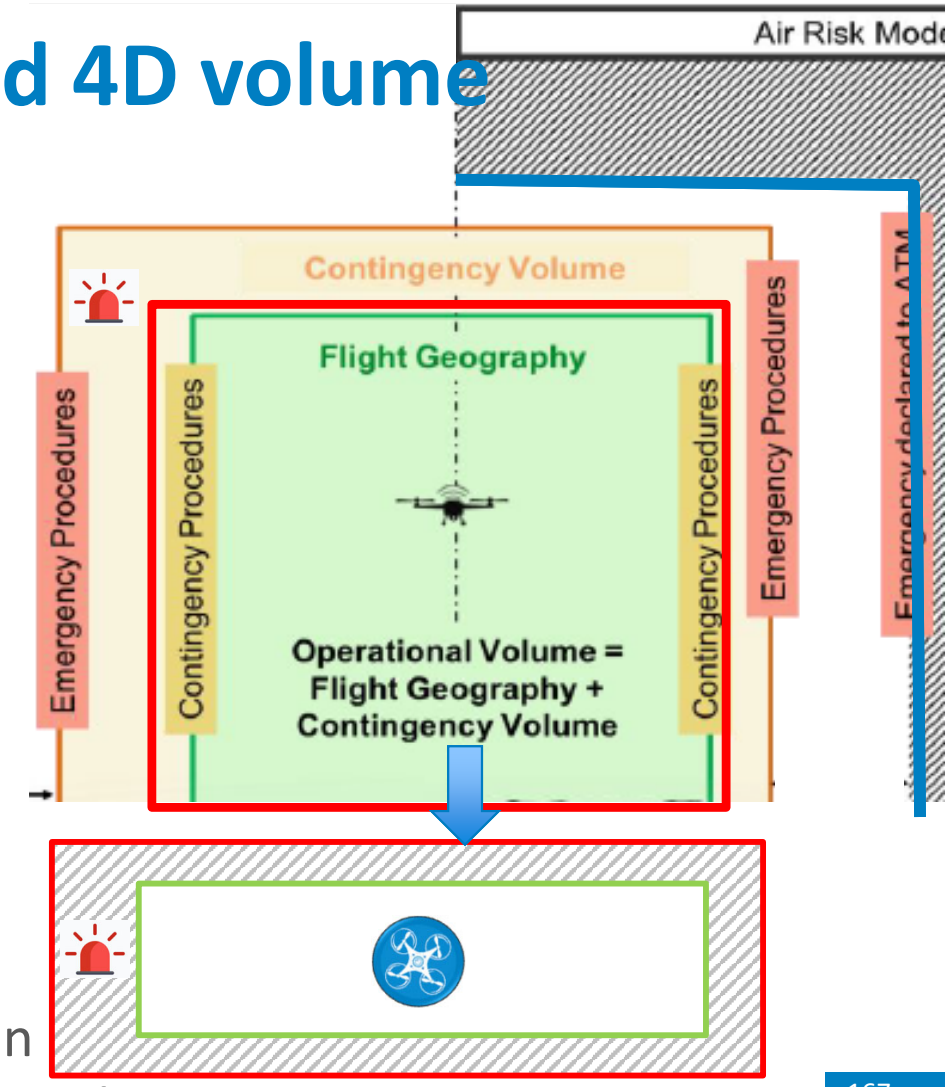
Conditions to raise non-conformance

- The conformance services raises alerts to the U-space airspace users and ATM (when relevant)
- Conditions raising non-conformance, in case of:
  - UA flying without flight authorization,
  - UA flying before the authorized time,
  - UA flying without activation of an authorized flight
  - UA flying after the authorized time
  - UA deviating from the authorized 4D volume more than 5% of the time

The tolerance of 5% of the time is NOT an authorisation to deviate 5% of the time

Deviation with the authorised 4D volume



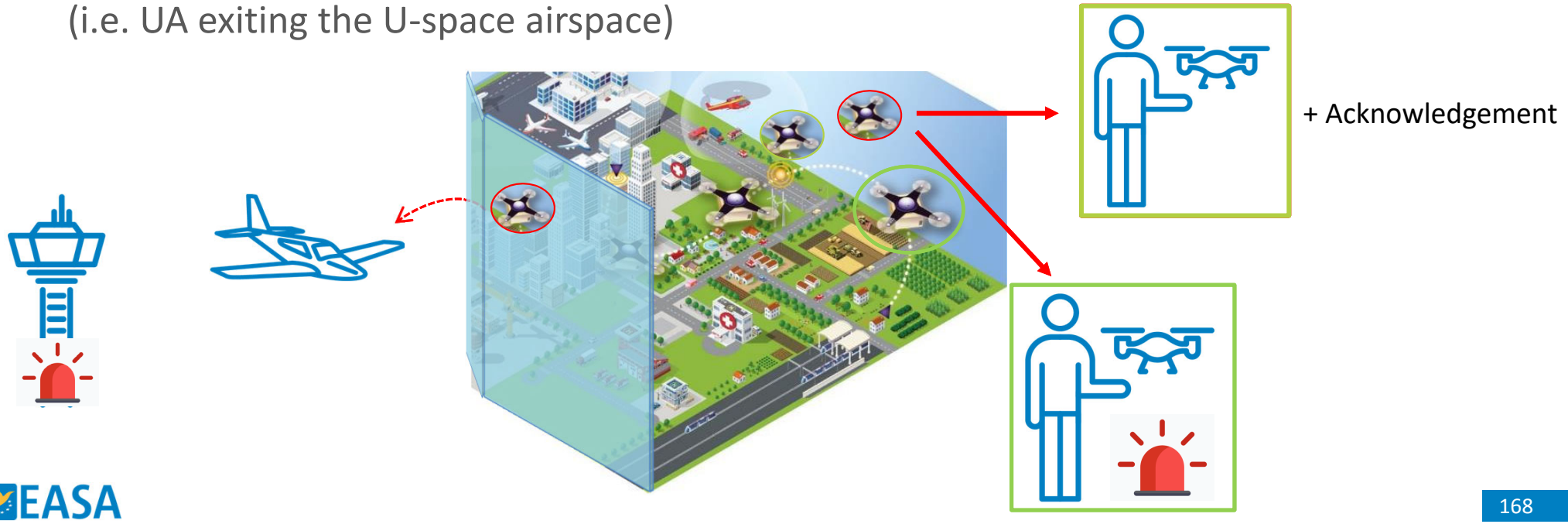


- → Constraint in T and d?
- → Verification by 4D sub-blocks ?
- → Adjustment to raise Alerts when stepping outside the flight geography ?

Authorised 4D volume

Alerts and acknowledgement

- NC alerts should be sent to the Operators of the non-conforming UA and Operators in the “vicinity”
- Acknowledgment should be performed by the operator non-conforming with the FA
- ATC should be made aware in case of threat to manned aircraft (i.e. UA exiting the U-space airspace)



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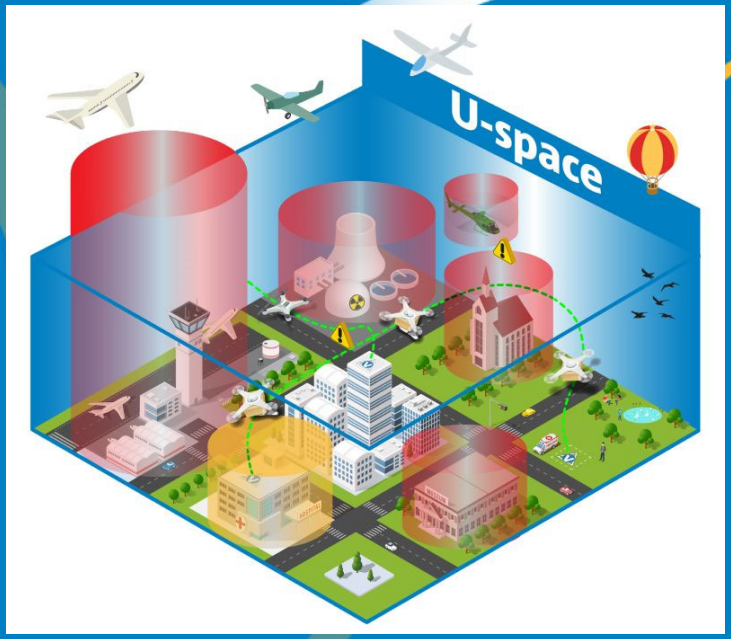
Evolutions of the AMC/GM to the U-space regulatory framework

Stéphane VAUBOURG, EASA
Drones Project Manager – U-space



Evolution of the AMC/GM, the timeframe

- Feedback on the AMC/GM published December 2022 is being consolidated
- Discussions on the AMC/GM will be re-engaged begin 2024
- NPA and publication of the updates are expected in **2025**
- Update will bring:
  - Clarifications on the existing content
  - Adjustments, when necessary, but should not change the existing approach
  - Complementary items
- Update approach and team is being discussed, but will required support of the U-space stakeholders

AMC/GM to (EU) 2021/664 – Potential additions

- Art. 3 - Cross border operations
- Art. 3(4) - Recommendations on the expected performances requirements
- Art. 4 and 6 - Human factors considerations and man/machine interfaces
- Art. 5, ANNEX II – Call to the SWIM yellow profile
- Art. 6 and 10 – Alignment with the SORA flight Geography
- Art. 6 and 10 - Operations starting/ending out of U-space
- Art. 7 and U-space Services – Improved standardisation of interfaces
- Art. 15 - Oversight and change investigations

- Meanwhile coupling with the (EU) 2019/947 - SORA may be clarified

AMC/GM to (EU) 2021/664 – Potential evolutions

- Art. 5 – Clarification on U-space models and data exchange
- Art. 3 and 18 – Reconciliation of coordination mechanism, ARA, and hearing processes
- Art. 6 and 7 – Enhanced recommendations on the installation/development of the Operators interfaces
- Art. 10 – Adjustment supporting live/in flight modification of the flight authorisation
- Art. 10 – Adjustment supporting “smooth” changes to flight authorisations
- Art. 10 – Adjustment of the “non-activation” in case of presence manned aircraft
- Art 6 and 10 – Adjustment on the integration of contingencies in the flight authorization
- Art. 13 – Adjustment of the alerts condition
- Art. 15 (e) – Clarification on the (System) Safety Assessment

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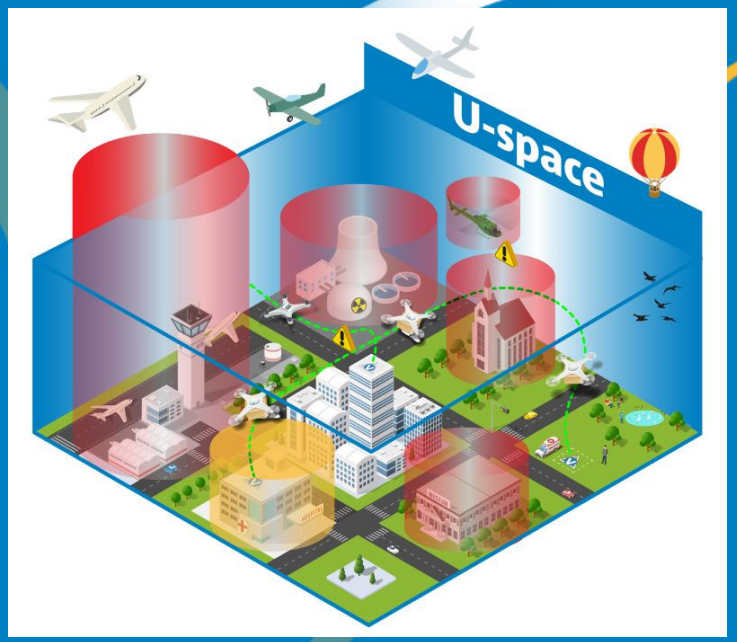
s-CISP and USSP certification framework and process

Maria ALGAR RUIZ, EASA
Programme Manager – Drones

Begona MARTIN VELAYOS, EASA
ATM/ANS Expert

Stéphane VAUBOURG, EASA
Drones Project Manager – U-space



Certification requirements and scheme

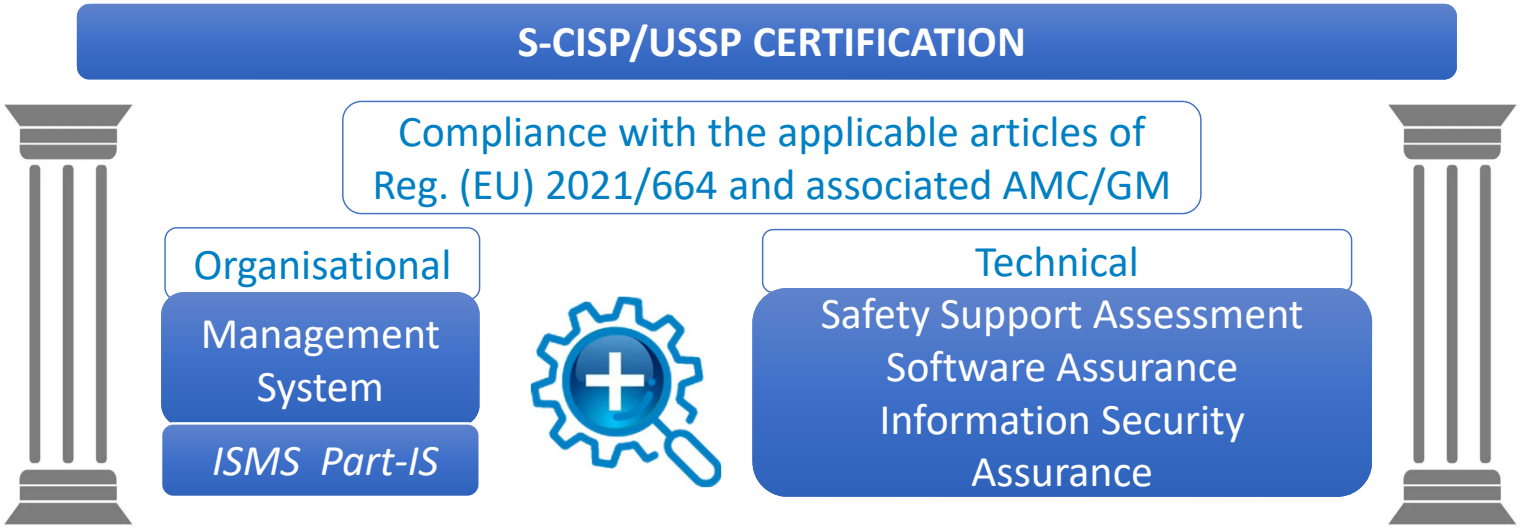
- Regulation (EU) 2019/664 Article 7(6)(a) and Article 14:
  - Obtention of certificate is the condition to start the provision of service
  - Relevant Competent authorities are:
    - Member States (local competent authority) of the principal place of business
    - Member Sates or EASA (opt-in) when the place of business is in more than one EU MS
    - EASA for third country operators
- Regulation (EU) 2019/664 Article 15:
  - Define the conditions to obtain a certificate and frame the certification activities
  - Technical level considerations -> 15(1)(a) in conjunction with Article 3(4) & 15(1)(b)
  - Organisational level considerations -> other parts of 15(1)

Mutual recognition of 'certificates' between Member States,
completed with local evaluation of
the suitability of the certified performances for a given U-space

U-space certification framework

→ Approach tailored from (EU) 2017/373 on ATM/ANS (per Article 15 of (EU) 2021/664)

→ Boundaries: based on Applicant's CONOPS and compliance strategy (compliance matrix)



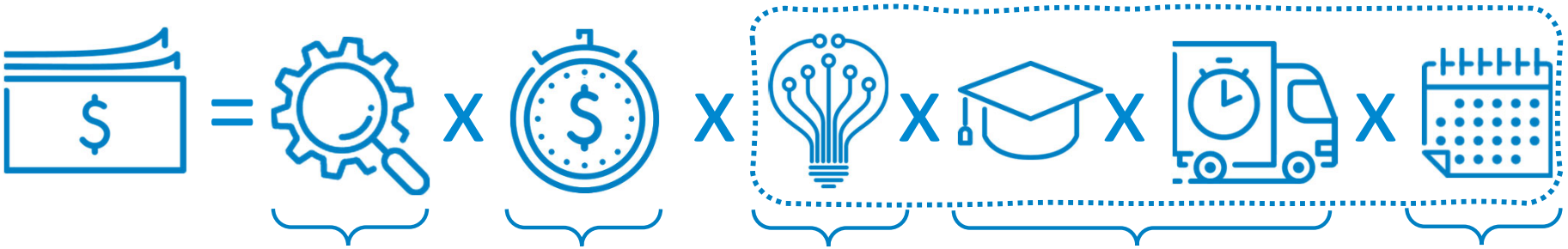
→ Evidence-based / (technical) data-driven approach (mostly remote, desktop review and audits)

→ Synergies: between certifications, and other appropriate activities *(when duly substantiated and agreed)*

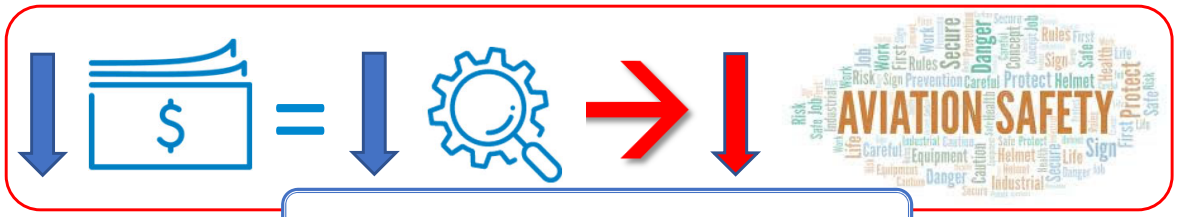
Certificate validity

- The approval certificate shall have an unlimited duration, subject to the organisation showing continued compliance with all applicable requirements.
- As such, there is not a renewal process in place but a continuous demonstration of compliance, which is monitored during the continued oversight.
- In the case of major findings, the competent authority shall take immediate and appropriate action, and may, if appropriate, limit, suspend or revoke in whole or in part the certificate.
- In case the organisation decides to surrender the certificate, it shall be returned to EASA without delay.
- *Due to the U-space performance based approach, in case of delay in starting or temporary ceasing the suitability of the provision of services should be "re-validated" before resuming the provision of services*

Certification cost factors



Certification team (roles) - PM + domains experts: U-space, ATM, SW, Cyber
(Team Members may have multiple roles)



Safety is an investment

Application form

4. Identification of service provision	
4.1 U-space services	**Type of Service**
☐ U-space mandatory services	☐ Network identification service
	☐ Geo-awareness service
	☐ UAS flight authorization service
	☐ Traffic information service
☐ U-space optional services	☐ Conformance monitoring service
	☐ Weather information service
Conditions/limitations identified	

4.2 Common information service (CIS)	
☐ Common Information Service	
Conditions/limitations identified	

5. Provision of documentation with the application	
5.1 ☐ **Description of the operational concept (Conops)**	please describe and specify the provided documentation
5.2 ☐ **Technical description of the services to be provided (U-space services/CIS)**	please describe and specify the provided documentation
5.3 ☐ **Compliance matrix and demonstration plan**	please describe and specify the provided documentation
5.4 ☐ **Management system manual including the organisation's exposition**	please describe and specify the provided documentation
5.5 ☐ **Information security management manual**	please describe and specify the provided documentation
5.6 ☐ **Change management procedure**	please describe and specify the provided documentation
5.7 ☐ **Occurrence reporting**	please describe and specify the provided documentation
5.8 ☐ **Business plan**	please describe and specify the provided documentation
5.9 ☐ **Contingency plan**	please describe and specify the provided documentation
5.10 ☐ **Emergency management plan (USSP only)**	please describe and specify the provided documentation
5.11 ☐ **Record-keeping**	please describe and specify the provided documentation
5.12 ☐ **Other:** **A copy of th… register / C… in the case … Provider pr…**	please describe and specify the provided documentation

Maturity of the Applicant's data set = efficiency in the investigations

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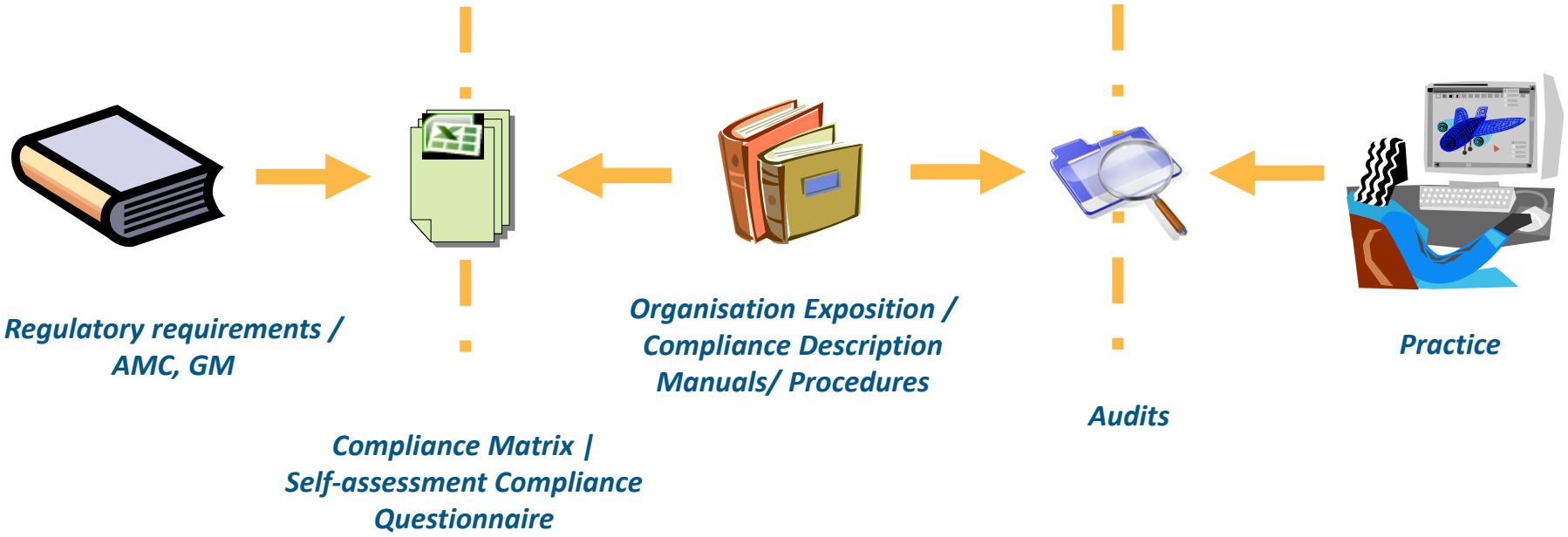
Organisation Approval

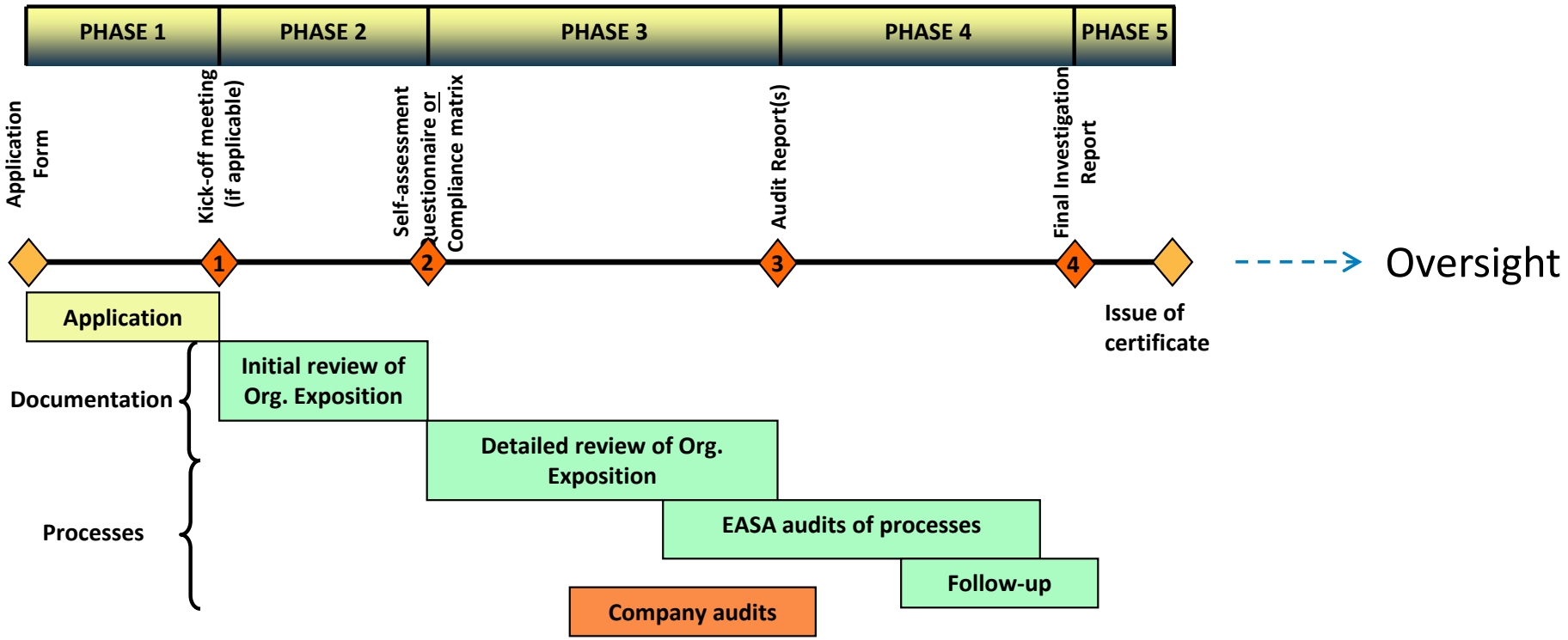
Typical Organisation Approval Process (I)

USSP Investigation

The USPP investigation is performed to show that your organisation is fulfilling all applicable requirements:



Typical Organisation Approval Process (II)



Certification team

- USSP/S-CISP certification share the spirit of the conventional OA
- The initial certification logic includes two core aspects: Organisation & Technical
- Initial certification will be a combination of desktop and audit activities
- Recommended certification team (domains/competencies):
  - Team leader: manages the project, is the interface with the Applicant
  - U-space expert: assess the CONOPS, compliance matrix, and compliance with U-space articles
  - ATM expert: MS, procedures, finance & legal aspects, safety support assessment
  - Software expert: Assessment of Software processes and product
  - Cyber Security expert: ISMS/Part-IS & Risk Assessment

Desktop/audit assessments

- Desktop review activities (including interactions to close the comments) will be performed. Iterative process:
  - Formal review of submitted data package (e.g. documentation)
  - Comments resolution / integration
  - Until achievement of an acceptable level of maturity to enable the audits
- Audits are planned for this initial certification activities:
  - Detail assessment of organizational/technical data
  - May lead to findings, based on the severity, to be solved for certification, or post-certification (documented in a “corrective action plan”)
- Certification records shall be generated all along the activities (e.g. review, findings, reports…), to capture agreements, corrective actions, etc…

Desktop/audits activities

- Desktop review:
  - CONOPS and compliance matrix
  - Organisation's manuals and procedures relevant for the provisions of services
  - Financial and legal aspects
  - Technical documentation, e.g. SW processes, test results, user manuals…
- Audits:
  - Management System (e.g. internal manual, procedures)
  - Safety Support Assessment (e.g. specification, training,,…)
  - Software Assurance (software lifecyle data/artefacts)
  - Security Assurance (e.g. analysis, (pen)tests results)

CONOPS

- The CONOPS is intended to frame the certification activities for a given Applicant
- The CONOPS allows:
  - to get understanding the Applicant use-case and to identify the depth and scope of assessment
  - to capture assumptions on the performances requirements, becoming the basis of the compliance demonstration (w.r.t Reg (EU)2021/664 Article 3(4)).
- The CONOPS enable to derive/define the “Functional systems”
- The CONOPS should describe the use case, e.g. if the services are to provided in centralised or decentralised model, or controlled/uncontrolled airspace

Compliance Matrix

- Formal evidence providing a global view of the compliance demonstration, intended to present the evidence linked to the satisfaction of each of the applicable requirements: Regulation (EU) 2021/664, related AMCs, and standards.
- The organisation is free to select the way of packaging the evidences supporting the compliance.
- Even if the evidences are not available yet, an initial version of the compliance matrix (including an early identification of the documents that will support the compliance) is found as necessary in order to have the overview of the compliance approach.
- Several versions of the **Compliance Matrix** can be provided along the initial certification process.

Investigation of changes

- Considerations about changes, including changes to functional systems will be developed

- Criteria will be established, to identify:
  - Changes that shall be notified and approved prior operations
  - Changes that shall not to be notified prior operations

Example of investigation breakdown

CERT - CONOPS
CERT - Compliance checklist and compliance demonstration plan/strategy
CERT - Management system, legal and financial aspects,… (8 documents)
CERT/Technical - Safety & Safety Support Assessment, manuals, operational procedure
CERT - ISMS
CERT/Technical - System technical familiarisation
CERT/Technical - Compliance of USSP platform/environment (Art 7) (e.g. Continuity of service, USSP/ATM/USSP agreements, interfaces USSP -> operators/CIS/USSPs, Operators App, Operators manuals/instructions, operational records)
Technical - Compliance of Network Remote-ID service (Article 8)
Technical - Compliance of Geo-awareness service (Article 9)
Technical - Compliance of Flight Authorisation service (Article 10)
Technical - Compliance of Traffic information service (Article 11)
Technical - Compliance of Traffic information service (Article 12), when required
Technical - Compliance of Non-conformance service (Article 13), when required
Technical - Security assurance (process overview security risk assessment)
Technical - Software assurance (process overview, audit preparation/follow-up)

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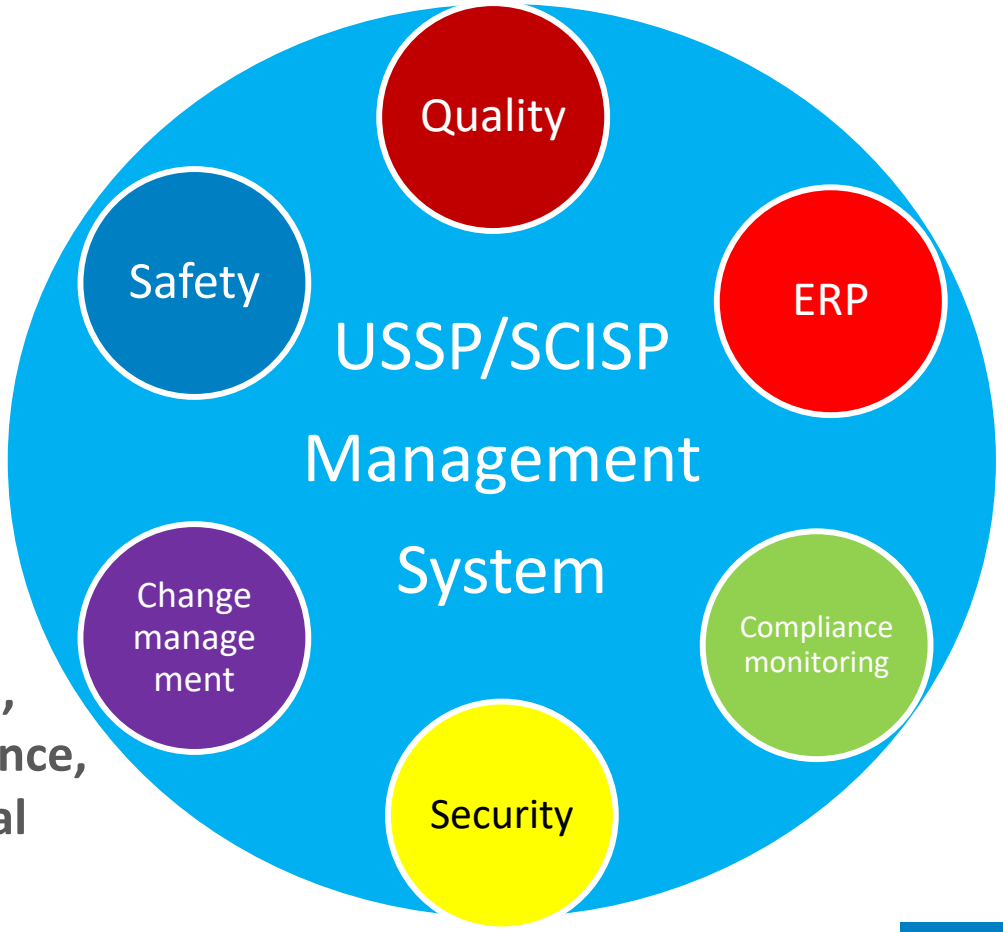
Management System

USSP/SCISP Management System

- Concept of 'integrated' or 'umbrella' management system **(in accordance with Subpart B of Annex III, Reg 2017/373)**
- **ISO 9001 certificate** is acceptable when adapted to USSP/SCISP framework
- **Management system** also cover:
  - Personnel management and training;
  - Management of subcontractors
  - **Management of safety (safety support), performance, security, quality, compliance, emergency, and operations/OPS manual**



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Oversight Program

Oversight Program

- After initial approval a continuous oversight program is started.
- A proportionate and suitable approach for USSP is being developed.
- The USSP oversight program will be developed along the certification activities, and will be established at the time of certification.
- Partnership and cooperation may be sought with the local competent authority.

USSP and SCISP Risk-Based Oversight process

Certified USSP/SCISP

- Ensure compliance with the applicable requirements
- Keep certificate valid (operates within 6 months after initial certification and does not stop more than 12 months)
- Proactive manage changes
- Proactive manage safety and monitor and manage occurrences
- Continuous report to CA and facility continuous oversight process/audits
- Implement corrective action plans and react on time to any potential enforcement measure
- Coordinate and collaborate with all U-space stakeholders

Competent authorities after initial certification

- Establish proper process and procedures
- Employ trained and qualified personnel
- Established appropriate enforcement measures
- Establish risk-based oversight process:
  - proportionate to the risk of the services;
  - to monitor of operational and financial performance
  - to monitor and assess the level of safety performance during operation (e.g. proactively and reactive after safety events assessment, implementation of corrective actions and/or enforcement measures)
  - to carry out audits, assessments, investigations and inspections of the providers (e.g. audits every 36 months or less depending on the results)

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Safety and Safety Support Assessment

Functional systems

→ Changes to functional systems (based on Reg. 2017/373):

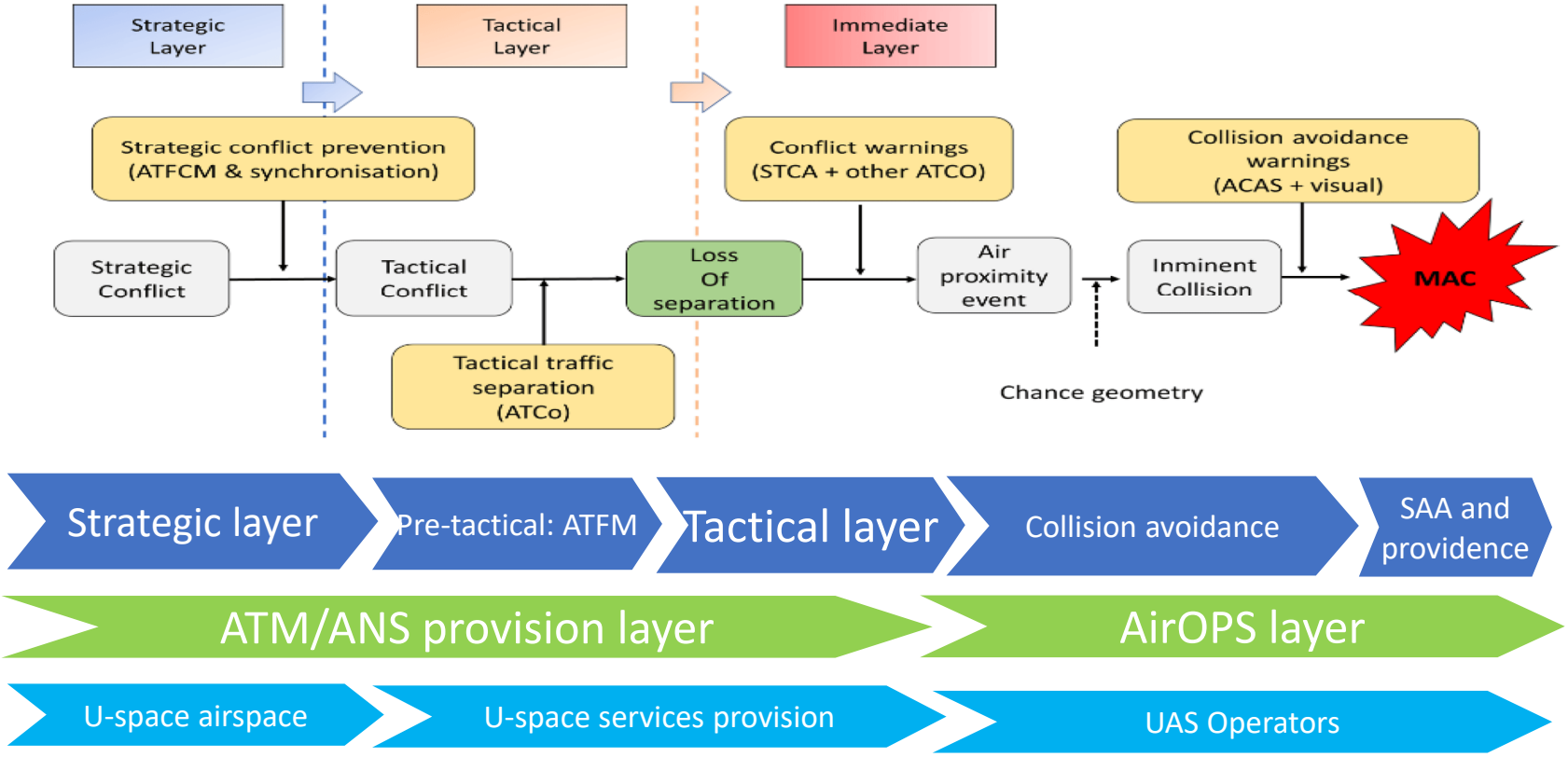
*[*For the purpose of Regulation (EU) 2021/664, 'functional system' means a combination of procedures, human resources and equipment, including hardware and software, organised to provide services within the context of a U-space airspace.*]*

Safety Support Assessment

→ The safety support assessment shall provide assurance, with sufficient confidence, via a complete, documented and valid argument that the service will behave and will continue to behave only as specified in the specified context.

Safety Assessment vs Safety Support Assessment (I)

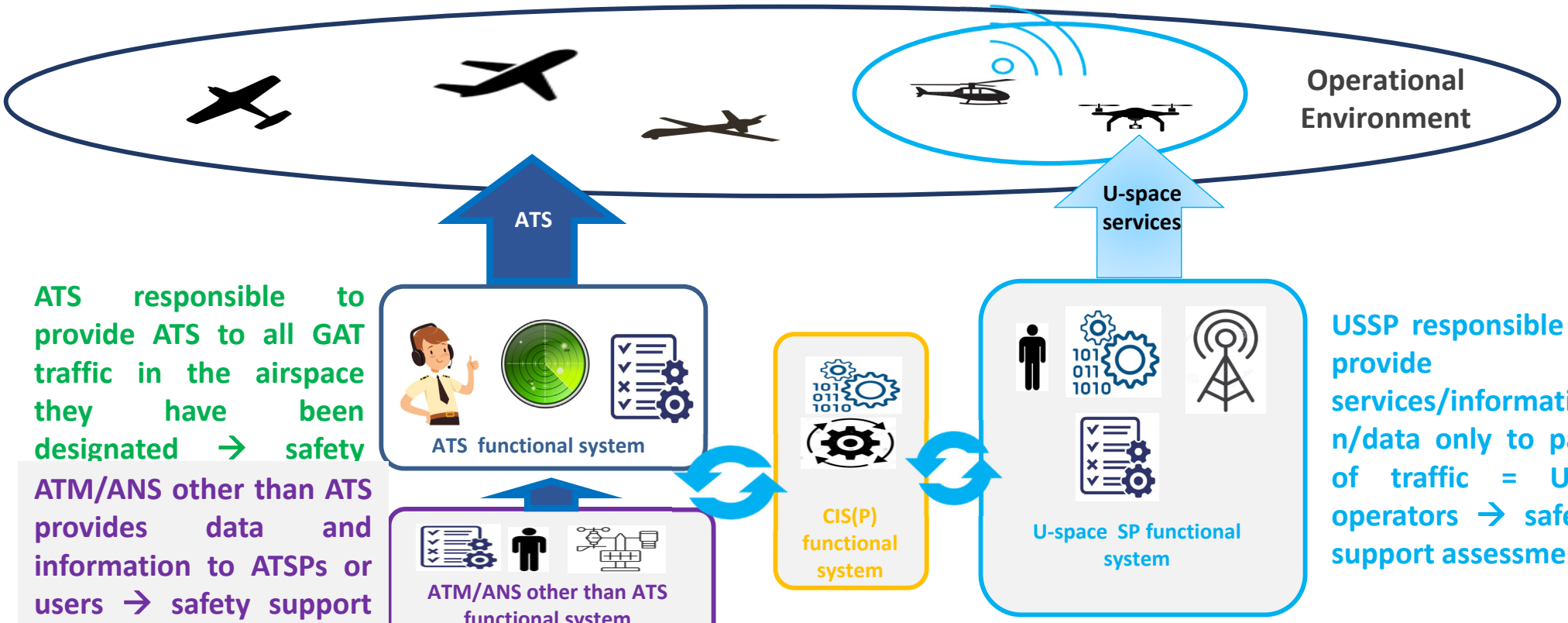
Barrier diagram for mid-air collisions (MAC), IRP



Picture taken from: MDPI and ACS Style Serrano-Mira, L.; Sanz, L.P.; Pérez-Castán, J.A.; Netjasov, F.; Moreno, I.G.; Ayra, E.S. Preliminary Feasibility Study of the Ad Hoc Separation Operational Concept. Aerospace 2023, 10, 539. https://doi.org/10.3390/aerospace10060539

Safety Assessment vs Safety Support Assessment (II)

Direct ATM contribution and indirect ATM contribution/ USS contribution



ATS responsible to provide ATS to all GAT traffic in the airspace they have been designated → safety

ATM/ANS other than ATS provides data and information to ATSPs or users → safety support assessment

USSP responsible to provide services/information/data only to part of traffic = UAS operators → safety support assessment

Safety Assessment vs Safety Support Assessment (III)

Airspace Risk Assessment by MS

- U-space services Performance requirements
- Operational conditions and airspace constrains

Safety Assessment from USSP

- Starting from outcome of the U-space airspace risk assessment
- Tailored to the USSP/SCIP functional system
- To ensure that risk assessment is complete and correct for their functional system
- To ensure safety criteria, service specifications and safety support requirements are complete and correct

Safety support Assessment from USSP

- Starting from outcome of airspace risk assessment complemented by the outcome of the USSP's 'safety assessment'
- Define functional system: people, systems (SW/HW), operational procedures and their interaction
- From safety criteria (also from ALoS) to definition service specification (also from CONOPS) and safety support requirements per element of functional system
- Provide assurance with sufficient confidence that the above is verified and the services are provided and will be provided as required

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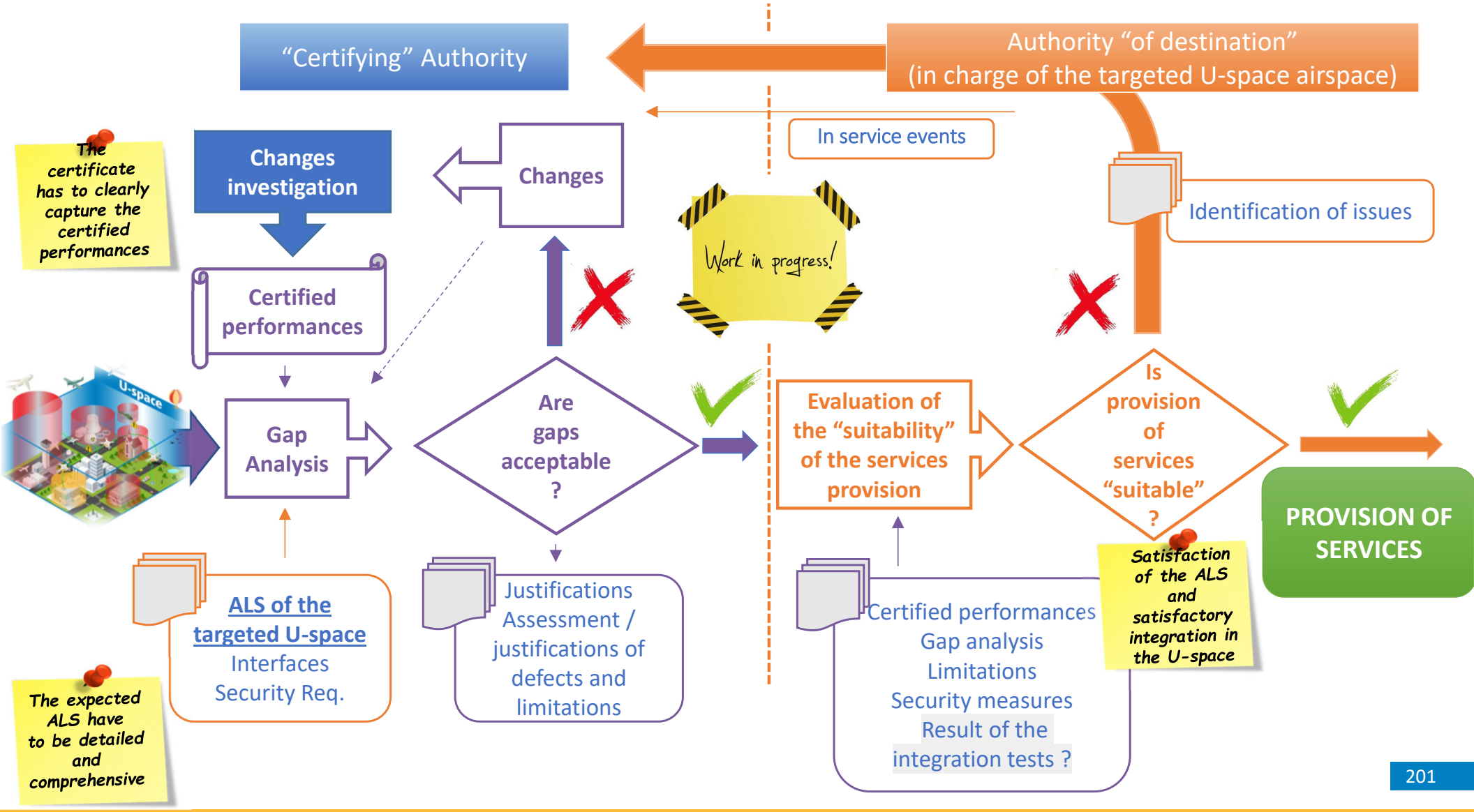
USSP
On-boarding process


"Certifying" Authority
Authority "of destination"
(in charge of the targeted U-space airspace)
In service events
Identification of issues
The certificate has to clearly capture the certified performances
Changes investigation
Changes
Certified performances
Work in progress!
U-space
Gap Analysis
Are gaps acceptable ?
Evaluation of the "suitability" of the services provision
Is provision of services "suitable" ?
PROVISION OF SERVICES
ALS of the targeted U-space
Interfaces
Security Req.
Justifications
Assessment / justifications of defects and limitations
Certified performances
Gap analysis
Limitations
Security measures
Result of the integration tests ?
Satisfaction of the ALS and satisfactory integration in the U-space
The expected ALS have to be detailed and comprehensive

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(Cyber) Security Assurance

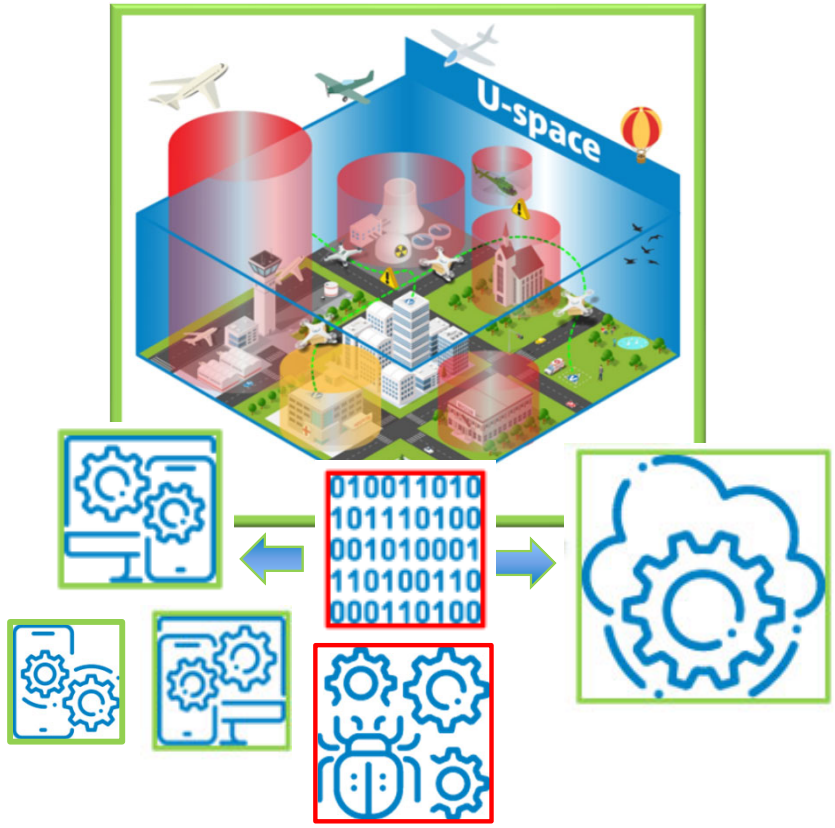
(Cyber) Security Assurance

Regulation (EU) 2021/664:

(f) implement and maintain a security management system in accordance with point ATM/ANS.OR.D.010 in Subpart D of Annex III to Implementing Regulation (EU) 2017/373;

B. **In order to protect the data, providers of common information services and U-space service providers shall:**

1. implement security policies, including data encryption and protection of critical data;
2. protect the open secure interoperable communication protocols from intentional unauthorised electronic interactions that may result in an unacceptable breakdown in communications;
3. identify, assess, and mitigate, as necessary, the security risks and vulnerabilities;
4. adhere to security standards and regulations regarding where data can be stored and ensure that third-party providers agree to follow security practices;
5. describe a policy for employee awareness and training and tools to reduce insider risks, and protection of data – including intellectual property. In doing so, they shall monitor the user and network activity to provide insight into ecosystem vulnerabilities and threats.
6. deploy solutions that augment threat detection and intelligence capabilities and ensure the use of technology safeguards.



SECURITY MANAGEMENT SYSTEM

(EU) 2023/203 – Part-IS

Management of information security risks with a potential impact on aviation safety for organisations

INFORMATION SECURITY ASSURANCE

Product - Security Risk Assessment

ISMS & Part-IS

Cyber Resilience Act

- (EU) **2023/203** Published February 2023
- Entry into force **February 2026**
- Amends the (EU) 2021/664:

Amendment to Implementing Regulation (EU) 2021/664

Implementing Regulation (EU) 2021/664 is amended as follows:

(1) in Article 15(1), point(f) is replaced by the following:

'(f) implement and maintain a security management system in accordance with point ATM/ANS.OR.D.010 in Subpart D of Annex III to Implementing Regulation (EU) 2017/373 and an information security management system in accordance with Annex II (Part-IS.I.OR) to Implementing Regulation (EU) 2023/203;';

(2) in Article 18, the following point (l) is added:

'(l) establish, implement and maintain an information security management system in accordance with Annex I (Part-IS.AR) to Implementing Regulation (EU) 2023/203.'.

- AMC/GM to (EU) 2023/203 will be published by end 2023
- Recommendation: to anticipate the compliance demonstrations

SAFETY vs SECURITY: the notion of "intent"

SAFETY

Fate

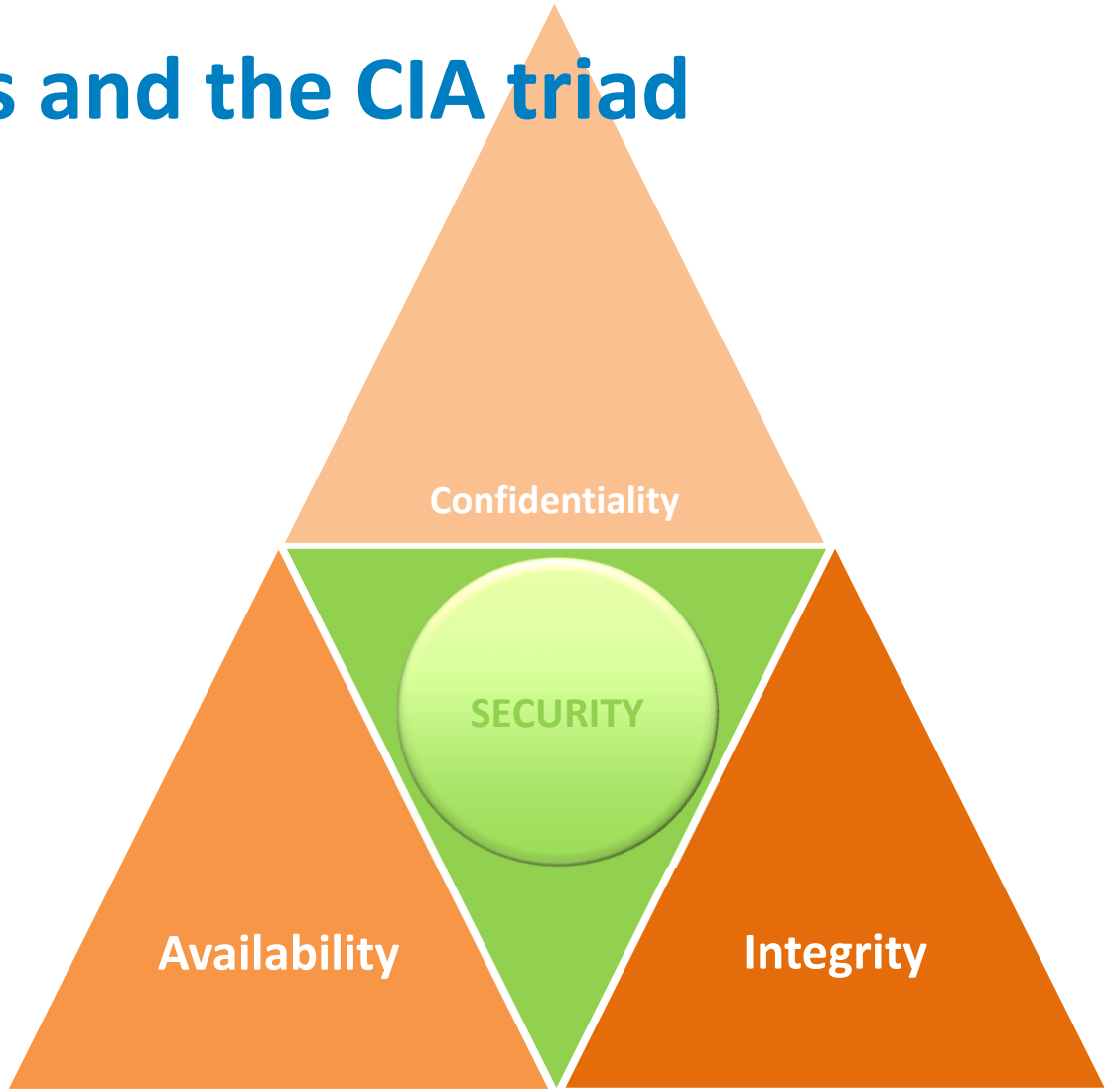
(likelihood of random failures)

SECURITY

Intent

IUEI: Intentional Unauthorised Electronic Interaction

Cyber threats and the CIA triad



(Cyber) Security Assurance

- Covers: All interfaces, CISP<-> USSP, USSP <-> USSP, USSP <-> UA / UAS operators,
- Considers: the cyber security attributes: Integrity, Availability, Privacy and typical threats/attacks (e.g. DoS)
- Is supported by: a (system) **security risk assessment**
  - Determination of the operational environment for the cyber security
  - Identification of the digital interfaces and assets
  - Identification of the attack paths
  - Assessment of the consequences (i.e. severity) of the threat to the affected items;
  - Evaluation of the potentiality of a successful exploit, or of the difficulty of performing a successful attack that would have an impact on integrity, availability and integrity
  - Iteration(s) until the result of comparing the severities with the potentiality to attack approach converges on an acceptable residual level of risk
  - Operational procedures/instructions to maintain security
- Is demonstrated by: (pen)tests or analysis

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Software Assurance

Software Assurance 1/2

- Assessment based on conventional and well-established software practices:
  - Software requirements
  - Software design / architecture
  - Reviews, testing
  - Traceability
  - Configuration and change management
  - Problem reports
  - Independent quality reviews,…
- Expected Data:
  - Documented software procedures
  - SW lifecycle data/artefacts, records

Software Assurance 2/2

- Applicant's are free to select their method, and to define heir own processes/procedures.

- To harmonize the investigations, a "check-list" based approach is proposed:
  - To raise awareness of the Applicant's on the items to be considered and shown to the CA
  - To define a consistent way to evaluate the "quality" of a software

- Adherence to an industrial standard, may be useful:
  - To establish a common reference
  - To facilitate the certification
  - To address different level of quality/integrity, according to the required level of safety

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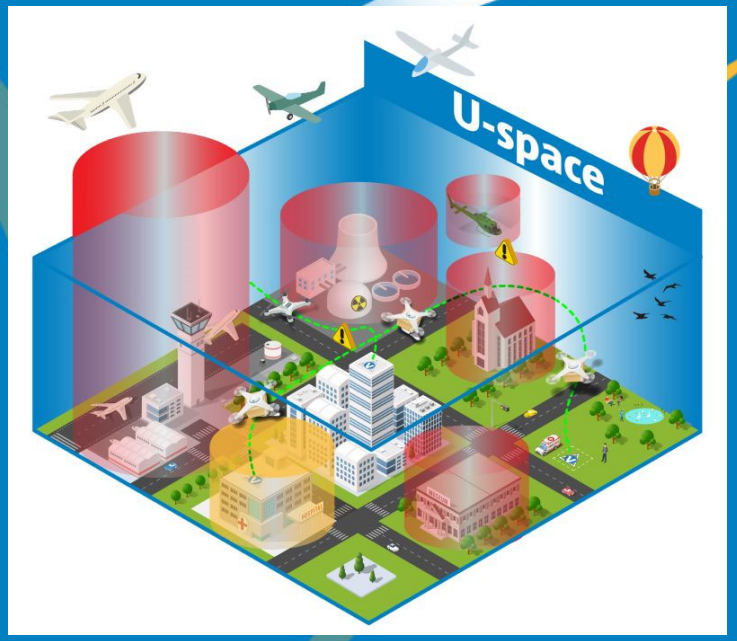
Workshop closure

Maria ALGAR RUIZ, EASA
Programme Manager - Drones

Stéphane VAUBOURG, EASA
Drones Project Manager – U-space



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Title