



EU Drone Days

Launch of the **CORUS-XUAM**
European Drone Strategy 2.0

SESAR U-space Showcase

Brussels, 29-30 November 2022



#EUDroneDays

The CORUS-XUAM partners

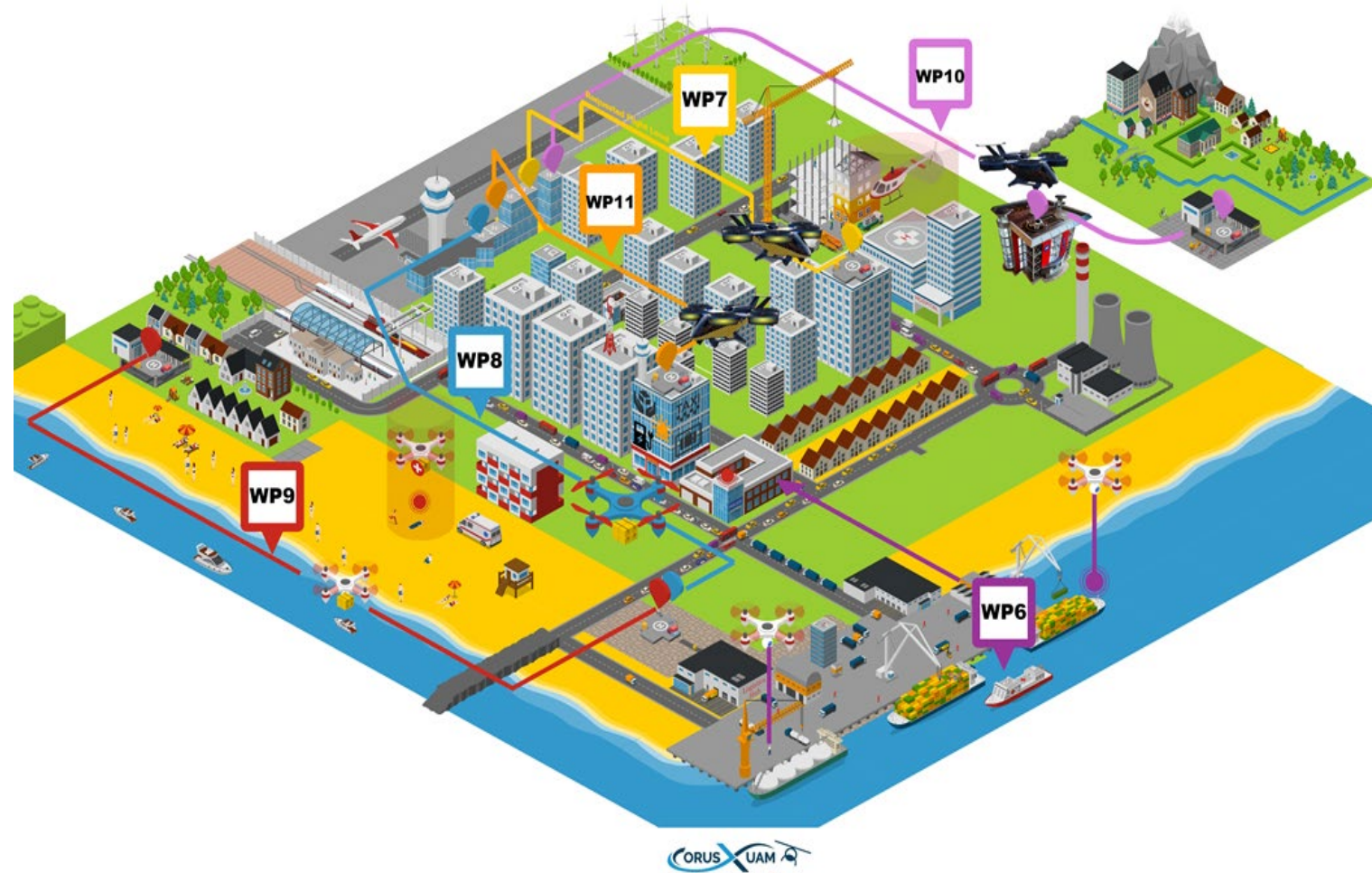


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The four CORUS-XUAM objectives

- Use early versions of end-user systems to test, mature and validate operational U-space concepts and services;
- Refine U-space services and solutions (relying on a high level of digitalization / automation of functions) to enable safe, secure, sustainable and fully integrated UAM;
- Extend the U-space CONOPS to address the specificities of Urban Air Mobility;
- Promote the use of U-space capabilities and services in Urban Air Mobility.



CORUS XUAM Results

- Initial ConOps in line with EU reg 2021/664 & adding UAM
 - Comments welcome - See <https://corus-xuam.eu/new-u-space-conops/>
 - Final version being prepared now
- Today the last of the six flight trials is taking place in Germany
- We are digesting the results of four, but the Spanish results are available.



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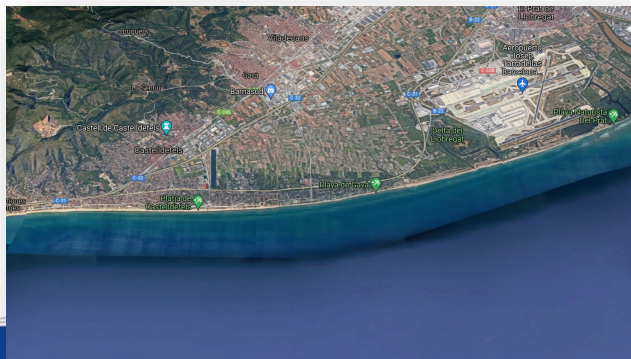
Spain VLD Exercise

- Last Mile delivery cargo;
- Emergency operation by local police authority.

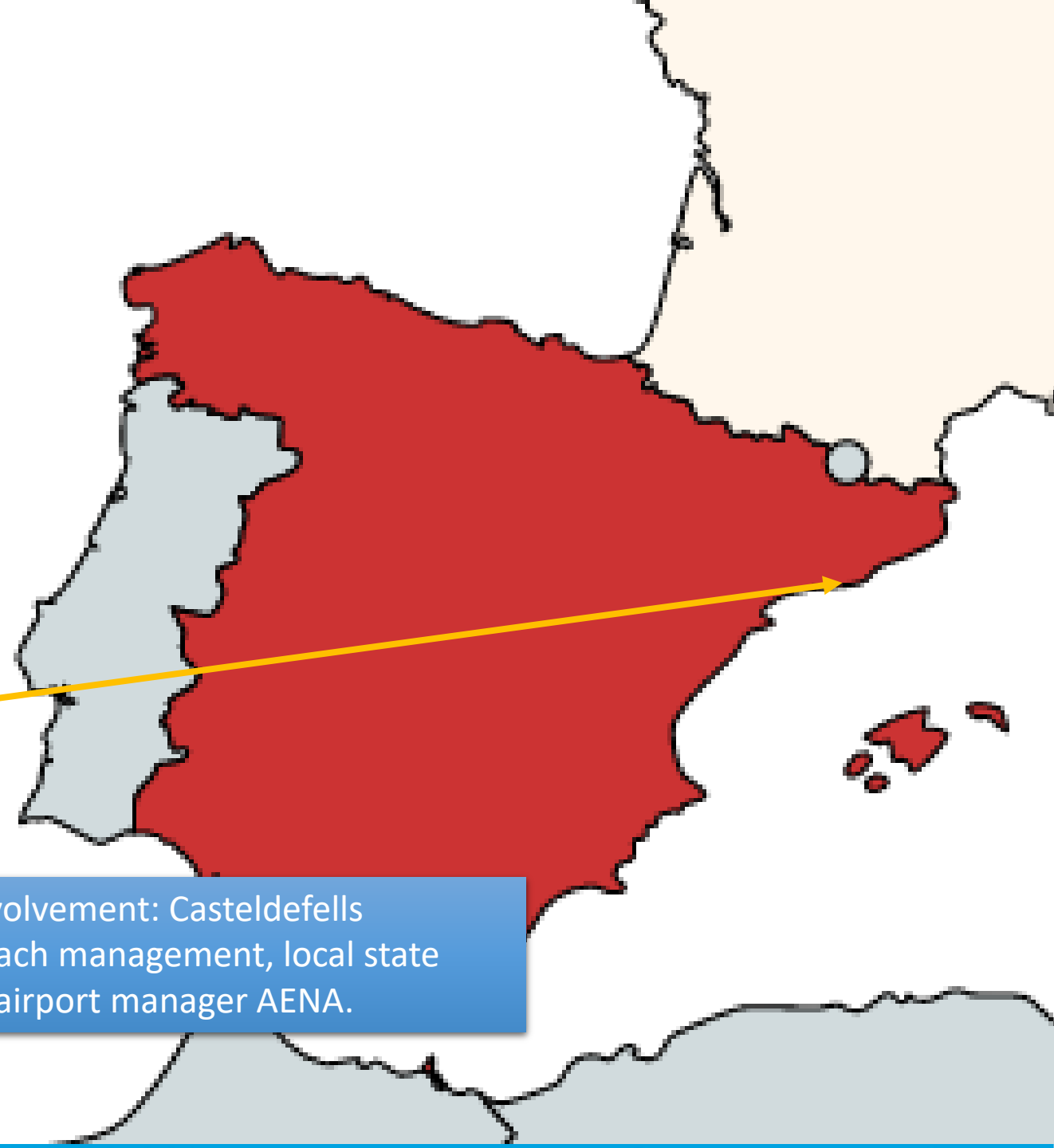
Special characteristics:

- CISP working with multiple USSP;
- Controlled Airspace within Barcelona Approach sectors.

Casteldefells

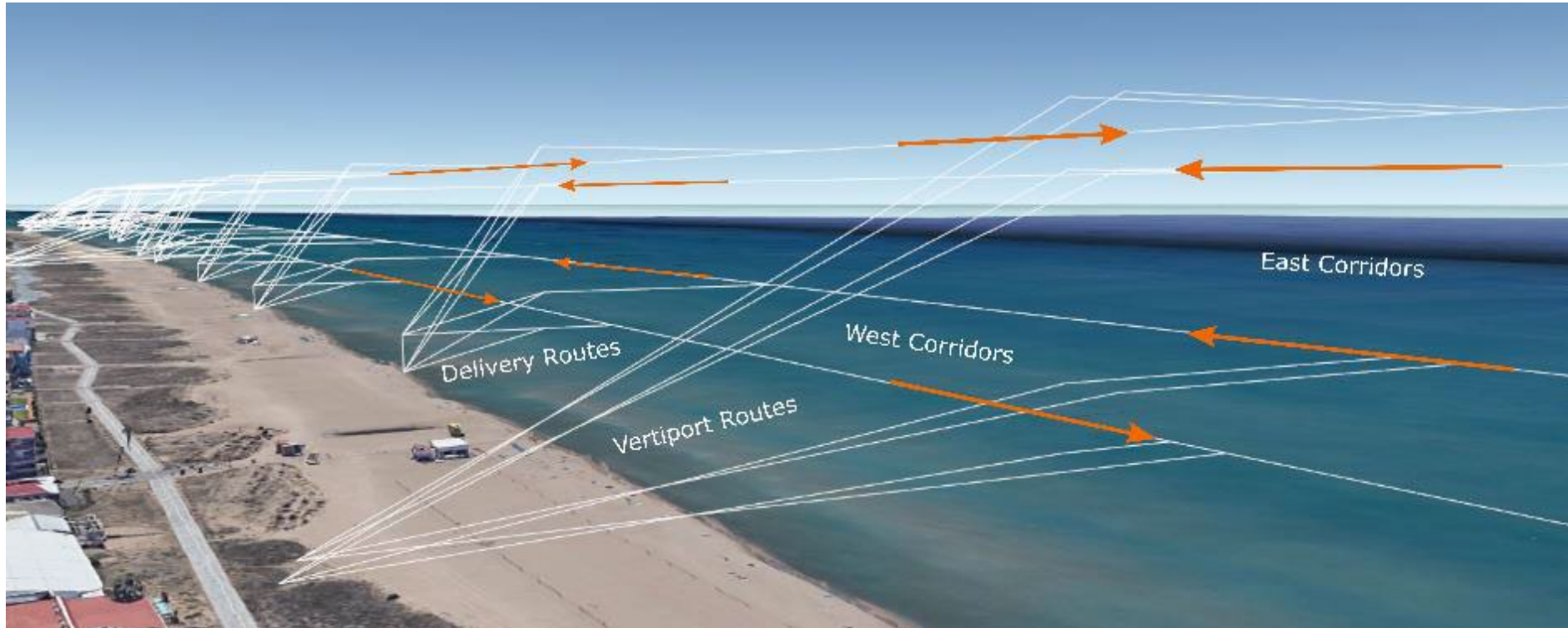


Stakeholders involvement: Casteldefells municipality, beach management, local state authorities and airport manager AENA.



CORUS-XUAM: Spain – Airspace Structure

The airspace structure used has been based on **parallel horizontal corridors for flying in opposite sense directions**. The corridors have a **slight vertical offset** which allows for a safe crossing of corridors from/to vertiports, as well as for establishing exit points along the corridor for RTL in case of contingency.



This setting of the airspace and traffic flows allows a **safety envelope** for the operations while accommodating **simultaneous operations**. It simplifies operations planning and tactical management exploiting as much as possible time-based control while still providing enough capacity as to accommodate simultaneous operations of various drone operators.

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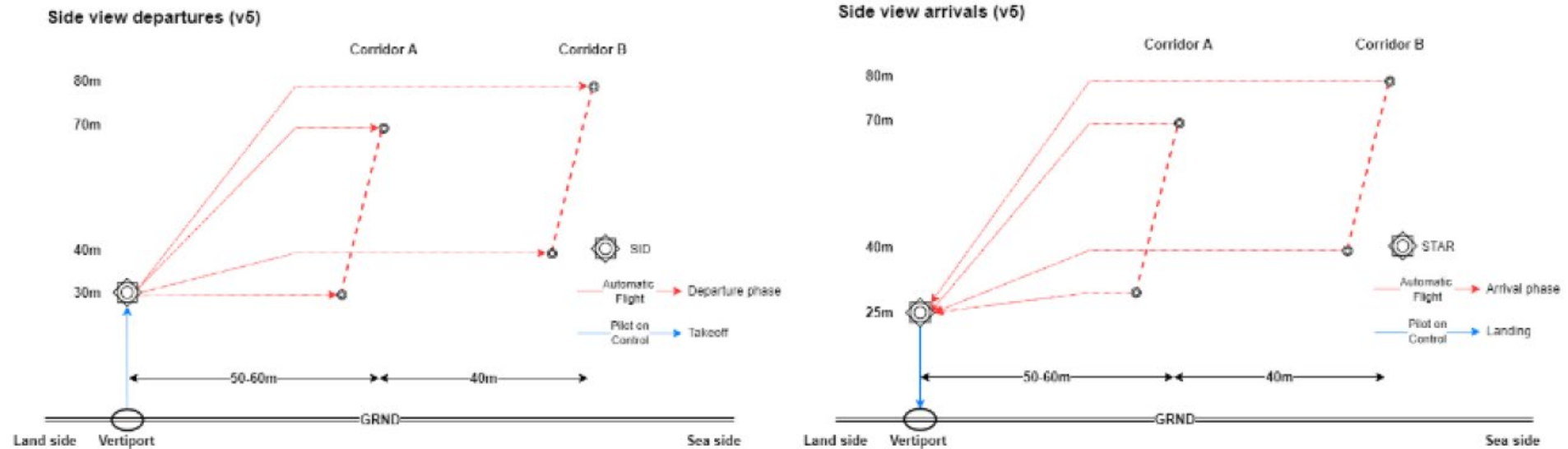
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CORUS-XUAM: Spanish Exercise Results – Airspace Structure

The corridor-based architecture has the advantage that can be incremental to respond to higher demand.

- To **increase the capacity of the airspace** it is possible to add **new vertical levels to the corridors**.
- With this approach, CORUS-XUAM Spanish exercise accommodated four Drone Operators in an area of 0,8 Km² and up to a density of **20 flights/ Km² / hour**.



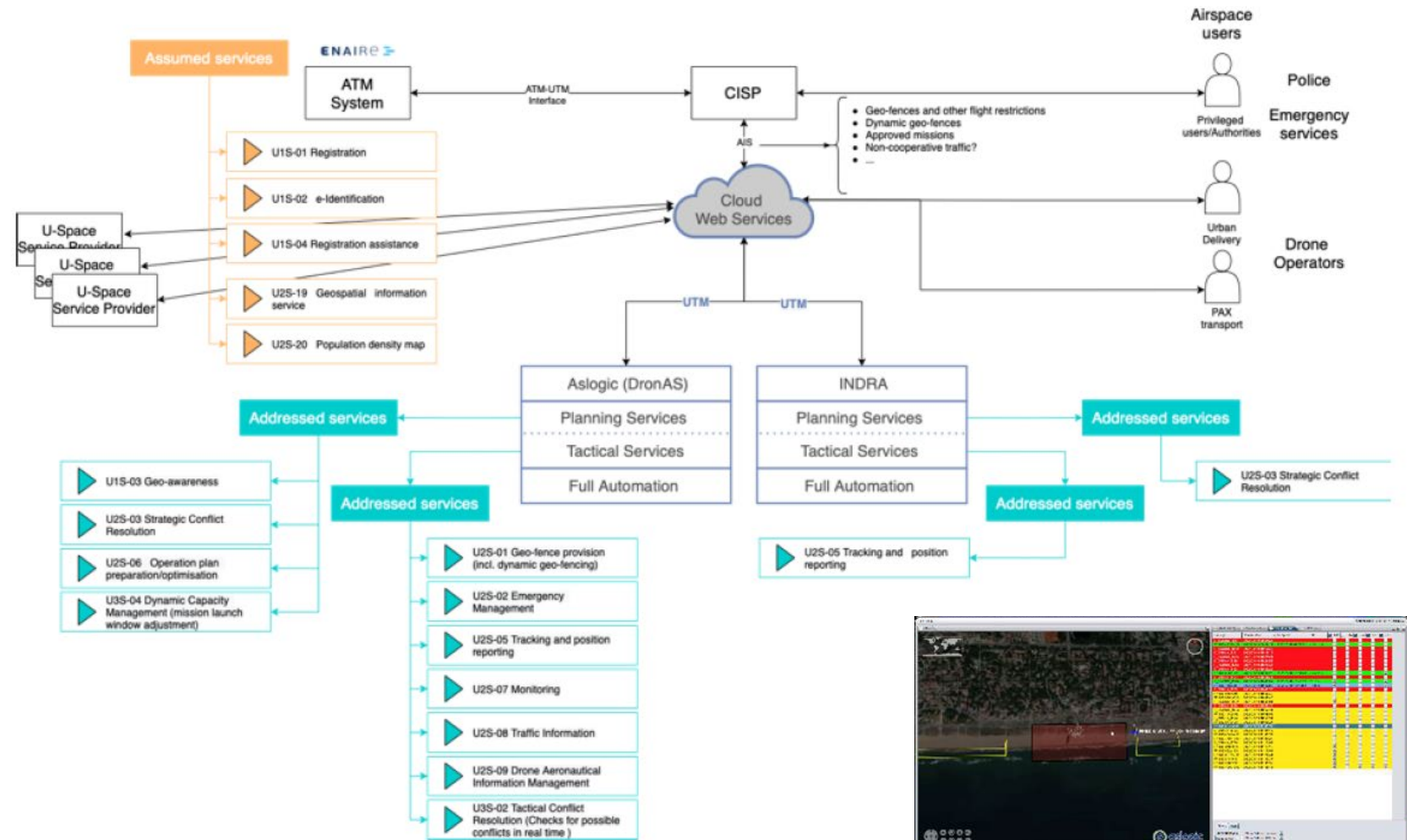
The **safety of simultaneous operations** is supported by the use of a block of altitudes reserved at the upper layer to enable safe RTL operations. A narrow altitude block can extend over all practicable corridor levels (separated 10 m from the nominal corridors) and be structured in a way in which each one of the operators has a unique altitude assigned (e.g. 90m – 93m – 97m – 100m).



CORUS-XUAM: Spanish Exercise Results – Distributed U-space Architecture

Interoperability and business-oriented U-space ecosystem have been granted by the deployed distributed architecture:

- CISP and both USSPs were able to reach **common situational awareness** exchanging information on FPs, tracking, alarms and geofencing;
- FPs requested by DOs were sent to corresponding USSP which retrieved global picture from CISP. If no strategic conflict, then FP was notified approved to both DO and CISP.



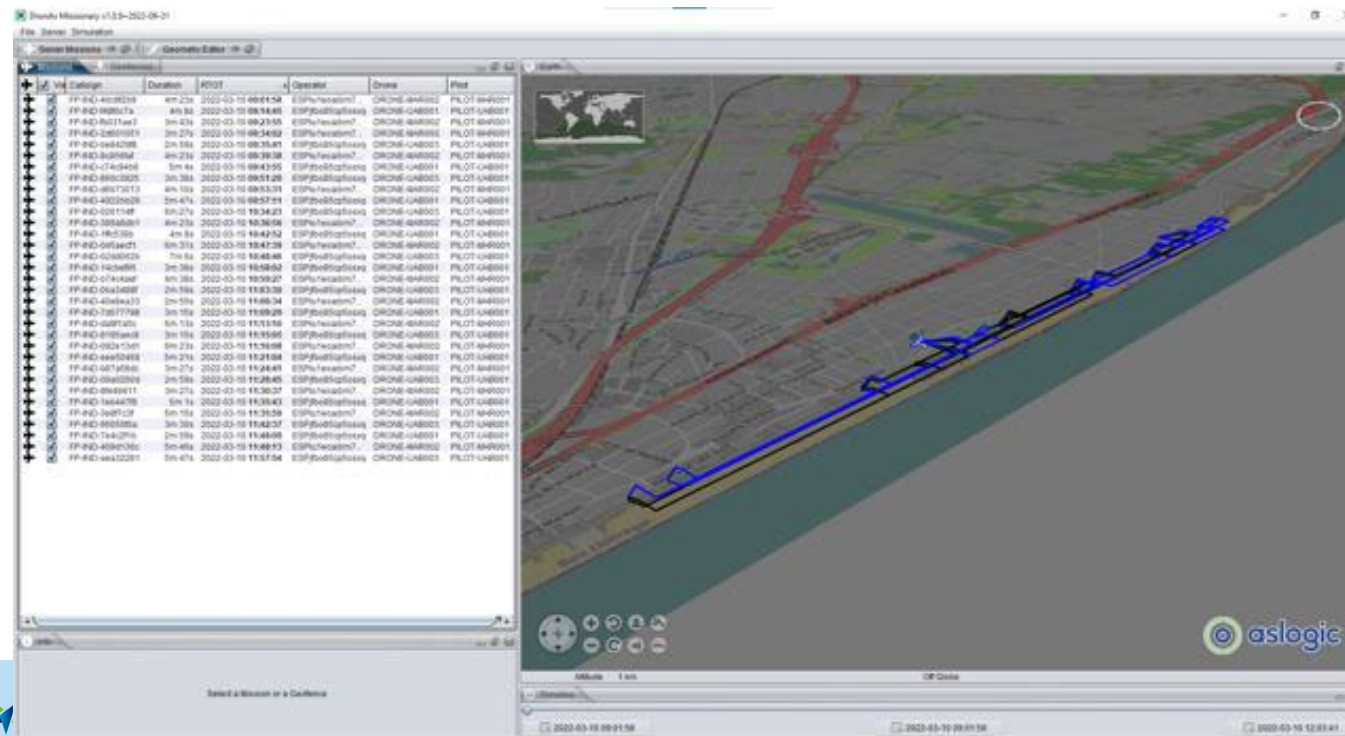
- **Registered authority (local police flying in the area)** was connected directly to CISP and able to directly create a geo-fence distributed on time to USSPs, each one



CORUS-XUAM: Spanish Exercise Results – Strategic De-confliction in Distributed U-space Architecture

The successful **deconflicting algorithm** has worked by searching for each flight for a *2-minute take-off window* embedded in a window of 15 minutes for take-off as part of the submitted flight plan.

- The 2-minutes envelope has been proven feasible for up to 4 simultaneous flight approval requests in an area of 0,8 Km² and successful in providing a safety envelop to the drones that **mitigates the impact of a long-track deviations**.
- The flights have been approved following FCFS rule, which has also been judged adequate for DOs interests.



CORUS-XUAM: Spanish Exercise Results – Strategic De-confliction in Distributed U-space Architecture

The use of new concepts for flight management has resulted in high **efficiency** and **acceptability**, being those:

- Requested Launch Window (RLW),
- Confirmation Due Time and
- Accepted Launch Window (ALW). The ALW **preserves the 4DT trajectory defined by the DO**, adding a **temporal envelop** to each of the trajectory points and transforming them in 4DT volumes.

- ALW is calculated to ensure no intersection between any of these 4DT volumes with other FPs will exist at any moment.
- This departure coordination mechanism is **not modifying** neither the trajectory geometry nor the flight duration.
- The ALW is contained in the RLW, respecting DO mission objectives. The Confirmation Due Time provides to the DO in all moments a deadline for receiving the approval of the requested FP.



CORUS-XUAM: Spanish Exercise Results – Operation Support Platform

DOs' platforms have been prototyped in the form of a **common Operation Support Platform (OSP)** that acts as link **between DOs and U-space system** and gateway to their corresponding USSPs. The OSP has focussed on management of the flight plans within the USSP approval process and tracking of the drone operations, and has acted as compiler and distributor of information exploiting 4G network and capabilities.

The **functionalities of the OSP have been validated** both in terms of **operational acceptability** by DOs and of **performance** (information transmitted timely and integral between involved parts allowing safe and efficient execution of flights).

Benefits:

- **Timely and integral flow of information** to both USSPs and DOs;
- **Harmonized information content and format;**
- **Common interface for DOs** that saves costs thanks to the availability of a plug-and-play solution compatible with available USSPs (business open).



Information:

- Flow of telemetry;
- Status and quality of the GNSS solution;
- Status of the command-and-control link;
- Autopilot status information;
- Mobile network performance;
- Communication latency measures;
- Quantification of the amounts of data sent;
- Status of the flight plan.

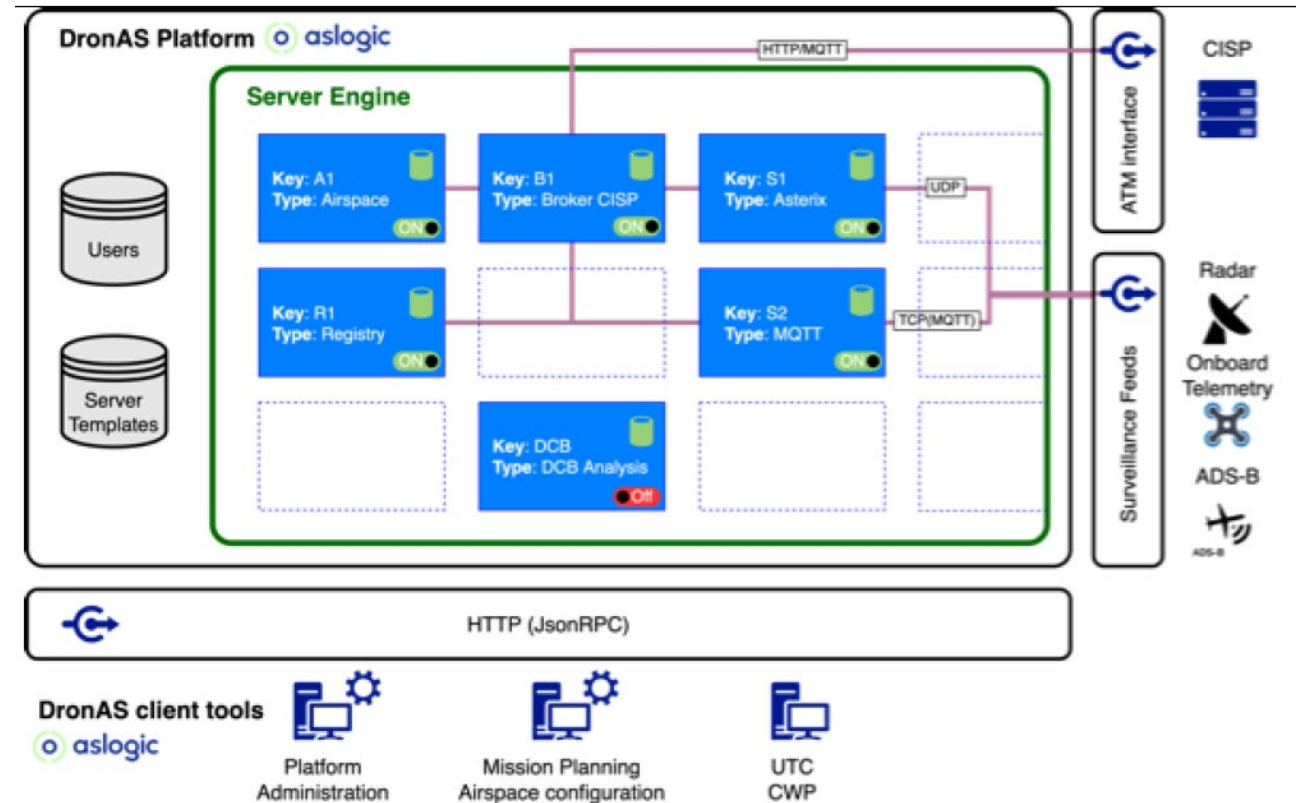
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CORUS-XUAM: Spanish Exercise Results – Secure surveillance for safe tactical management

Spanish exercise has found a way of allocating tracking and monitoring services provision to the USSPs (instead of centralising them in the CISP) in a safe and efficient way:

- The vehicles participating in the exercise have provided tracking information to their corresponding USSP provider by sending a stream of messages through **dedicated USSP communication brokers, one for each operator.**
- Access to the brokers has been protected and restricted to the participating operators, allowing a **secure ecosystem** where only previously certified DOs can send information.



- Flight tracking data was exchanged in real time 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).



<https://corus-xuam.eu>

CORUS-X-INFO@LISTS.EUROCONTROL.INT



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