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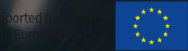
Fakulteta za logistiko



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# "U-space" : DIGITAL TWIN-BASED UNMANNED AIR TRAFFIC MANAGEMENT FOR EMERGENCY RESPONSE



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- **Recently, we have witnessed significant development and increasing use of drones (Unmanned Aerial Vehicles or UAVs) in many areas.**
- **Challenges are not necessarily technical and are not caused by the technology of the components involved (Gonzalez-Ra, et al., 2020).**
- **The most important for us are the problems arising from the use of UAVs in logistics distribution tasks, especially in the so-called "last mile" delivery.**





# THE MAIN OBSTACLES

## SPECTRUM OF COMMUNICATION

One way to alleviate this burden is to use existing commercial wireless infrastructure and spectrum to provide command connections for most BVLOS (**Beyond Visual Line of Sight**) low-altitude missions.

## A PATCHWORK OF STATE AND LOCAL REGULATION

The inconsistency of different local regulations with each other and with state ones can lead to unmanageable chaos

## ROGUE AND IRRESPONSIBLE OPERATORS

A large number of commercial flights currently operated are operated without a certified operator. Even worse, it is on the side of recreational UAV users.

## LACK OF RESOURCES OF STATE AGENCIES, INCONSISTENT PROCEDURES, BACKLOGS

The relatively low cost of entry and operation means that the use of UAVs will soon far exceed air operations with crew. The use of this technology will continue to grow and develop, while the relevant state agencies will continue to step on the ground, unless radical changes take place soon.





# **THE NEED FOR UAV TRAFFIC MANAGEMENT**

- **The need for some sort of UAV flight control and management system was clearly expressed.**
- **It becomes clear that we cannot solve problems without focusing on all five exposed barriers at once.**
- **In order to make use of UAVs for commercial purposes truly possible.**





## **“LAST MILE” PACKAGE DELIVERY REQUIREMENTS**

- **Pre-arranged flight routes are needed, but they can be constantly changing, depending on the reality in which we find ourselves at a given moment.**
- **Flying out of the operator’s field of vision (BVLOS-Beyond Visual Line of Sight).**
- **PIC (Pilot in Command). Dealing with only one customer per flight is not acceptable.**
- **From this point on it is clear that some kind of automatization is needed.**



# **EU ANSWER TO THIS CHALLENGES / U-SPACE**

- **The idea of U-space is designed to be able to ensure the smooth operation of drones in all possible operating environments.**
- **The needs of individual missions can vary greatly. For example, filming a sporting event is not comparable to regular safety overflights.**
- **In the first case, a trained operator and an excellent director are needed, but there is no need for any pre-determined routes or automatic guidance.**
- **In the second case, there is already a need for a pre-prepared flight route, which is repeated cyclically, but is still static.**



# U-SPACE

- U-space is a set of specific services and procedures designed to ensure safe and efficient access to airspace for a large number of drones.



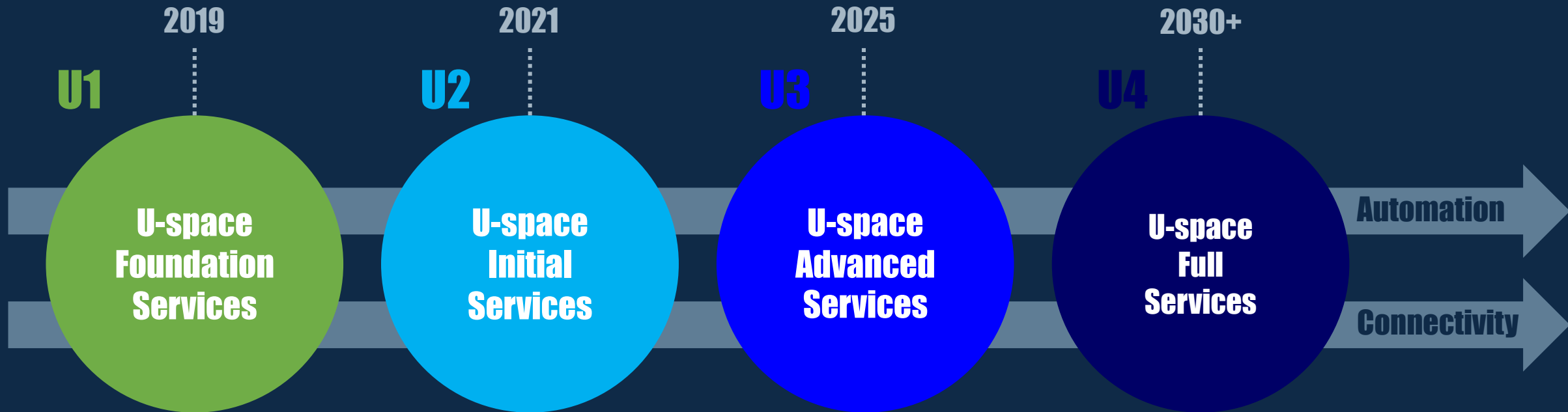


# U-SPACE SERVICES

Phase	Service
U1 Foundation Services	U1.1 e-Registration
	U1.2 e-Identification
	U1.3 Pre-tactical Geo-fencing
U2 Initial Services	U2.1 Tactical Geo-fencing
	U2.2 Flight Planning Management
	U2.3 Weather Information
	U2.4 Tracking
	U2.5 Monitoring
	U2.6 Drone Aeronautical Information Management
	U2.7 Procedural Interface with ATC
	U2.8 Emergency Management
	U2.9 Strategic De-confliction
U3 Advanced Services	U3.1 Dynamic Geo-fencing
	U3.2 Collaborative Interface with ATC
	U3.3 Tactical De-confliction
	U3.4 Dynamic Capacity Management
U4 Full Services	- TBD



# U-SPACE PHASES



# OUR UATM

## URBAN AIR TRAFFIC MANAGEMENT



- **UAV and operator registration**
- **flight submission**
- **flight analysis**
- **flight confirmation**
- **flight execution (???)**
- **monitoring and recording flight parameters,**
- **flight changes**
- **end of the flight.**

