Unnamed Traffic Management (UTM)

Air space management is crucial to embrace all the benefits of drones for public safety. This document explores UAV use cases, focusing on the considerations for UTM.

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FOREWORD

When talking about UAV technology, we tend to focus on the aircraft itself and its capabilities. However, a great deal of innovation is also happening in air space management, data processing and how UAVs can be fully integrated within the current airspace. This specific point is crucial to embrace even more the benefits that this technology can offer to Public Safety. This will allow the automation of processes saving human resources, and also the operation of UAVs in ways that previously couldn't be possible.

This document aims to be a discussion starter. It aims to shine light on how this field of U-Space could change the perception of drones in public safety. It also helps to encourage both technology developers and lawmakers to consider how U-Space could be used by such relevant users as first responders.

The insights in this document have been gathered by a series of interviews and sessions where first responders, aeronautics and air traffic experts were included, carried out as part of an EENA project. We would like to thank all of them for their support and contributions in deepening the conversations of how Public Safety can benefit from U-Space and UAVs even further.

GLOSSARY

ACO: Airport Operations

BVLOS: Beyond Visual Line of Sight

EMS: Emergency Medical Services

EASA: European Union Aviation Safety Agency

FAA: Federal Aviation Administration

FRS: Fire & Rescue Services

ICAO: International Civil Aviation Organization

NOTAM: Notice to Airmen

PSAP: Public Safety Answering Point

SAR: Search & Rescue

TSA: Temporary Segregated Area

UAV: Unmanned Aerial Vehicle

UTM: Unmanned Traffic Management

U-SPACE: In Europe, the term U-space has been introduced to refer to the future implementation of UTM in the European airspace.

USSP: U-space Service Provider

VTOL: Vertical Take-off and Landing

VLOS: Visual Line of Sight

1 l INTRODUCTION: U-SPACE, ORIGINS & STATE-OF-THE-ART

The expected increase in the use of unmanned aircraft for civil operations will have an unprecedented impact on current airspace management technologies. The development of specific solutions addressing the technological, regulatory and business challenges is required to ensure the safe and efficient integration of civil drone operations, allowing for a seamless integration with other airspace users in a safe and highly automated manner. Unmanned Traffic Management (UTM) concepts and technologies are being defined to coordinate safe and efficient multiple drone operations and their integration in all types of airspace, including those dominated by commercial manned aviation.

UTM nomenclature was initially adopted by NASA and later used by ICAO (International Civil Aviation Organization) to refer in a generic way to unmanned air vehicles traffic management solutions. It comprises all the items required for a safe integration of unmanned vehicles in the airspace, including coordinating with standard air traffic. UTM implementation will require the development, amongst others, of new:

- Operational concepts
- Communication, navigation and surveillance systems
- Automated procedures
- Standards and regulations

Whilst the Federal Aviation Administration (FAA) has also adopted the term UTM to refer to the future implementation of this concept, adapted to USA airspace needs, in Europe the term U-space has been introduced to refer to the future implementation of UTM in the European airspace.

The UTM concept started its development in 2016 through several national, regional and global initiatives with the aim of creating an operational and regulatory framework for the safe, efficient and interoperable integration of drones in the airspace. Key initiatives include the UTM initiative from the FAA, the U-space initiative within the SESAR joint undertaking in Europe and global initiatives supported by ICAO like Drone Enable. Although the focus in the early years (2016-2018) was on small drones operations at low altitude in uncontrolled airspace, the aspiration of UTM is to guarantee simultaneous operations of unmanned and manned aircraft of any Maximum Take-Off Weight (MTOW) in any airspace.

To do so, UTM will include the technologies required to guarantee vehicle separation with other airspace users, being key for enabling scalable drone operations, including Beyond Visual Line of Sight (BVLOS) operations and autonomous operations in dense traffic environments.

The SESAR U-space blueprint published in 2017 settled the ground for discussions about U-space implementation in Europe, by defining an evolutionary approach for the deployment of services based on 4 temporal scenarios:

- U1 (2019+): U-space foundation services, including e-registration, e-identification and geofencing.
- U2 (2022+): U-space initial services, including services such as flight planning, flight approval, tracking, and the interface with conventional air traffic control.

- U3 (2027+): U-space advanced services supporting more complex operations in dense areas, such as traffic prediction and capacity management as well as assistance for conflict detection and resolution (automated detect and avoid functionalities).
- U4 (2035+): U-space full services still to be defined, which will enable seamless automatic integration with manned aviation and will provide support for high levels of autonomy and connectivity.

However, the increased demand for standard solutions and regulations has led the European Union Aviation Safety Agency (EASA) to publish their opinion 01/2020 setting the ground for the initial provision of U-space services in Member States. When enacted (expected to be implemented during 2021), this regulation will define the application of U-space for manned/unmanned aircraft operators and for U-space service providers (USSPs). Key items in current regulation include:

- Member States are responsible for defining U-space volumes in controlled/uncontrolled airspace on a temporary or permanent basis.
- In controlled airspace, the air navigation service providers remain responsible for manned aircraft operators' dynamic reconfiguration to ensure segregation. USSP is responsible for providing services for unmanned aircraft operators.
- In uncontrolled airspace, the air navigation service is responsible for providing the flight information service to manned aircraft operators. USSP is responsible for supporting the safe & efficient movement of aircraft.
- The following services are considered mandatory in U-space designated areas: Network identification, Geo-awareness, Flight authorisation, Traffic information, Tracking, Weather information & Conformance monitoring.

Finally, it is expected that unmanned operations supporting emergency services will be considered as "special operations" by EASA and therefore will be given priority over other airspace users. As anticipated by CORUS, the U-space ConOps developed by the SESAR Joint Undertaking, the rules of the air for U-space will be designed to give right of way to emergency operations. In addition, digital U-space services will provide operational support to implement those rules, for example by means of dynamic airspace reconfiguration or the definition and dissemination of dynamic airspace constraints. Thus, emergency operations traversing U-space will be given right of way in a safe manner. In addition, the technologies developed in the context of UTM/U-space and the future operational U-space services could support the safe operation of complex emergency bodies, especially in the areas of fleet management, coordination in dense operational scenarios and safe integration with other airspace users.

2 I EXAMPLES OF USE CASES IN PUBLIC SAFETY

U-Space brings a new scene for Emergency Services to use unmanned aircrafts. The technological and operational capabilities, together with the ongoing new regulations, are offering new scenarios where drones could support first responders. This opens a new dimension from which UAVs could prove even more valuable to Public Safety agencies, making their implementation even more justified.

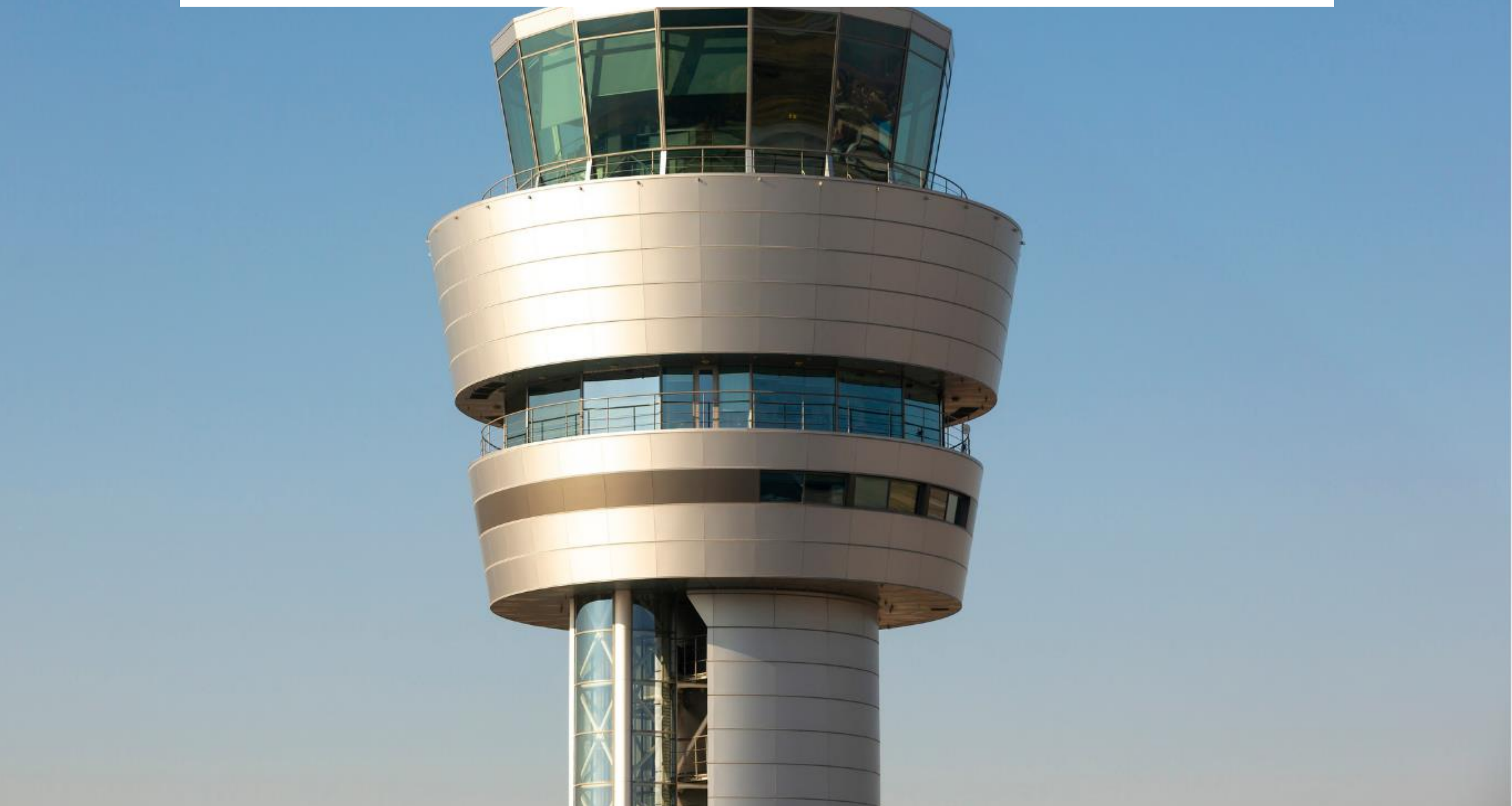
What can be considered a U-Space use case?

Following the general industry criteria, the use cases considered include at least one of the following aspects:

A. Weight larger than 25Kg
B. Flights over people (e.g. uninvolved people in the mission or masses of people)
C. Urban areas
D. Fly together with other aircrafts & near airports
E. BVLOS
F. Carrying hazardous cargo/people

In addition to this, the following use cases would be operated by or for one of the following organisations:

- Fire & Rescue Services (FRS)
- Search & Rescue organisations (SAR)
- Emergency Medical Services (EMS)
- Public Safety Answering Points (PSAPs) & Civil Protection
- Law Enforcement
- Military operating for public safety (e.g. response to wildfire)



USE CASE 1: Maritime Search & Rescue operation

SAR mission on the sea below civilian air traffic corridor. Multiple air assets are involved:

- *Large fixed wing UAV:* streaming images to control room and possibly to ground teams, supporting them with situation awareness to locate victims. Aircraft would be flying BVLOS. Could be operated from the control room itself or autonomously (executing a pattern to cover the search area). Fixed wings would take off and land from a remote base like an airfield.

- *Multicopter UAV flying VLOS:* operated from boats or the shore for equipment transportation.

- *SAR manned helicopte*r for rescue and survivor winching: taking off from the SAR base, supporting the search task over the sea and in charge of evacuating the victim.

This operation would be done under an air traffic corridor, where commercial airliners would operate.

This type of operation could be also cross-border, where teams and airspace from 2 or more countries are involved.

This sort of capability is beneficial due to the following:

- Situation awareness to coordinate air assets for a more efficient SAR operation;
- Ensure faster response & the best help possible to victims;
- Avoid the impact of cancelling flight operations of ordinary civilian air traffic.

USE CASE 2: Wildfire response

Wildfire response is a complex environment combining many types of air assets and airspaces.

Regarding the aircraft present:

- *Fixed wing UAV:* used to stream images to control rooms and incident command to have an overview of the situation and its evolution. Operated in BVLOS from a control room, and taking off & landing from its airfield base.

- *Small multicopter UAV:* operated VLOS by a field crew. Used for images for situation awareness of a specific zone of the incident.

- *Manned fixed-wing water bombers:* in charge of dropping water or fire retardant. Would do several flights to recharge (in base or in a water source) and to the front-line to drop its payload.

- *Manned helicopter*: in charge of dropping water. Would do several flights to recharge (in base or in a water source) and to the front-line to drop its payload.

- *Manned helicopter:* in charge of carrying crews to a certain area of the wildfire or to carry equipment.

- *Large UAV fixed wing:* in charge of dropping water or fire retardant. Operated in BVLOS from a control room. Would do several flights to recharge (in base or in a water source) and to the front-line to drop its payload.

- *Small UAV (fix wing or multicopter)*: to map the outcome of a wildfire affected area. Flying in VLOS by field crew or BVLOS from a control room. Would do several grid flights to capture the inputs needed.

This scenario can become more complex when happening near or across borders, in military areas or near airports.

USE CASE 3: Road traffic collision reconstruction

In car accidents, law enforcement need to gather evidence of what happened for investigation into the incident. Measurements, the presence of debris, the position of cars etc. are all captured. These teams must gather data precisely but also need to be quick to re-open the road. Road restrictions bring several risks, like potential 2nd or 3rd collisions by other cars or even injuries of police officers by cars passing by.

The usage of drones allows a faster and safer data recovery. This could be done in densely populated environments or on highways, over crowds and over moving and stopped vehicles.

Two possible cases:

a) UAV operated by a field team. Set in automatic flight to execute a certain flight pattern, or operated manually by a field officer.

b) UAV deployed from a control room, operated in BVLOS to the incident site. After getting a 112 call concerning a road traffic collision, the first responding unit will be a drone operated from the 112 call centre's drone remote operation room. The route to the collision scene is an automated mission. When reaching the scene, the drone will provide some overview of the situation and if needed will gather all the necessary data for accident scene reconstruction. After the mission is completed, it will return to its home base in an automated way. During the mission, the operator can take over the mission manually from the drone operation room.

An automated car collision evidence gathering operation would allow:

- Faster data retrieval and road clearing;
- Less risk for officers;

- In the autonomous case, freeing resources from an already stretched police department which may not have many police officers to operate this sort of service.

USE CASE 4: Incident response in densely populated areas

Emergency response in cities where drones & UTM are relevant can take several forms:

Fire response:

Structural fires or industrial fires (with the presence of hazardous materials). In these cases, several appliances are deployed and the incident is managed by an incident commander or team.

Air support could come in the following forms:

- *Small fixed wing UAV:* deployed when the incident call is received in the controlled room. Autonomously flies to the incident area to give direct situational awareness to the PSAP staff about what is happening. This will help them to better locate the incident area and to better estimate which appliances to send. This UAV can also send visual input to crews on the way to the scene so that they know what they will find, and it can stay during the incident to give real-time situational awareness to the control room and to incident command.

- *Small multicopter:* operated by field crew in VLOS. Used to gather images, videos and other types of real-time data (e.g. hazmat detection) to support the incident commander's situational awareness. Also to be used in triage activities (sending video, using speakers for oral triage).

- *Medium multicopter attached to a water hose:* supporting fire extinguishing tasks. Flying autonomously from a fire truck.

- *Large multicopter for delivery of equipment:* from the base to the incident. UAV operated autonomously, flight operators from the control room could take over control if needed.

Law enforcement:

To support large police operations like firearms incidents or mass casualties incidents. In this case, decision-making and coordination is often done from a remote post (e.g. control room).

Air support could come in the following forms:

- *Small fixed wing UAV:* deployed when the incident call is received in the control room. Autonomously flies to the incident area to give direct situational awareness to the PSAP staff on what is happening. This will help them to better locate the incident area and to better estimate who to send. This UAV can also send visual input to teams on the way to the incident to know what they will find, and can stay during the incident to give real-time situational awareness to the control room and to incident command. Could also serve to follow suspects.

- *Small multicopter:* operated by field crew in VLOS. Used to gather images, videos of specific zones of the incident.

- *Manned helicopter*: sending aerial visuals to commanders and also supporting ground operations.

USE CASE 5: Medical logistics

Similar use to Helicopters for Emergency Medical Services. A large UAV could be used to transport people in different situations:

- Patient evacuation: a large UAV multicopter is sent to an incident site where a patient is waiting to be transported to a hospital. The UAV would fly autonomously from its base to the incident evacuation site, where ground emergency services would board the patient. The UAV would then fly to the hospital and land on the helipad where hospital staff would take over the patient. The whole operation would be done autonomously.

- Doctor delivery: a large UAV multicopter would fly from a base to the hospital, where it would land on the helipad. A doctor would board the UAV, and the UAV would fly to the incident site where the doctor is needed. The UAV would fly back to its base and the doctor would return in an ambulance when the incident is over. All the flight would be done autonomously.

USE CASE 6: Surveillance

Law enforcement agencies could use aerial support from UAVs in urban environments to execute surveillance tasks. Small multicopter or fixed wing UAVs could be operated autonomously to send visual information to control room staff or field officers.

Some examples of this could apply to:

- Large events: like concerts, sports events or demonstrations. UAV input would help law enforcement to detect potential risks and to have better situational awareness in case of an incident.

- Infrastructure: surveillance of critical buildings like government buildings.

- Specific areas: patrolling and surveillance of areas to enforce certain norms (e.g. confinement during pandemic) or urban areas that require extra surveillance support from the air.

USE CASE 7: Mountain rescue SAR

SAR missions on land in and out of the civilian air traffic corridor. Multiple air assets are involved:

Multicopters UAV flying BVLOS: operated from land or a command & control van. Live streaming images to the 112 control room and to ground teams, supporting them with situational awareness to locate missing persons.

- All UAVs would be flying BVLOS.
- 4-10 UAVs flying at the same time in coordinate search.
- TSA (temporary segregated area) reaches 1500m above ground level, so all commercial air traffic is rerouted if needed.
- Notice to Airmen (NOTAM) is issued and navigation warnings are in place.

*SAR manned helicopte*r for rescue and survivor winching: taking off from the SAR base, supporting the search task over the search area and flying in coordination with SAR and ACO, which are all on site together in the same airspace as the UAV.

- All pilots need to be certified pilots with at least 100 hours of flight experience.
- All UAVs need to have a valid periodic maintenance check mark.
- All flights need to be recorded and marked in the log.
- All UAVs need to have valid insurance.

In this case, we use properly marked UAVs (beacon, orientation LEDs that need to be visible from above and below). All UAVs must have Automatic Dependent Surveillance Broadcast (ADS-B) and all manned aircraft entering the search area need to have a transponder on-line.

- All pilots are in loop via Airport Operations (ACO) and all UAV are segregated by height and lateral distance.
- Air Traffic control is constantly informed by special tools that allow them to follow all UAVs on ground with precise height and position in real time.
- ACO constantly communicates with manned aircraft entering the zone and keeping the area in order.

In the SAR area, a drone detection system is deployed to double check all existing participant UAVs and also to be on watch for any illegal drones that may enter the area.

This case can also happen near airport traffic. In this case:

- Close coordination with air traffic control. The best way is for ACO to go to the Control Tower (TWR) of the airport.
- Depending on the situation, UAV may fly in between gaps of inbound traffic or the airport may be closed for some time.
- Deployment of drone detection system for greater security.
- Usage of as many drones as necessary to get the job done in the shortest time possible.
- All pilots need to be certified pilots with at least 150 hours of flight experience.

- All UAVs need to be have a valid periodic maintenance check mark.
- All pilots need to have a license to speak on aircraft frequencies.
- All flights need to be recorded and marked in a log.

USE CASE 8: Emergency delivery of medical supply

In this case, the ground team is by the victim and transport takes a long time due to heavy snow, the distance, water condition, etc.

During transport, it is important to give victims constant doses of oxygen and the team is unable to carry enough supply to last them for 15+ hours of transportation to urban areas.

A Vertical Take-off and Landing (VTOL) UAV will take off from the base or medical facility carrying a tank of oxygen. The UAV flies to the location of the team and when it arrives, it switches to hover mode and, via the deployment system, gives them a fresh tank of oxygen and takes the empty one. It can also bring any specific equipment when the need arises, for example: saws, bandages, blankets, a spare tire for the transportation carriage, etc.

Aircrafts involved:

- *VTOL flying BVLOS:* operated from land or a command & control van. Live streaming images to the 112 control room and to ground teams, supporting them with situational awareness and precise navigation. One hybrid VTOL that will carry supplies to ground team already on site.

- *Temporary Segregated Area* (TSA) is communicated to air traffic control, which shares it with the whole corridor of operation. NOTAM is issued and navigation warnings are in place.

- All pilots need to be certified pilots with at least 100 hours of flight experience.

- All UAVs need to be have a valid periodic maintenance check mark.

- All flights need to be recorded and marked in a log.

- All UAVs need to have valid insurance.

USE CASE 9: Border patrol

In this case, VTOL is used in a 12+ hour patrol mission on the border. It flies at about 2000m above ground level so it is constantly in an air controlled area. In this case, the border patrol service has the exclusive authority to use UAVs due to the TSA structure.

- *VTOL flying BVLOS:* operated from land or a command & control van. Live streaming images to the border patrol service control room and to ground duty officers. One hybrid VTOL that will carry a thermal camera with optical zoom, high resolution camera with at least 120x optical zoom, and a specially designed directional megaphone.
- All pilots need to be certified pilots with at least 50 hours of flight experience.
- All UAVs need to be have a valid periodic maintenance check mark.
- All flights need to be recorded and marked in a log.
- All UAVs need to have valid insurance.
- No public NOTAM is issued, but navigation warnings are in place.
- The duty officer in charge of ACO duty is in constant loop with air traffic control in case an emergency medical flight needs to cross the area or SAR needs to be conducted in the controlled area.
- Operations will be conducted at least 12 + hours in loop.

ABOUT MISSION DURATION, PAYLOAD AND ADVERSE OR VERY DEMANDING FLIGHT CONDITIONS

Mission duration:

a) In Fire Response cases:

For fire incidents, 3 hours of flight would cover the large majority of the missions. In these cases, the first hour is the most critical one, since it's the moment when decisions are made and information must be accurate. The first hour would condition the whole response.

b) In Search & Rescue cases:

This kind of operation would require long distances of up to 100km. This would allow a remote pilot to operate from its base without having to be deployed in remote areas of the country.

If we are speaking about one specialised SAR BVLOS aircraft, it could take about 3.5 hours to reach the incident, SAR operations can last 10 hours, and 3.5 hours more to return to the base.

Payload:

Payloads can fall in 2 categories:

1. *Sensors:* devices to capture data. These can range from small cameras to larger devices like radiation sensors.
2. *Cargo:* items to be transported to a certain destination. These can range from a life jacket, an Automated External Defibrillator (1kg to 15kg), oxygen (1-5kg) or even people (e.g. a doctor).

Flight in adverse or very demanding conditions

Flight control in adverse or very demanding conditions (e.g. high wind speed, wind gusts, high ground effect, or wind turbulences) can be very challenging when using conventional multicopter architectures because they don't allow independent control of all the degrees of freedom of the aircraft. The current state of the art commercial multicopters can withstand constant wind speed up to 30-40kph, but with difficult flight control and reduced flight accuracy.

Many of the use cases presented in this document related to multicopter-based architectures could benefit from architectures (e.g. overactuated) that are more adequate to deal with adverse flight conditions. These architectures could enhance the flight controllability and safety of the multicopter in such challenging conditions, allowing the control of the six degrees of freedom of the main cabin independently. This may allow teams to perform missions which could otherwise be impossible.

Below is a list of the use cases that could benefit from this type of architecture and perform flight missions with severe windy conditions, or under flight conditions that require demanding or critical stability and accuracy targets (e.g. high ground effect or turbulent conditions).

USE CASE 1: Maritime Search & Rescue operation

- *Multicopter UAV flying VLOS:* operated from boats or the shore for equipment transportation.

USE CASE 2: Wildfire response

- *Small multicopter UAV:* operated VLOS by a field crew. Used for images for situational awareness of a specific zone of the incident.

USE CASE 3: Road traffic collision reconstruction.

USE CASE 4: Incident response in densely populated areas

- *Small multicopter:* operated by field crew in VLOS.
- *Medium multicopter attached to a water hose:* supporting fire extinguish tasks.
- *Large Multicopter for delivery of equipment:* from the base to the incident. UAV operated autonomously, flight operators from the control room could take over control if needed.
- *Small multicopter:* operated by field crew in VLOS. Used to gather images, videos of specific zones of the incident.

USE CASE 5: Medical Logistics:

- Patient evacuation in a large UAV multicopter.
- Doctor delivery in a large UAV multicopter.

USE CASE 6: Surveillance

USE CASE 7: Mountain rescue

- *Multicopters UAV flying BVLOS:* operated from land or a command & control van.

3 I U-SPACE CONSIDERATIONS TO COVER THOSE USE CASES

a) EASA opinion 01/2020 states that "special operations" (within the meaning of Article 4 of Commission Implementing Regulation (EU) *No 923/2012*) have priority over other airspace uses.

1) Public safety use cases fall into this category which allows for specific procedures to ensure mission fulfilment. However, U-space regulation is initially not applicable for these operations.

2) However, current draft regulation doesn't include the process for existing airspace users that may be impacted by emergency operations.

3) Our recommendation would be to promote exploratory research and demonstrations addressing the different solutions available to support regulators in defining the standard procedures to adapt future routine U-space flight operations to an urgent special operation airspace reserve.

4) Also, it's recommended to explore how the EU should position the integration with airspace management and the definition of standard procedures regarding the development of public safety use cases (e.g. local regulations vs. standard procedures across countries).

5) Explore the potential benefits that U-space services may bring to emergency drone operations, for example access to traffic information and deconfliction services.

6) Investigate the minimum requirements for vehicles and emergency operators to achieve the level of U-space integration required to guarantee operational safety, e.g. declaration of operational intent and provision of tracking data to allow U-space service providers (and potentially ANSP) to segregate specific volumes of airspace to guarantee operational safety.

7) Special consideration should be given to use cases involving simultaneous operations of manned and unmanned vehicles in the same volume of airspace. The procedures that need to be in place for the potential integration with U-space services may differ from scenarios involving only drones and should duly consider the implications on helicopters and other manned vehicles.

b) Cross-border operations will require the definition of a specific U-space area whose governance is agreed amongst the involved countries or strong coordination between adjacent U-space areas to ensure handover doesn't negatively impact the mission success. It is therefore important that the early identification of cross-border operation areas for each regulator takes into account this consideration when defining the U-space area requirements. One of the potential challenges will be to define and implement adequate procedures to manage the impact of an emergency operation spanning different states on different U-space airspaces.

c) In addition, BVLOS missions over long distances would involve operation across multiple U-space areas and U-space/controlled airspace transitions. Emergency services will benefit from a predefined standard set of rules to ensure coordination amongst all stakeholders.

d) Considering the state of the art and foreseen evolution of U-space technologies and regulations over Europe:

1) Operation of VLOS with small drones is feasible as of today.

2) Operation of BVLOS in non-densely populated / dense airspace areas will be feasible in the short term with upcoming U-space regulations and solutions.

3) Operations of BVLOS transporting people or large goods and/or in densely populated areas will be feasible in the mid to long term as technology matures and certification rules are defined.

4) We consider the major risk won't be on the U-space technologies but on the certification level required for special mission vehicles (e.g. drone carrying a water-hose, medical transport).

e) In addition to the considerations already mentioned in paragraph 1 about coordination of simultaneous operations; when the use case involves tight coordination of air means to act in a dense, collaborative mission environment (e.g. fire extinguishing), it will benefit from a dedicated mission (& fleet) management tool to ensure mission coordination between the different airborne assets. We therefore identify as a topic for research the potential interfaces between these mission management solutions and the U-space service providers.

f) As a special case, maritime SAR and border control missions could include operation in international waters. Public safety stakeholders could benefit from some basic services (e.g. airspace information) to avoid incidents between different operators that may coexist in the same area.

4 I CONCLUSIONS

The implementation of U-Spaces will enable Emergency Services to embrace and benefit from UAV technology in many new and different dimensions. The capacity of automatising operations, flying BVLOS, operating in shared airspace and in urban environments unlock a series of new use cases that can help first responders to operate more efficiently and in a safer way.

The use cases described in this document form part of an initial exercise to start exploring specifically how U-Space will help Emergency Services in operations that range from daily situations to more complex and multi-agency interventions.

Finally, to achieve this scenario and to foster the development of U-Spaces, there are several lines of work that should be considered:

a) Dedicated working groups including first responders to support the evolution of legal frameworks, technology and operations;
b) Further exploration and validation of public safety use cases, to understand which are more relevant and focus the efforts;
c) Openly share the conclusions with the Public Safety Community, law makers, researchers and technology developers to unify efforts and speed up the adoption of U-Spaces for emergency response.