U-space

Delivering drone solutions for smart and sustainable air mobility

U-space research and innovation portfolio

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U-space in a nutshell

U-space is a set of services and specific procedures designed to support safe, efficient and secure access to airspace for large numbers of drones. These services rely on a high level of digitalisation and automation of functions, whether they are on board the drone itself, or are part of the ground-based environment. U-space allows this market to grow by helping to establish technologies, rules and procedures that will eventually enable drones to safely share the airspace with manned aviation.

By 2035, the value of the drone market is estimated to exceed EUR10 billion annually, rising to over EUR15 billion annually by 2050[1].

Benefits

DRONE USERS/OPERATORS:
- Offer fair, flexible & open access to the airspace
- Open up drone services market

CITIZENS:
- Offer new & innovative services
- Ensure safe & secure drone operations
- Safeguard privacy & ensure environmental protection (noise & visual pollution)

REGULATORY AUTHORITIES:
- Maintain control over airspace
- Ensure privacy, safety, security & environmental protection
- Enforce registration & identification of drones
- Protect safety & security critical areas

BUSINESSES:
- Enabling the development of new business models
- Spurring jobs & market growth
- Support move towards automation & digitalisation

[1] European Drones Outlook Study
https://www.sesarju.eu/sites/default/files/documents/reports/European_Drones_Outlook_Study_2016.pdf

The innovation story so far

The SESAR Joint Undertaking (SESAR JU) completed a first wave of 19 projects in 2019([2]),which demonstrated U-space services from U1 to U3 in a variety of environments, and concluded that U1 and U2 services were essentially ready for use in rural areas, segregated airspace and low density airspace. In 2020, a second wave of industrial and exploratory research projects and very large-scale demonstrations got underway to extend the scope of U-space to address more advanced services, including addressing the requirements for urban air mobility (UAM). These will support exciting new opportunities, such as medical services, goods delivery, air taxis and emergency response to demonstrate a host of new capabilities including avoiding no-go areas, giving way to other airspace users and cross border operations. All projects work closely with regulatory and standardisation bodies. *See page 5 for details of the current research and innovation portfolio.*

Deployment

The deployment of U-space is taking place progressively based on increasing availability of blocks of services and enabling technologies.

As with manned aviation, drone operators and U-space service providers will need to comply with regulations set by the European Union Aviation Safety Agency (EASA). This regulatory framework and the first U-space regulations, adopted by the European Commission in 2021, come into force in January 2023.

Smart and sustainable future

The U-space sector is developing rapidly with new innovative ways of using drones emerging at a fast pace. The European Commission has announced plans for a new Drone strategy 2.0 to be published in 2022. This will provide a forward-looking vision for the future holistic development of the sector while supporting the European Green Deal, Smart and Sustainable Mobility Strategy, Digital Strategy and other Union policies.

U1 Foundation services
- e-identification
- e-registration
- geo-awareness

U2 Initial services
- Flight planning and approval
- Tracking
- Traffic information

U3 Enhanced services
- Dynamic capacity management
- Tactical conflict resolution

U4 Full services
- Collaborative interface with ATC
- Additional new services

([2]) SESAR U-space projects results
https://www.sesarju.eu/sites/default/files/documents/u-space/U-space%20Drone%20Operations%20Europe.pdf

URBAN AIR
MOBILITY

COMMUNICATIONS
NAVIGATION AND
SURVEILLANCE

DYNAMIC
CAPACITY
MANAGEMENT

DEPLOYMENT

SECURITY

AIRPORT
ROTECTION

COMMON
ALTITUDE
REFERENCE

STANDARDISATION

SEPARATION
MANAGEMENT

PERFORMANCE
FRAMEWORK

INFORMATION
EXCHANGE

SAFETY

REGULATION

INTERFACE
WITH AIR
TRAFFIC
CONTROL

Research and innovation project portfolio

ASPRID
Airport system protection from intruding drones

ASPRID is investigating the vulnerability of airports to different types of threat from drones (careless or malicious) and possible responses. ASPRID identifies possible technologies, procedures and regulations that could help safeguard airports and/or recover from disruptions by means of a more integrated and coordinated approach.

Topics addressed: Airport protection

Web: https://www.asprid.eu

BUBBLES
Defining the basic building blocks for a U-space separation management service

BUBBLES is defining separation minima for operations in very low-level (VLL) airspace using standard methodologies like specific operations risk assessment (SORA) to assess the risks for unmanned systems. It is also developing algorithms to compute the collision probability between drones and manned aircraft, and investigating how artificial intelligence (AI) can help to dynamically manage separation minima.

Topics addressed: Separation management

Web: https://bubbles-project.eu/

DACUS
Demand and capacity optimisation in U-space

DACUS aims to develop a service-oriented demand and capacity balancing (DCB) process for drone traffic management. The project intends to integrate in a consistent DCB solution the relevant demand and capacity influence factors - such as the performance of communications, navigation and surveillance (CNS) services

– and define the airspace structure, the processes and the services necessary to support drone traffic management.

Topics addressed: Separation management; dynamic capacity management; U-space performance framework

Web: https://dacus-research.eu

ICARUS
Integrated common altitude reference system for U-space

ICARUS proposes a common altitude reference system for manned and unmanned aviation using multi-constellation navigation satellite systems. The project is developing and validating a new U-space service that will provide, during pre-flight and actual flight, real-time information of vertical distance to the ground to ensure collision avoidance; and will convert different altitude reference systems to ensure vertical separation of all traffic.

Topics addressed: Common altitude reference

Web: www.u-spaceicarus.eu

METROPOLIS 2
A unified approach to airspace design and separation management for U-space

METROPOLIS 2 is developing solutions to support high-capacity urban airspace, specifically advanced service requirements for strategic deconfliction, tactical deconfliction, and dynamic capacity management. By applying principles of geo-vectoring in combination with flight planning and detect-and-avoid tools, the project aims to define robust and efficient flight plans along with resolution strategies.

Topics addressed: Separation management

Web: https://metropolis2.eu/

USEPE
U-space separation in Europe

USEPE is researching drone separation methods in high demanding environments such as cities. It is defining the actors, the decisions and the technology that are needed during the strategic and tactical planning phases of flight. The research also covers machine learning algorithms to automate the safe separation and deconfliction of drones in different environments. The work will result in an urban space separation management system which will be validated using a series of typical urban scenarios.

Topics addressed: Separation management

Web: https://usepe.eu

Other projects addressing drones in a broader context include: FACT, INVIRCAT, SAFELAND and URCleared.

AURA
ATM U-space interface (PJ.34)

AURA aims to identify the requirements for U-space information exchange with airspace management and define the system wide information management (SWIM) candidate services necessary for new entrants to be compatible with the current airspace management environment. It will then define a concept of operations for drones in a fully collaborative environment and will provide input to regulatory and standardisation bodies.

Topics addressed: Interface with air traffic control; information exchange.

Web: www.sesarju.eu/projects/aura

CORUS-XUAM
Concept of operations for European U-space services – extension for urban air mobility

CORUS-XUAM is extending the initial concept of operations (ConOps) developed in the first wave to include urban air mobility and, in doing so, is incorporating UAM concepts being developed in the other UAM-related demonstrations. It looks at the rules that govern how airspace users fly, the role of automation and the performance of communications, navigation and surveillance technologies. Some urban air mobility operations – like air taxis - will operate like manned aviation, while others – such as deliveries – will rely on U-space services. This project considers services included in the more advanced U3/U4 phases of U-space.

Web: https://corus-xuam.eu

AMU-LED:
Air mobility urban large experimental demonstrations

AMU-LED is testing urban operations using several types of unmanned vehicles with a view to identifying U-space services needed and equipment requirements on board the drone platform in order to operate safely above populated areas. The scope includes coordination with other airspace users and with air traffic control, as well as the impact of tall buildings in complex urban environments on airstreams and navigation and communication signals. It will deliver a detailed concept of operations for urban air missions.

Topics addressed: Interface with air traffic control; Urban air mobility; separation management; U-space regulation; CNS; standardisation; safety assessment.

Web: https://amuledproject.eu/

GOF2.0

Gulf of Finland 2.0 – Integrated urban airspace very large demonstration

GOF2.0 is validating the architecture for highly automated real-time separation assurance in dense airspace including precision weather and telecom networks for air ground communication. The aim is to demonstrate safe, secure and sustainable integration of UAS and taxi operations without disrupting current airspace operations.

Topics addressed: Urban air mobility; U-space regulation.

Web: https://gof2.eu

SAFIR-MED

Safe and flexible integration of advanced U-space services for medical air mobility

SAFIR-MED is conducting beyond visual line of sight (BVLOS) drone operations in real urban environments using a range of different platforms. Use cases include transporting medical supplies between hospitals and healthcare centres to demonstrate and improve operational procedures and mechanisms for effective interface with air traffic control.

Topics addressed: Transport from/to predefined locations; urgent transport from hospitals to unknown location; transport from/to different U-space areas; Urban air mobility.

Web: https://www.safir-med.eu

TINDAIR

Tactical instrumental deconfliction and inflight resolution

TINDAIR is demonstrating the requirements for tactical conflict resolution and emergency landing strategic deconfliction, as well as detect-and-avoid services to enable unmanned vehicles to operate in highly complex airspace. The aim is to deliver strategic and innovative technologies that can drive competitiveness and UAM growth using an impact-oriented approach and demonstrate the safe integration of UAM aircraft as additional airspace users.

Topics addressed: Dynamic capacity management; Urban air mobility

Web: https://tindair.eu

USPACE4UAM

USPACE4UAM is demonstrating the criterial enablers needed for urban air mobility to take off. This includes high levels of automation, connectivity and digitalisation for both the drone and U-space system. It is also looking at safety cases and their impact on system requirements, and at how regulation and standardisation can be set up to support a multi-modal transport network.

Topics addressed: Urban air mobility

Web: https://www.sesarju.eu/projects/Uspace4UAM

U-space

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