

UAM Logistic Operations in U-space Distributed Architecture

CORUS-XUAM - U-space from Concept to Operations

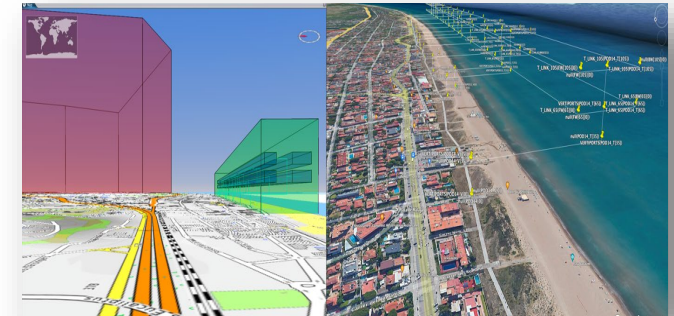
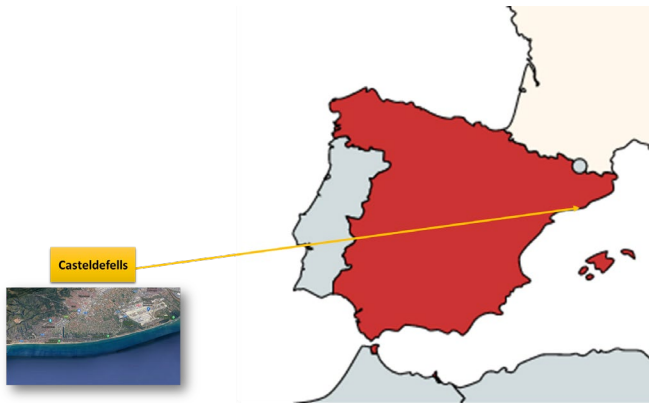
Marta Sánchez - CRIDA/ ENAIRE



SESAR 2020 SHOWCASE

Spanish demo - Scope

- Demonstrating the U-space system capability of managing simultaneous UAS logistic operations within mid-size urban and suburban areas and controlled airspace.



Spanish demo – Challenges

Authorisation of operations within the Barcelona-El Prat airport CTR & ATZ and below the glide path for approach to runway 07L.

 Strategic de-confliction of large number of drones and operators executing last-mile deliveries.

 Development of departure and arrival procedures at vertiports.

 Access of privileged users to same airspace.

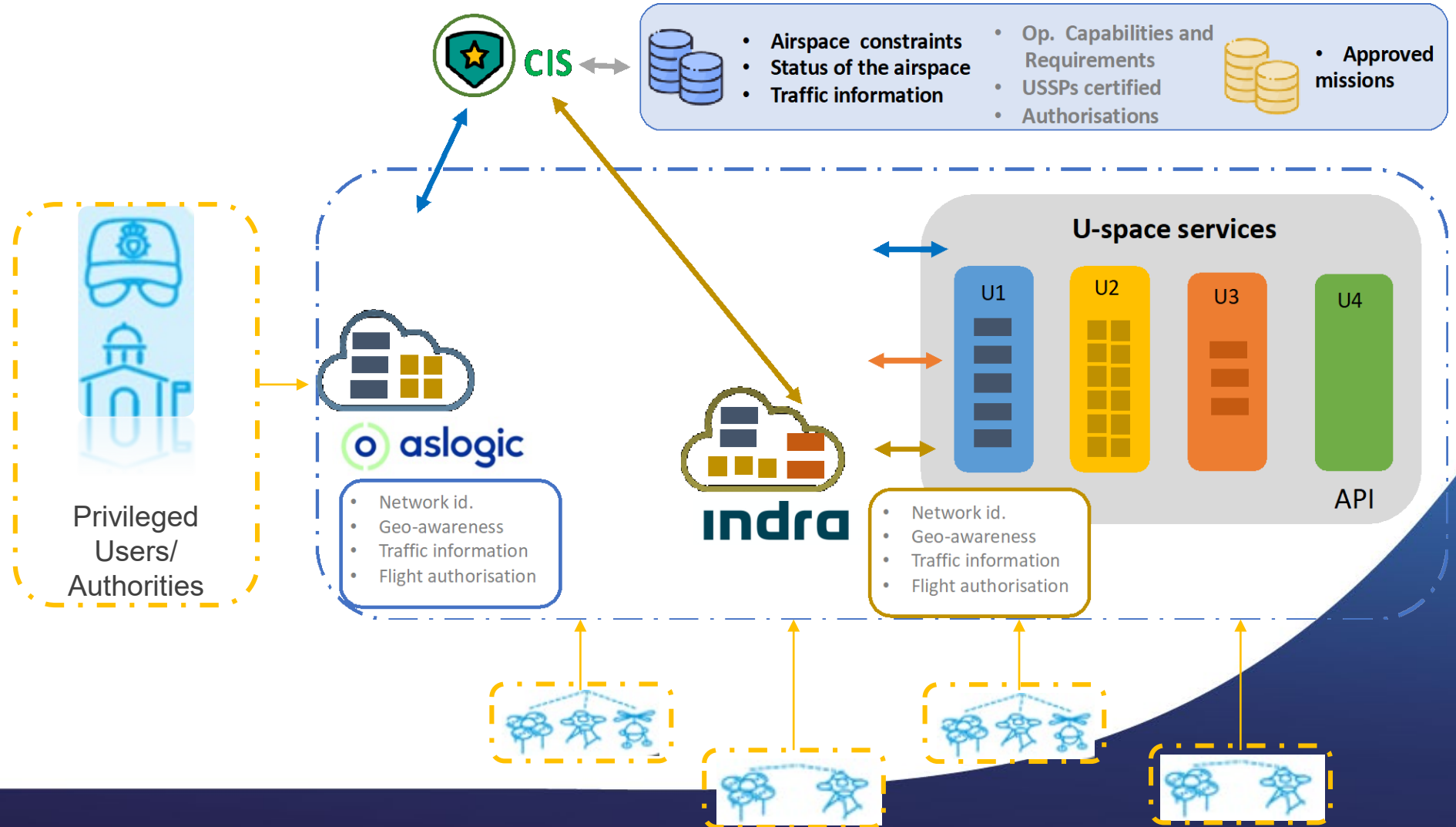


Spanish demo - Challenges



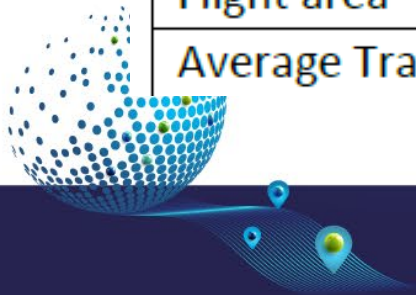
U-space distributed architecture:

- One CISP and two USSPs;
- Four Drone Operators.



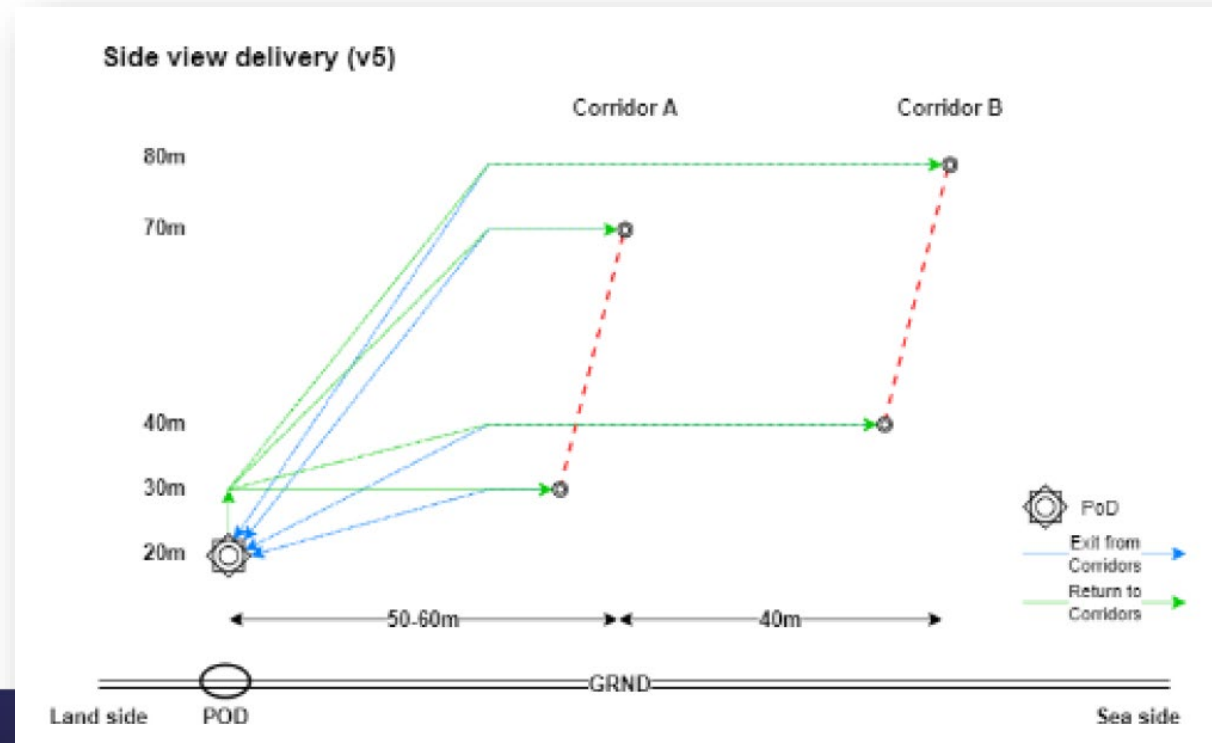
Spanish demo - Results

Metric	Result
Total number of flights	63
Total number of flights on 9/3/2021	39
Total number of flights on 10/3/2021	24
Total flight time	319.5 min
Total flight time 9/3/2021	200.4 min
Total flight time 10/3/2021	119.2 min
Total flight time in U-space	253.3 min
Total operations launched within 2min window	62
Total operations launched within tight 1 min window	56
Average Traffic Density (I)	16 flights/h
Flight area	0,8 Km ²
Average Traffic density (II)	20 flights/h/ Km ²



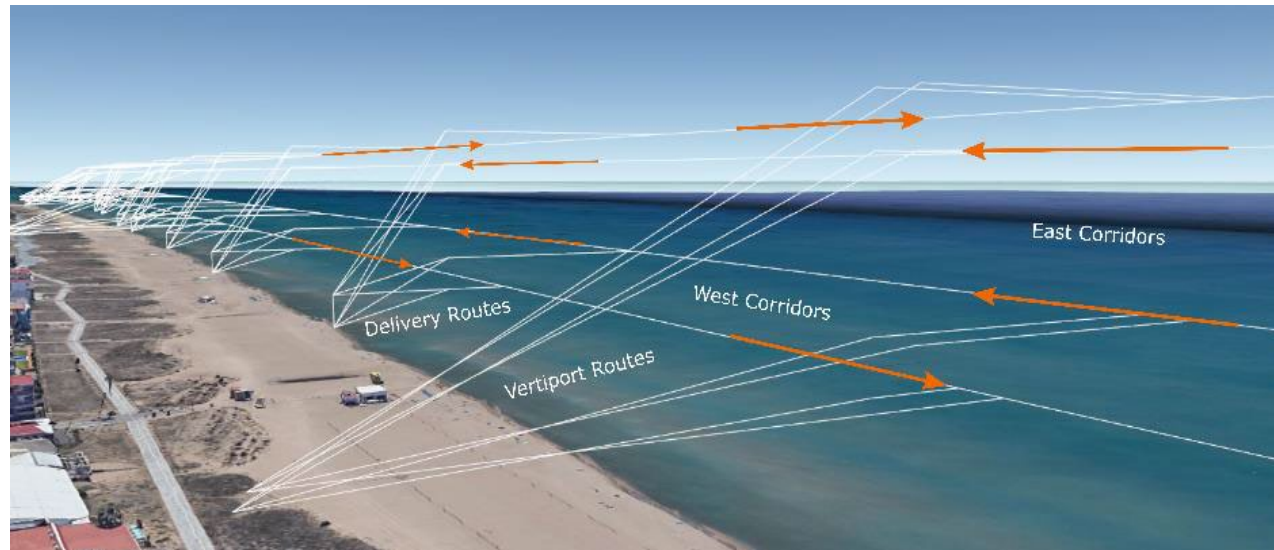
Spanish demo Results: Airspace Structure

- Based on parallel horizontal corridors for flying in opposite sense directions.
- Slight vertical offset for safe crossing of corridors from/to vertiports, and for establishing exit points along the corridor for RTL in case of contingency.



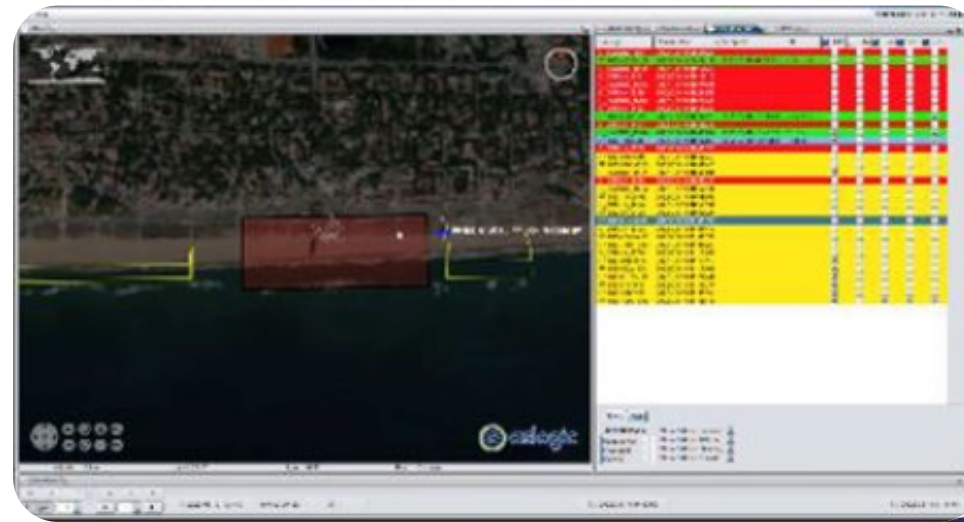
Spanish demo Results: Airspace Structure

- The corridor-based architecture has the advantage that can be incremental to respond to higher demand.
- Scalable structure: to **increase the capacity of the airspace** it is possible to add new vertical levels to the corridors.



Spanish demo Results: distributed U-space architecture

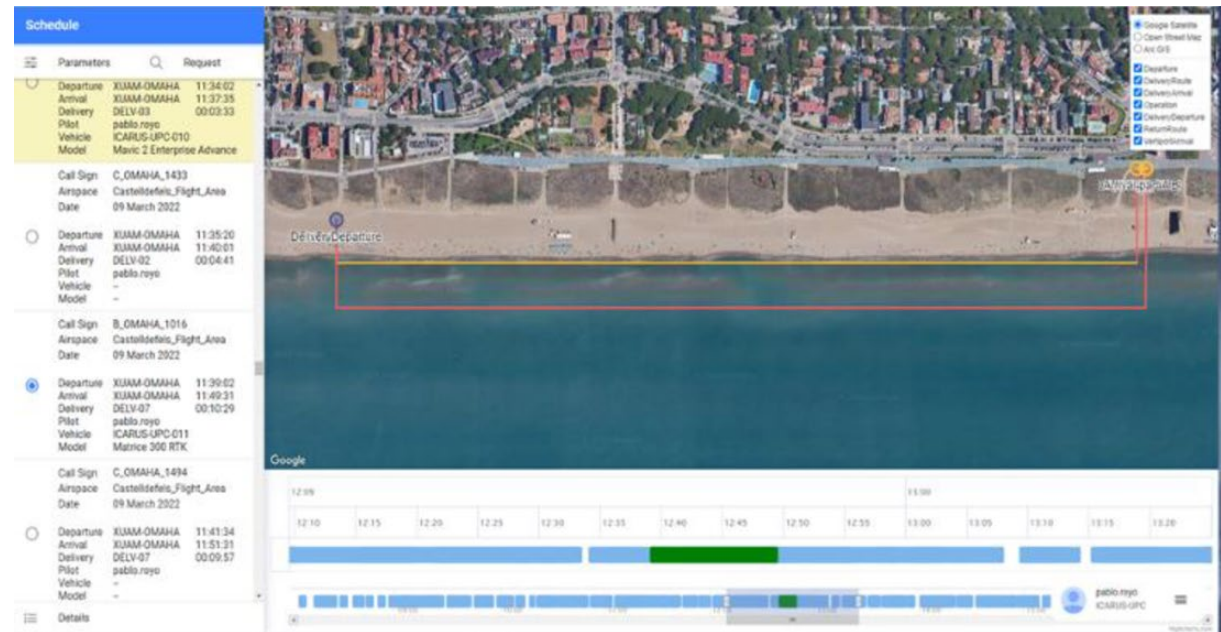
- CISP and USSPs able to reach common situational awareness on FPs, tracking, warnings and geo-fences;
- Registered authorities connected directly to CISP and able to manage geo-fence -> timely warnings and solutions to all drones flying in the area.



Spanish demo Results: new concepts for strategic de-confliction

2-minute take-off window embedded in a window of 15 minutes for take-off as part of the submitted flight plan:

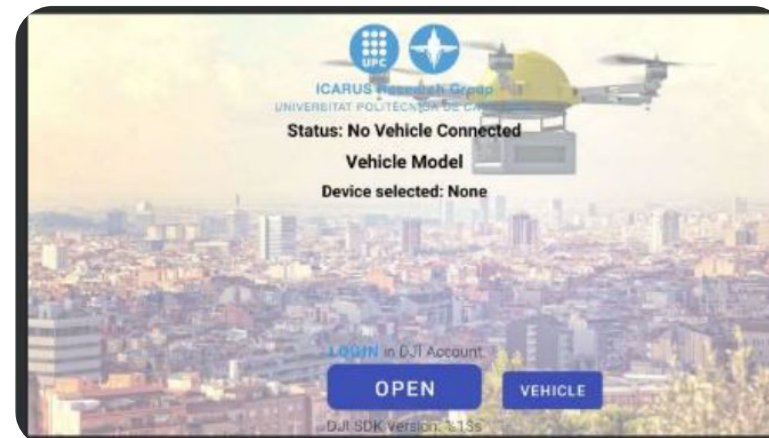
- Requested Launch Window (RLW);
- Confirmation Due Time;
- Accepted Launch Window (ALW).



Spanish demo Results: Operation Support Platform

DOs' platforms have been prototyped as a common Operation Support Platform (OSP):

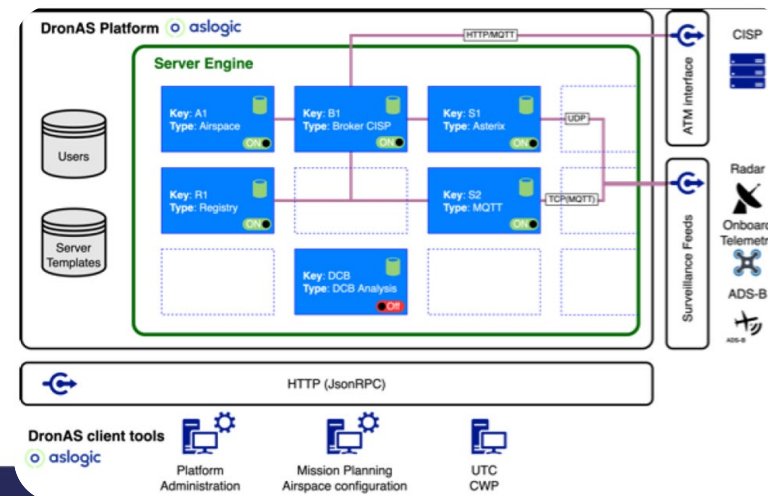
- Link between DOs and their corresponding USSPs;
- Harmonized information content and format;
- Common interface for DOs, a plug-and-play solution compatible with available USSPs (business open).



Spanish demo Results: Secure surveillance for tactical management

Vehicles have provided tracking information to their corresponding USSP provider by sending messages through dedicated USSP communication brokers:

- Access to the brokers protected and restricted, allowing a secure ecosystem where only previously certified DOs can send information;
- Flight tracking data exchanged through the mobile 4G network and the set up MQTT brokers. MQTT (Message Queuing Telemetry Transport) is the standard used in IoT (Internet of Things).



Spanish demonstration exercise in CORUS-XUAM - Partners



ENAIRe

indra



MARS
INTELLIGENCE



UAB
Universitat Autònoma
de Barcelona



UNIVERSITAT POLITÈCNICA
DE CATALUNYA
BARCELONATECH



Policia Local
Castelldefels

mossos d'esquadra



Thank you for your attention!

