CORUS-XUAM – 2st Stakeholders Workshop

WP9 Demo Activities presentation. ATM/U-space interface

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Founding Members

EUROPEAN UNION EUROCONTROL

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Agenda

Acknowledgments

WP9 Overview

Airspace Analysis (ATM-UTM Interface)

U-space Architecture

U-space Services Deployed

Conclusions

Acknowledgments

WP9 Overview

The **Spanish VLD** will look deeper into the interrelations between UAM operations, urban restrictions and intermodality links.

- CORUS U-space services to be demonstrated to be capable of managing **drone logistic operations** into mid-size urban and suburban areas within a controlled airspace, exploring the interrelation with *intermodal transport*, *manned aviation*, and *drone emergency operations*.
- The scenarios reproduce the door-to-door transport of goods.
- This VLD will also deploy two possible U-space architectures: one with a federated network of U-space service providers (USSP) plus an inter-USP platform; and another where a Central Information System (CIS) serves critical services to connected USPs.

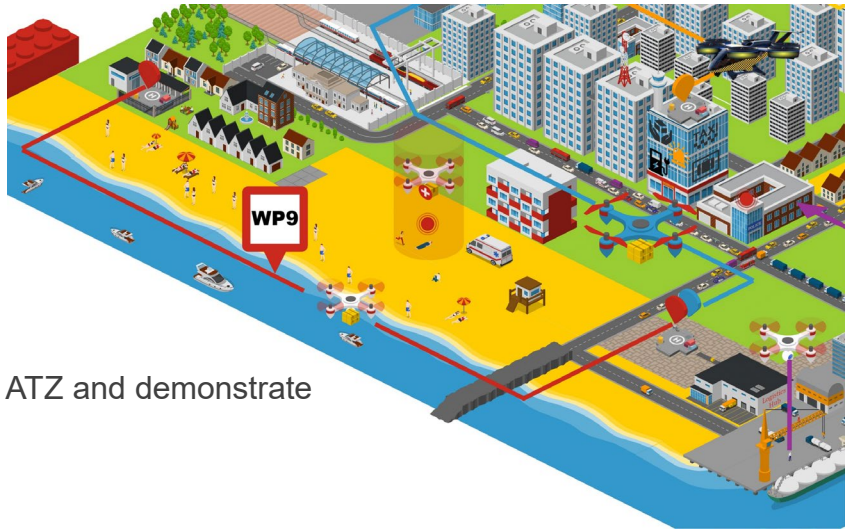
Location

- Castelldefels (Barcelona)

WP9 Overview

The biggest challenges:

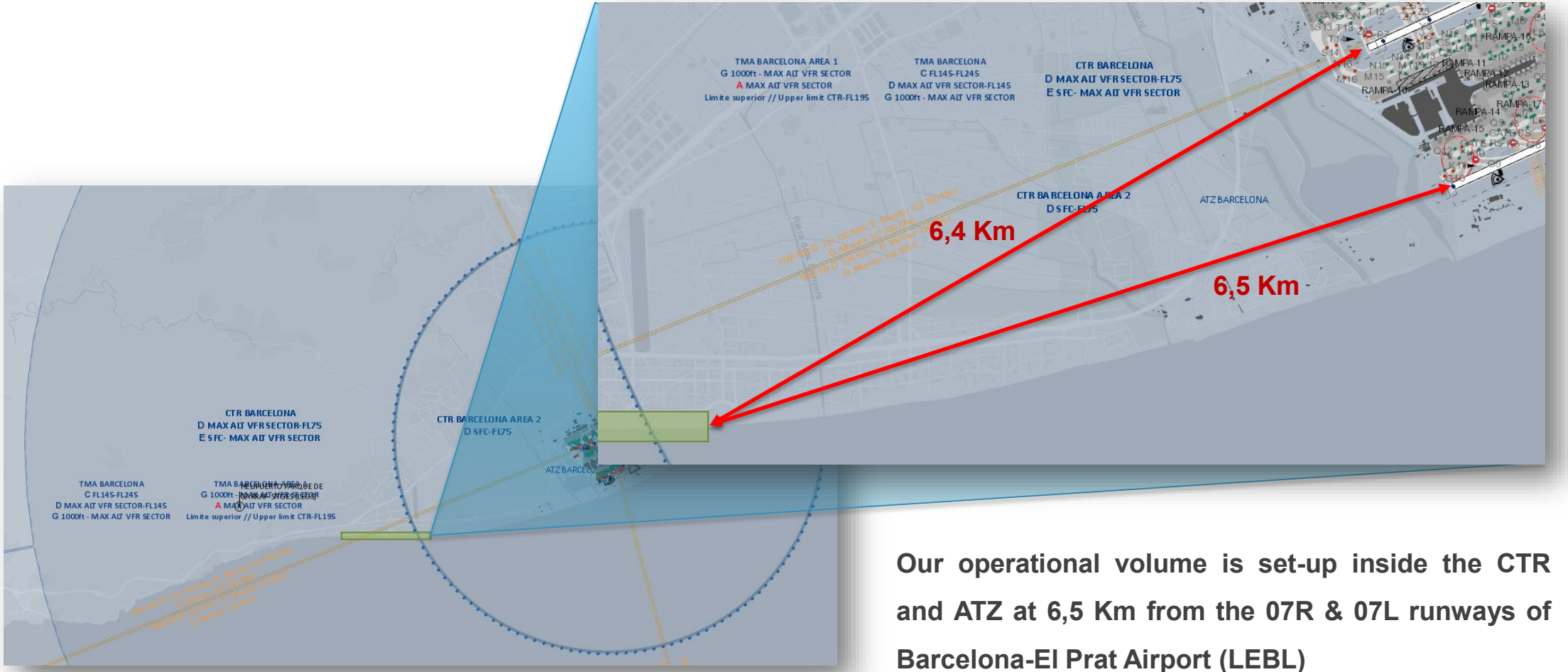
- **Authorization**: Operation within the Barcelona-El Prat airport CTR & ATZ and below the glide path for approach to runway 07L.
- **Technical and temporary:** Drones connected to INDRA & Aslogic U-space services, Multi-USSP architecture with a CIS, communications based on mobile networks.
- **Human/Organizational:** Coordination of a large number of drone operators, secure access to VLL airspace, development of departure and arrival procedures at vertiports, request for access to airspace for multiple simultaneous operations.



Main impacts:

- Allow **door-to-door transport of goods** in coordination with urban transport managers to guarantee compliance with urban restrictions.
- **Demonstrate the access of privileged users** such as the police to the U-space and test the coexistence of logistics operations with police surveillance and emergency actions.
- Demonstrate the full complexity of strategic de-confliction resolution in the urban environment of CTR & ATZ and demonstrate **successful interaction between different U-space service providers.**
- Update and refine the central role of the CIS.
- Test the successful **interaction between U-space and ATM**.
- Facilitate the business perspective of drone operators in the provision of U-space services.
- **Promote and study** in detail more aspects of **the social acceptance of the use of drones in urban environments.**

Airspace Analysis



Our operational volume is set-up inside the CTR and ATZ at 6,5 Km from the 07R & 07L runways of Barcelona-El Prat Airport (LEBL)

Airspace Analysis

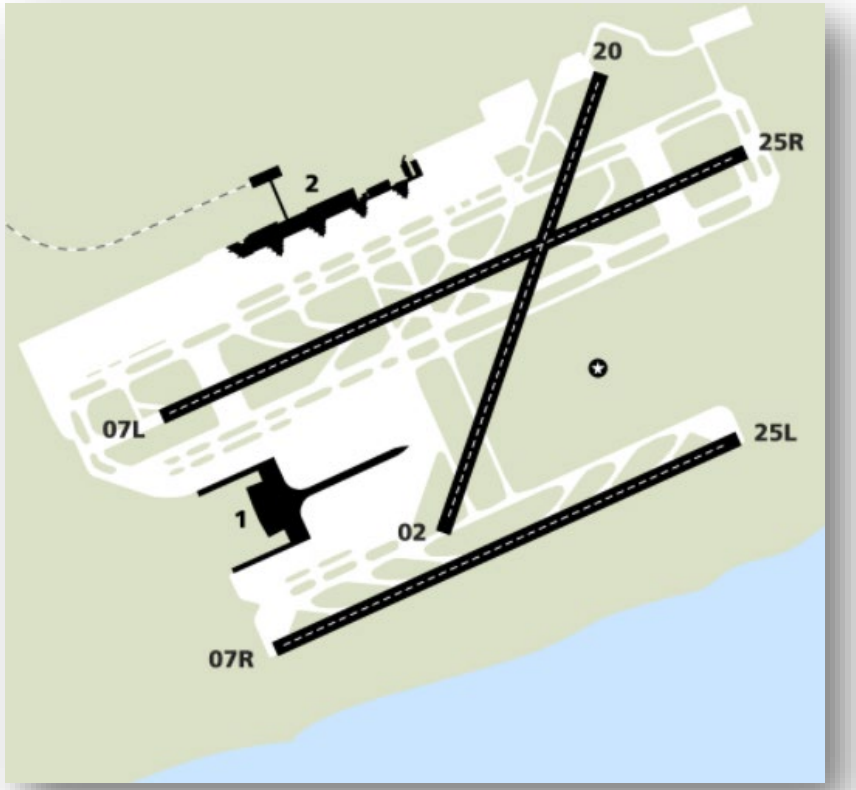
LEBL has **two different configurations**.

West configuration will take precedence over **East configuration** between 07:00 and 23:00 Local Time (LT) and East configuration will take precedence over West between 23:00 and 07:00 LT for environmental reasons.

Daytime configuration between 0700 and 2300 LT :

- Preferential: West configuration parallel runways
    - Arrivals: 25R
    - Departures: 25L and 25R
- No preferential: East configuration parallel runways
    - Arrivals: 07L
    - Departures: 07R and 07L

We have had to study each configuration and consider any type of change in the airport's configuration due to wind conditions. Analyze and mitigate the affections that we can cause in arrivals, departures and missed approaches by each configuration.

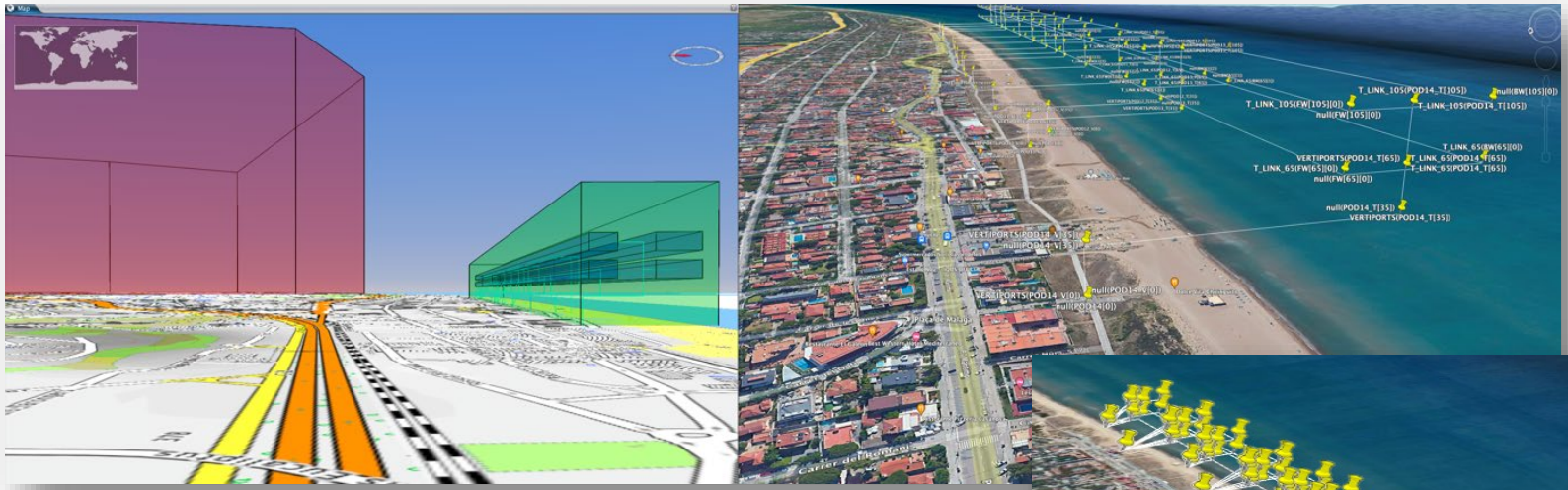


Airspace Analysis

¡¡¡ We had to analyse more than 100 potential affection points !!!

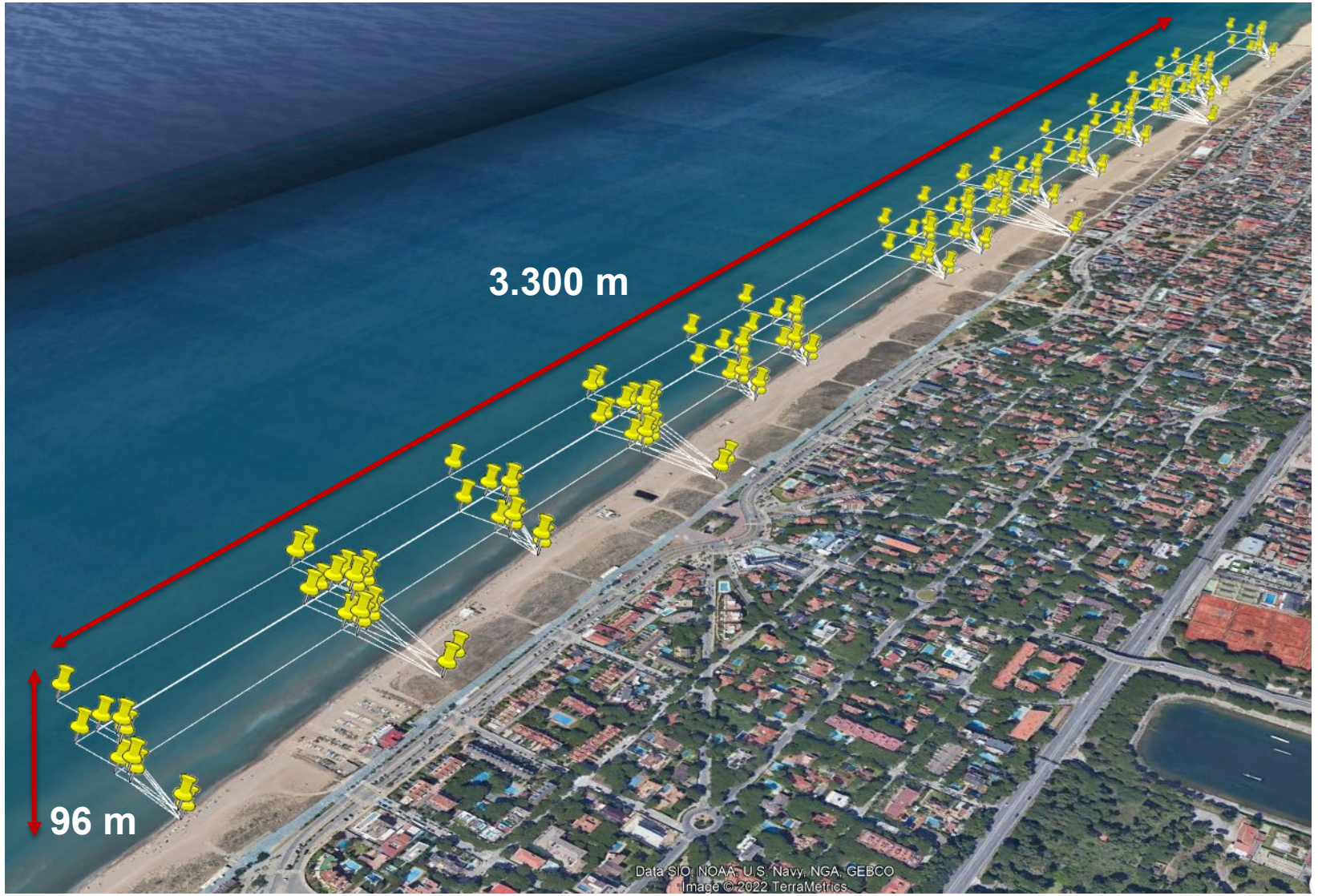
The importance of the of U-space and CIS platforms to start to **digitalize and automatize** all the authorizations, clearances with airports, heliports, ATM-UTM interface…etc.

Airspace Analysis



Re-do and re-locate the airspace structure due to some airport infrastructures that causes electromagnetic interferences (One of the biggest challenges)

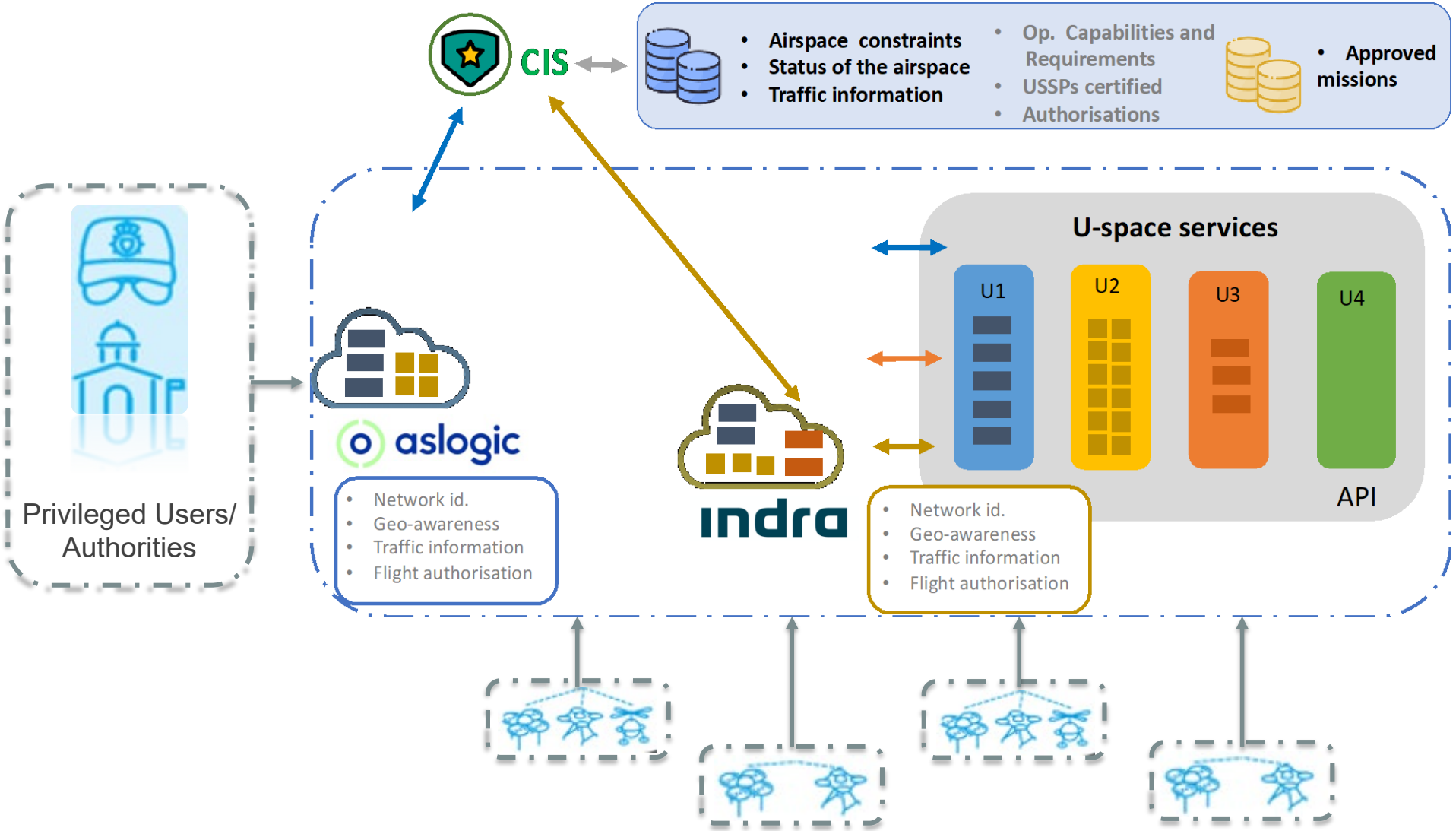
Airspace Analysis



Operational Resources

- 4 Generic UAS operators
  - 8 Multirotor UAS
- 1 Police UAS Operator
  - 1 Multirotor UAS
- 4 Vertiports
- 12 Delivery Points
- +40 people involved

U-space Architecture



U-space Services Deployed

Registration: Operators, drones and pilots were registered at USSP platforms & CISP

e-Identification: all UAS were equipped with a system to identify and report telemetry during flight

Geo-awareness: USSPs provides the relevant data to safely design and performs the missions

Strategic Conflict Resolution: all FPs went through de-conflicting algorithms to compute a conflict-free launch window

Tracking and position reporting: telemetry reported from drones was correlated with planned missions, so flight execution was tracked and registered both at USSP and CISP

Operation plan preparation/optimisation: DronAs platform together with UPC systems closed the link between 4DT FP (for USSP) and Drone FP (for GCS)

Geospatial information service: FPs were designed with the cartography, where airspace arquitecture was represented with the geographical context

Geo-fence provision (incl. dynamic geo-fencing): Dynamic Geo-fences were set at the CISP and USSP platforms reacted upon CISP notification by revoking the authorization to the FPs already planned during the activation of the fence.

Emergency Management: Local Police activated a dynamic geo-fence for emulating an emergency situation. USSP platforms reacted as described above

Monitoring: **conformance monitoring** of correlated tracks was executed during the flight tactical phase. Loss of adherence and potential loss of separation were eventually detected and reported.

Traffic Information: thanks to the presence of the CISP, both USSP platforms (and operators) were able to keep a common situational awareness at the strategic and also at the tactical phases.

DAIM: interoperability through the CISP, the USSP platforms were able to manage relevant DAI (mainly approved FPs, tracking data and geo-fences)

Tactical Conflict Resolution: no tactical CR was applied but the USSP were detecting potential loss of separation and reporting the corresponding alerts,

Dynamic Capacity Management: DronAs planning services computed required the mission launch window adjustments to maximiz the airspace occupancy

U1 Level

U2 Level

U3 Level

Conclusions

High level conclusions. We are processing all the data from the VLD to achieve hight quality insights, conclusions and lessons learnt.

After +6 months of preparation of ground and air authorizations. And +12 different authorities, ANSP, safety agencies, airport managers, city council, police forces…among others.

We need to digitalize and automatize this procedures through the first U1 and U2 U-spaces services and convert days and months to hours and minutes in the time scale.

ATCOs, Polices Forces, no EASA operations organizations where extremely pleased on start using U-space for its benefits in terms of coordination, safety, security and agility.

Delivery operations with drones are feasible in a near future with some constraints such as:

- Harmonized airspace structures with specific airways, turns, heights, separations, speeds, RTH corridors…
- Extremely good coverage of telecommunications infrastructures
- First airspace structures will be placed in low population areas near urban nuclei due to high ground risk level

Improve tracking, telemetry, C2 Link, Mobile Network (4G, LTE…). We are limited by law to use some bands and technologies that are currently no available for UAS. (i.e: Pire: CE vs FCC) for long range flights.

More technological steps has to be taken to embrace the future U-space services in urban and airport zones.

Design of common airspace structures for different types and performances of UAS is crucial for safety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Thank you very much for your attention

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