

CORUS-XUAM: 2nd Stakeholders Workshop

The Vertiport in the CORUS-XUAM ConOps

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Agenda



Why Vertiports?

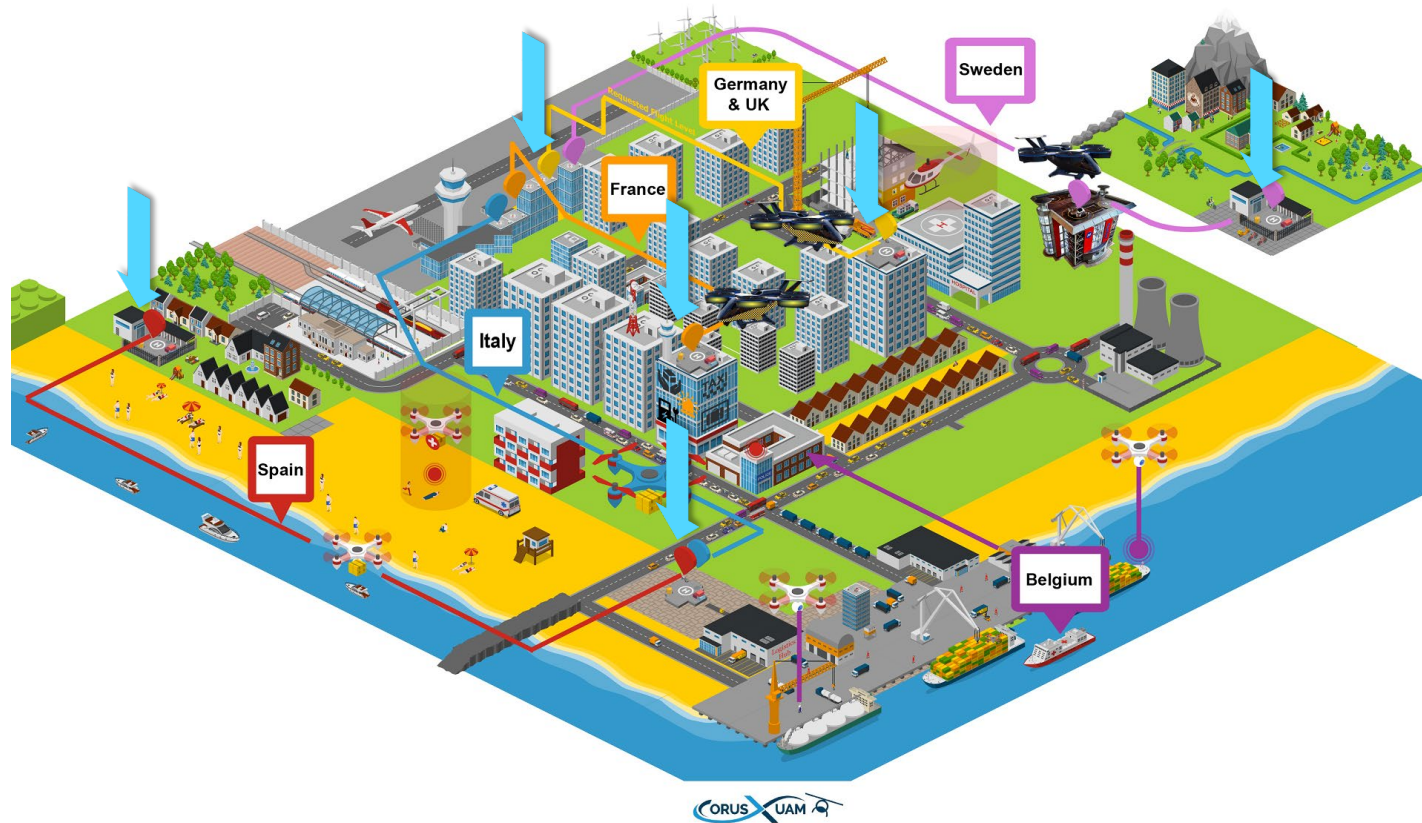


Regulatory Framework



Vertiports in U-space

Why Vertiports?



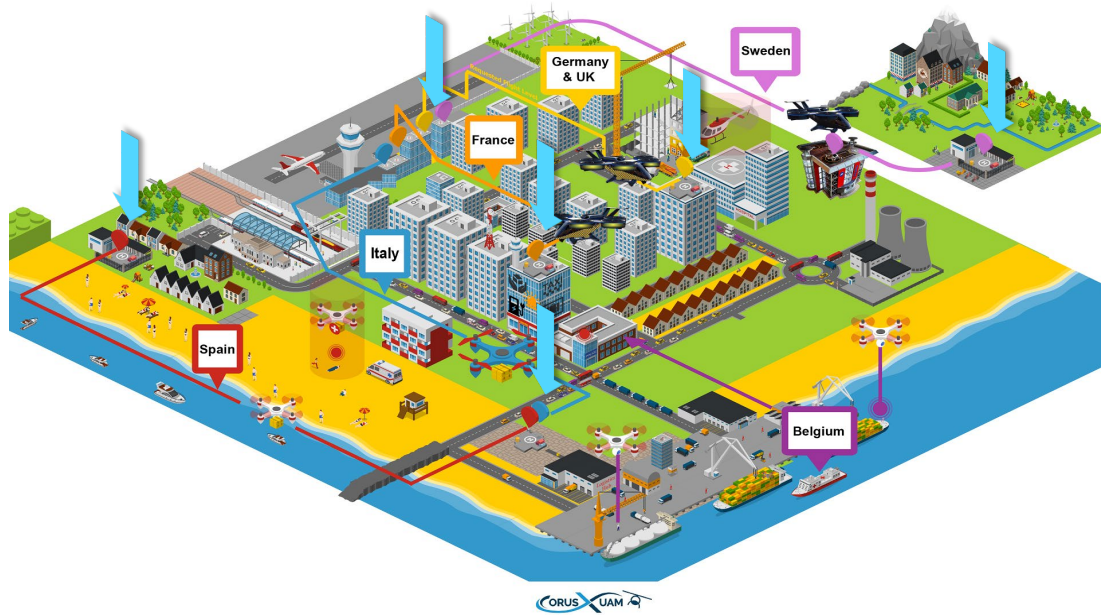
Crucial for providing
UAM services

Critical resource/
Capacity bottleneck

Important element
when scaling-up UAM
operations

Novel Stakeholder in
the U-space
framework

Challenges #1 for Vertiports – Macro Level



- Complex obstacle scenery
- Densely populated environment
- Limited available ground -and airspace
- Releasing UAM flights into in (controlled) airspace used by other airspace users
- Integration into existing (public) transportation networks and behaviors
- Facing „urban weather“
- Contingency and emergency measures
- Meeting requirements of noise and privacy concerns

Vertiport – Common Basis



Vertiport
Operation



Vertiport
Business



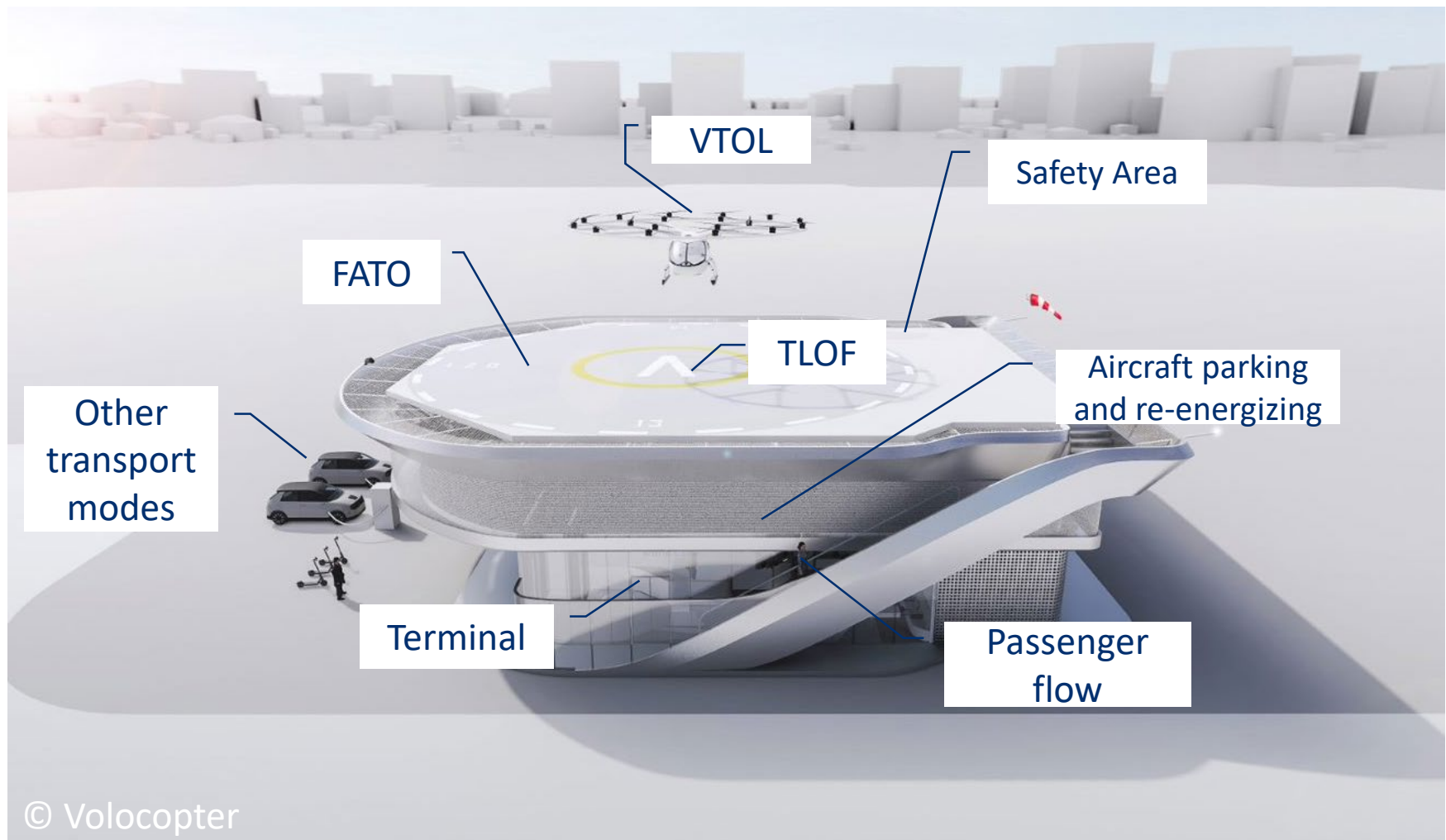
Vertiport
Characteristics



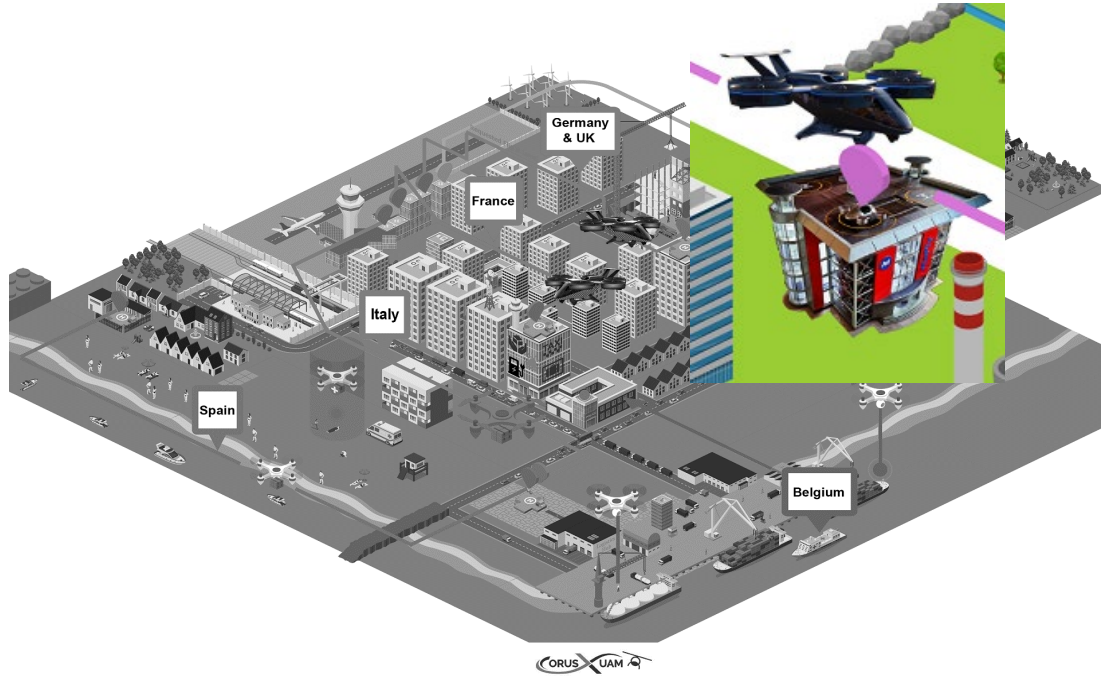
Vertiport
& Complex



Vertiport – Common Basis



Challenges #2 for Vertiports – Micro Level



- Vertiport Layout/ Operation
 - Forecast, real demand
 - On-demand, scheduled, mixed
 - Long/short lead time
- Mixed VTOL aircraft fleet
 - Manned, unmanned
 - Electric, hybrid
 - Passenger carrying-services
 - Delivery services
- Vertiport movement
 - Ground movement, air taxiing
- Type of infrastructure
 - Existing, retrofitted, new
 - Level of equipage
- Contingency and emergency measures

Regulatory framework

EASA Special Condition VTOL (SC-VTOL) and Proposed Means of Compliance (MOC-2 SC VTOL)

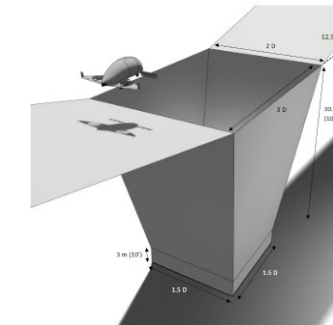
Definition of Vertiport introduced

- **'vertiport'** means an area of land, water, or structure used or intended to be used for the landing and take-off of VTOL aircraft.
 - *predominantly used by and designed to accommodate VTOL capable aircraft*
- Vertiport reference volume Type 1

VTOL aircraft categories

- **Category Enhanced** – have to meet requirements for continued safe flight and landing, and be able to continue to the original intended destination or a suitable alternate vertiport after a failure
 - aircraft intended for operations over congested areas or for Commercial Air Transport operations of passengers must be certified in this category;
- **Category Basic** – controlled emergency landing requirements would have to be met, in a similar manner to a controlled glide or autorotation

Category enhanced of VTOLs requires vertiports for take-off and landing, but also en-route vertiports for the purpose of continued safe flight and landing.



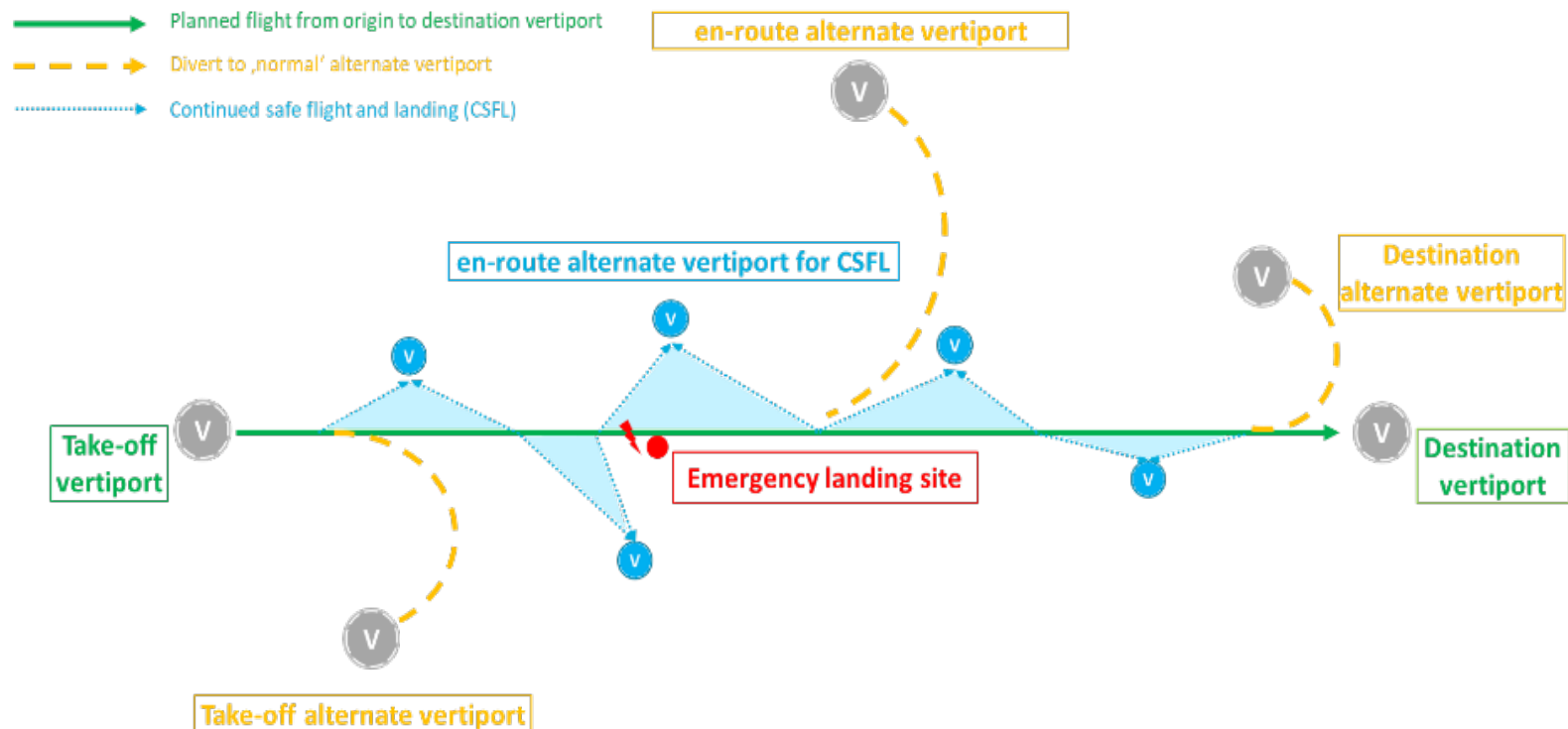
Regulatory framework

The grey circles -> vertiports with the full range of facilities/services required for the operation, that the VTOL vehicle can land and take-off from.

- Take-off and destination vertiport
- Alternate take-off and destination vertiport
- Alternate en-route vertiports

The blue circles -> vertiports for CSFL, with minimum set of facilities and services, from which VTOLs may not be able to take-off.

Emergency landing site: emergency landing may be carried out at any possible location, not necessarily at a pre-planned aerodrome



Regulatory framework

First draft issued



U-Space Regulatory framework AMC/GM proposal:

- Aerodrome/heliport/vertiport operators identified as stakeholders to provide and retrieve information from the Common Information Service (CIS).

To be published



EASA RMT.0230 for operations of UAS and for UAM

- operational requirements to take-off from and land at vertiports;
- aerodrome/vertiport design and operational services

To be published

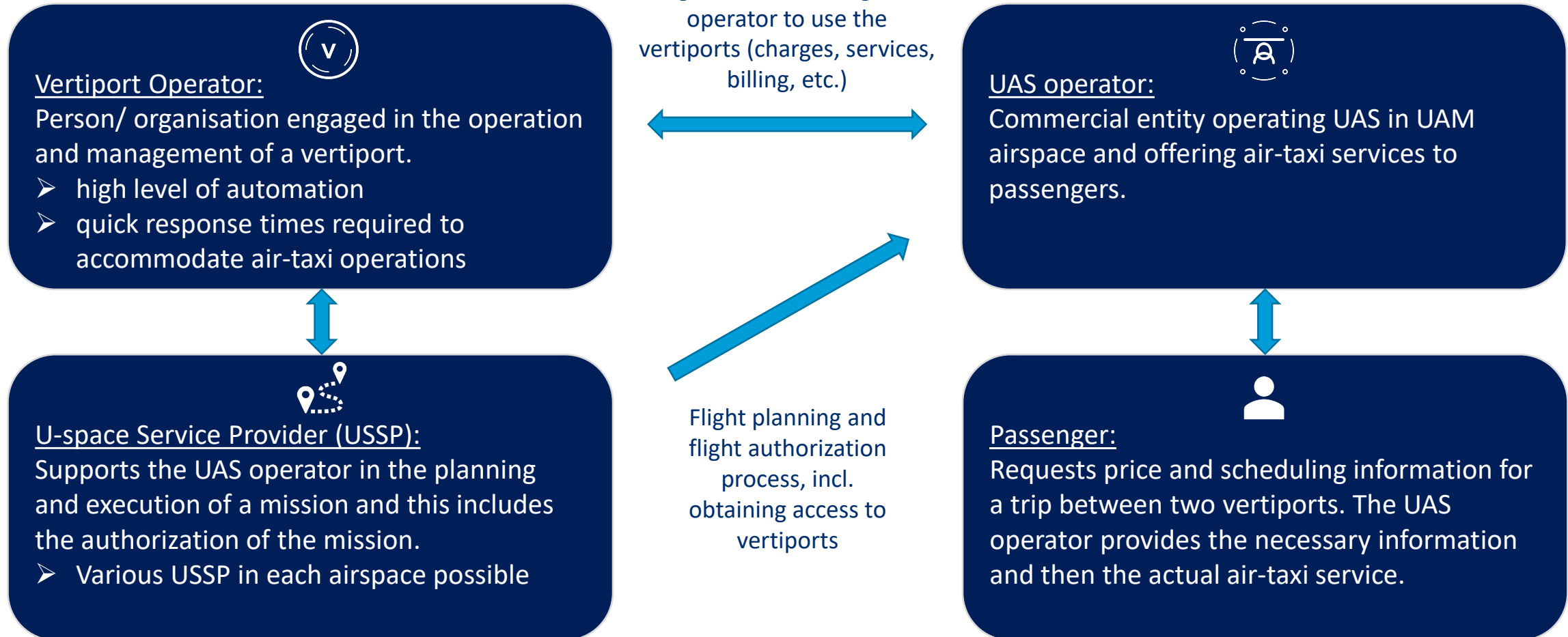


ED-299 "Guidance for vertiport operators and operations"

- Vertiport roles and responsibilities

👉 The importance of vertiports for U-space and UAM operations is recognized; Roles and responsibilities are yet to be defined!

Vertiport stakeholders



Vertiport in U-space

Vertiport management system

Vertiport operator responsible for the vertiport. Vertiport actual state and operations plans subject of the **vertiport management system**

USSPs control the V-TZ and receive information via **the vertiport management system**.
*Need for fair and transparent coordination of USSPs offering services in the same V-TZ.

Booking of vertiport resources

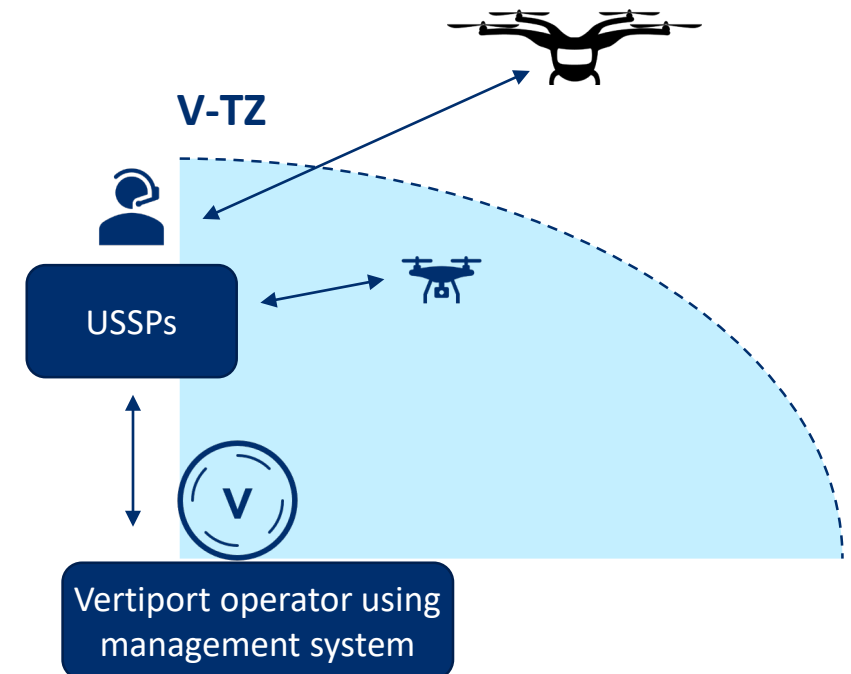
Flight planning and authorization performed by the **USSP providing service to the UAS**, incl. booking of vertiports access

Vertiport access booking does not authorize the vehicle to take-off or land. **Take-off/landing clearance*** is required which will be obtained shortly prior to the operation.

*Concepts as vertiport access booking and UAM take-off and landing clearance are still under discussion

Vertiport Terminal Zone (V-TZ)

U-space airspace with a defined set of rules and procedures



Vertiport Management System

New U-space service: Vertiport dynamic information service



Provides information about the vertiport in real-time

- Availability, capacity changes, utilization

Benefits strategic planning processes

- Resource allocation
- Demand and capacity balancing

Benefits tactical processes

- Deviations, diversions, closure, etc.
- Demand and capacity balancing

Linked to:

Common Information Service Provider (CISP)?, operation plan preparation/processing/optimization, strategic/tactical conflict resolution and demand capacity balancing,...

Vertiport in U-space

Supporting U-space: Operational Handbook



Linked to the general U-space community, aircraft fleet operators and UAM service provider

Provides general information about the vertiport:

- Operating hours
- Vertiport layout
- VTOL aircraft designs and performance requirements
- Capabilities
 - Charging, refueling, maintenance, etc.

Provides information about operational procedures at the vertiport

- Standard procedures
 - Procedures inside Vertiport Traffic Zone (Arrival, Departure, Sequencing approaches)
- Contingency and emergency procedures
 - Waiting, short-term blocking, diversion, etc.

Vertiport in U-space

Supporting U-space: Weather Information Service



Provides real-time information about weather conditions at the vertiport

- Temperature
- Wind
- Visibility
- ...

Linked to:

Weather information service,
Operation plan
preparation/optimization,
In general: Supporting urban
climatology

Stepwise integration of vertiports into U-space



CRAWL

Pre-operational trials and validation

- Prototypes of aircrafts and vertiports
- Test flights in restricted environment
- Setting up U-space services and testing the interoperability and viability



WALK

Early commercial operations

- Low traffic levels, crewed UAM operation, VFR
- No active use of U-space by crewed UAM
- Only a few vertiports and UAM routes in the urban environment, usage of existing infrastructure (heliports)
- Pre-scheduled flights, strategic slot planning



RUN

Increasing automation level

- Higher volume and more automated operations, permeability between crewed and uncrewed operations
- Integration of UAM in U-space
- Increased automation and integration between U-space operations and the ground infrastructure



FLY

Larger scale operations

- Highly automated and autonomous operation
- UAM operations relying on U-space, vertiports connected to U-space
- Take-off and landing at a variety of sites, high amount of urban UAM routes
- On-demand flights, tactical slot management

Summary

“Infrastructure constraints (both the number of vertiports and capacity) were the greatest limitation for AAM demand” [1]

Vertiports are crucial for UAM operations on a strategic and tactical level

Vertiports need to be part of the U-space framework

A Vertiport needs to share real-time information with the U-space community

A vertiport’s role inside U-space (architecture) and its participation in information flow processes needs to be investigated and defined!

Maturity Level/ Traffic Density → Scalability

[1] R. Goyal, C. Reiche, C. Fernando, and A. Cohen, “Advanced Air Mobility: Demand Analysis and Market Potential of the Airport Shuttle and Air Taxi Markets,” *Sustainability*, vol. 13, no. 13, p. 7421, Jul. 2021, doi: [10.3390/su13137421](https://doi.org/10.3390/su13137421).

THANK YOU FOR
YOUR ATTENTION



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