Drone Alliance Europe
U-space Whitepaper Version 2.0
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Drone Alliance Europe (DAE) has long supported the development and implementation of an unmanned traffic management system ("U-space" or "UTM"). U-space will play a critical role in helping to realise the potential of commercial drone operations while ensuring safety and security.

A U-space ecosystem is essential to respond to the growth of drone operations, first in low-level airspace, and eventually extending into fully integrated operations at higher altitudes. This growth soon will surpass by far the volume of traffic currently seen with manned aircraft. As such, it is unrealistic to expect the Air Traffic Management (ATM) infrastructure to safely and efficiently manage this expected drone traffic.

U-space is needed to open the drone service market and enable more complex and longer distance operations: to ensure operations beyond visual line of sight (BVLOS) are conducted safely and efficiently, there must be a U-space system. U-space services should cover all airspace in which drones may be operating BVLOS (as well as when operations are autonomous).

DAE envisions a U-space ecosystem that covers all European airspace. While initial focus is on low-altitude airspace, a U-space system, for instance, must also accommodate unmanned air mobility (UAM) operations that will be conducted in both low and intermediate altitudes, especially over urban areas.

Similar to the Single European Sky concept, the European Aviation Safety Agency (EASA) and the European Commission (Commission) should publish a specific U-space regulation that allows and facilitates U-space service providers (USPs) that provide services across Member State borders, without derogating Member State and local authority responsibilities. EASA and the Commission can and should include performance requirements in the U-space regulation. USPs should be able to offer a range of services in a free market setting, provided that they are duly qualified to comply with a core set of performance and interoperability requirements. This federated model encourages multiple providers to enter the market, and in so doing enhances safety and efficiency while driving down cost to the end users.

DAE envisions a U-space system that is federated in that it comprises a network of USPs communicating and cooperating in a standard, collective, and connected environment, for a range of purposes. It is decentralized in that, except in limited circumstances, there is no central authority. A decentralised approach helps to eliminate single points of failures and best supports the volume and diversity of operations. It is competitive in that multiple entities, including ANSPs, may serve as USPs.

DAE believes that at the outset, U-space services may be introduced within the existing airspace classification system, e.g., Class G (uncontrolled airspace). In the future, it may be appropriate for U-space, perhaps in certain areas, to have specific flight rules and an airspace classification. Most importantly, U-space services must be future proof and thus must be realised within the framework of current and future flight rules.

To meet these requirements, DAE believes that effective and reliable U-space management is best served with a federated framework in which individual aircraft are supported by approved USPs, with cooperation via a common industry standard discovery and communication protocol. U-space services may be provided and managed by multiple USPs that overlap in geographical coverage. This approach to U-space management will enable remote identification and strategic deconfliction, in addition to other essential capabilities to ensure the safe operation of drones.

A federated and decentralised solution provides many benefits. Placing the responsibility on USPs for implementation and supporting infrastructure minimizes any adverse economic regulatory impact. It also enhances safety and security because most data will not be stored in a single, vulnerable location. Safety and security are further enhanced by the capability of USPs to support e-registration, remote (electronic) identification, and geo-fencing capabilities for diverse UAS. These solutions will support a wide range of applications using commercial drones available for broad use, as well as custom manufactured drones for specific enterprises, allowing different USPs to focus on delivering tailored services applicable to their operation.

DAE members - and other stakeholders around the world - have already shown how the federated and decentralised approach can work in practice. These concrete cases provide a wealth of best practices from which the EU can when crafting its policy frameworks for U-space. DAE strongly encourages EASA and other EU bodies to learn from these demonstrable cases.

With the impending implementation of the Commission’s Delegated and Implementing Regulations, EASA has turned its attention to developing a U-space regulatory framework. Specifically, EASA published a draft opinion for comment in the fall of 2019 and a final opinion is expected in 1Q 2020, with the Commission’s Delegated and Implementing Regulations to follow later in in the year. DAE supports this ambitious timeline in order to expedite the safe and secure integration of UAS.

To contribute to the discussions on how U-space should take shape, the purposes of this whitepaper are to lay down guiding principles and key attributes for establishing U-space, and provide recommendations for the decision makers taking this forward.

Guiding principles and key attributes for establishing a U-space system

The Commission's recently published Delegated and Implementing Regulations have set out the three prerequisites for establishing a U-space regulatory framework: (1) electronic registration, (2) remote (electronic) identification, and (3) geo-awareness. Beyond these prerequisites, a U-space system must also include airspace authorisation and communications among civil aviation authorities (CAAs), air navigation service providers (ANSPs), drone operators, and USPs.

The next challenge will be to build from these basic requirements and decide on a set of rules and relationships that will allow U-space to open up the skies for the many exciting applications that drone technology can offer.

Current trials, experimentation, and active UTM services across the world – from the EU-funded Demonstrator Network projects to live testing undertaken by leading industry partners – are proving invaluable for determining the most effective approach. Indeed, early lessons have shown the enormous potential for industry leadership and collaboration that is inclusive, driven by best practices and focused on outcomes that can benefit the entire drone community.

DAE believes that a U-space system must promote safe, secure, scalable, and environmentally friendly operations of aircraft in U-space airspace while respecting the privacy of European citizens; it must ensure the continued safe operations of manned aviation. A new approach to traffic management is required to support the volume and diversity of drone operations.

In addition, we believe the following principles should guide the next phase of work – for both policymakers and industry – to advance the vision of a functional and comprehensive U-space architecture:

(1) Prioritise a model that is operator-focused and performance-centric
(2) Empower USPs to take on as much responsibility as possible
(3) Ensure efficient cooperation among USPs in a competitive marketplace
(4) Enhance safety standards by creating a robust approval and oversight framework
(5) Streamline interfaces with ATM to provide those items that ensure mutual benefit to U-space operators and ATM partners

(1) Prioritise a model that is operator-focused and performance-centric

The development of a U-space system needs to be a dynamic and iterative process (as opposed to focusing on an overly rigid endpoint) so industry can keep innovating. U-space services can be gradually rolled out as the drone industry matures in order to fulfill the needs of new and different types of operations.

The resulting framework should maintain operators' interests at its core. Furthermore, it is imperative to create a system that enables qualified U-space service users to have broad operational access (as opposed to being confined to a given airspace), making it as easy as possible for operators safely to conduct flights, supported by the services that they require for the specific nature of their intended operation.

This focus on the distinct characteristics and associated risks of various types of operations is also key to determining the level of participation in U-space and the services required. For instance, to operate BVLOS, including for highly automated operations, the operator must participate in the U-space system in order to maximize situational awareness and conflict detection.

(2) Empower USPs to take on as much responsibility as possible

A federated architecture has advantages in terms of facilitating the ability of USPs to offer services wherever users require them and provide a variety of U-space capabilities to meet the increasingly varying needs of drone operators.

To achieve these ends, DAE believes the U-space system should involve many USPs, in contrast to a single USP operating in a Member State or volume of airspace. USPs may be commercial entities, as well as ANSPs. Commercial involvement brings with it both additional expertise and the financial investment needed to develop the necessary systems.

To achieve this required level of cooperation between the public sector/ANSPs and private entities, regulators and ANSPs should leverage industry investment, innovation and speed, as the Federal Aviation Administration (FAA) has done in the Low Altitude Authorization and Notification Capability (LAANC) program in the United States. With LAANC, industry helped the regulator to deliver a significant new U-space capability within a matter of months.

A U-space network featuring multiple USPs will result in efficiencies, innovation, and spreading of costs, As the wider industry absorbs the cost of developing capabilities across all European airspace, the entire system is able to limit recurring costs, while also becoming more responsive to the fast pace of innovation needed for the drone sector.

(3) Ensure efficient cooperation in a competitive marketplace

DAE supports U-space competition. DAE does not believe that effective airspace management requires only one USP for a particular Member State or volume of airspace. DAE envisions multiple USPs supporting diverse drone operations, competing for customers in overlapping geographic areas and the same volume of airspace. Like telecommunications carriers that manage traffic across their competing networks through standards that allow for the exchange of traffic between them, DAE believes that interoperability is the key to a competitive market for USP services. In a competitive market, USPs would offer services in overlapping geographic areas, but to promote interoperability, each USP must be appropriately qualified and capable of providing the required set of services – as well as any additional service the USP commits to provide.

In this U-space model, a distributed network of USPs would provide essential U-space functions and collaborate, where necessary, via a common discovery and communication protocol. DAE envisions a system of multiple USPs not necessarily confined to any particular volume of airspace, enabled by seamless communication of safety-essential information. In order to provide the broad range of services that drone operators will need, now and in the future, an open market system is needed while adhering to the required safety levels.

DAE agrees with EASA that a regulation is needed to ensure fair access to drone operators in a cost-effective manner through a competitive U-space services market. DAE thus supports competition as well as the Commission's competence to assess any market dominance.

To ensure efficient cooperation among USPs, common data exchange protocols need to be developed. Such protocols have been demonstrated in practice, based on standards developed by ASTM International. Developing data exchange protocols and using supporting data from standards setting organisations is essential for the seamless exchange of UAS operator intent, operational approvals, operational constraints, and other data critical to maintaining airspace safety and security. This data exchange among aircraft, operators, USPs, and the CAA and ANSP must be provided through a distributed network of highly automated systems by means of application programming interfaces (APIs), rather than traditional communication between pilots and controllers. There is already a strong track record of industry-led cooperation and standards-setting.

These communications will need to be supported by reliable, resilient, and ubiquitous communications systems that correspond with the performance risk of the operation. Standards for communications systems will need to consider the relevant risk for command and control (C2) links in the context of each operation, and metrics pertaining to transmission latency, integrity, availability, redundancy, and interoperability. DAE has long supported a flexible use of communication modes (e.g., commercial cellular) available for such services. Setting standards for communications systems and allowing

the distributed network to meet those standards using a range of communication modes will provide maximum efficiency, security, and flexibility for USPs to safely accomplish their mission. DAE members already have ongoing active operations using non-aviation band communication such as LTE/3G/4G . The U-space system would also leverage existing connected software solutions, such as 5G wireless communications and the Global Navigation Satellite System (GNSS).

(4) Enhance safety standards by creating a robust approval and oversight framework

DAE acknowledges that the industry and standards-led approach that we recommend needs a robust regulatory oversight and approval framework, which would continue to uphold the stringent safety protections for which the aviation sector is known.

For example, one of the most important roles to be retained by competent authorities is the provision of authoritative data, such as registration data. A U-space system must have real time access to mission- and safety-critical information such as weather data, which will be provided to the USPs and directly to operators, but DAE does not believe this data needs to be the sole province of the competent authority.

Other important roles for competent authorities include setting the rules of operation and defining the USP approval process. This allows authorities to maintain high levels of safety by holding service providers fully to account, in a way that is also future-proofed for services that are not yet developed. With respect to approval of USPs, DAE strongly recommends setting EU-wide approval criteria, which then can be implemented by Member State CAAs with any necessary jurisdiction-specific requirements. A robust set of EU criteria is essential to ensure a viable market for USPs that does not become fragmented and create uncertainty. The approval of USPs can be monitored at national level but the parameters need to be uniform to ensure consistency.

(5) Streamline interfaces with ATM to provide those items that ensure mutual benefit to U-space operators and ATM

As outlined above, it will be imperative to establish a communications protocol and interfaces between USPs and ANSPs. U-space and ATM systems should be complementary, but their needs are not the same. Establishing a unified ATM/U-space system would undermine the cost-effectiveness of U-space as opposed to using interfaces between distinct U-space and ATM systems that are utilized only when needed and in line with risk.

Cooperation with the ATM system will be needed of course, such as real time data sharing to provide the ATM system with the information required to ensure safe coexistence between manned and unmanned aviation, but this should be digital and managed in line with risk cases. Where necessary, USPs will be able to interact with the ATM system to ensure the safe transition of drones between uncontrolled and controlled airspace.

DAE Recommendations

In line with the principles spelled out above, DAE recommends that the EU take the following approaches in addressing specific issues relating to U-space development.

Decentralised, federated system. DAE's primary recommendation is that the U-space system be decentralised and federated. While USPs must cooperate and collaborate among each other, multiple, overlapping USPs will ensure the variation of capabilities to match the drone operation, and competition will enhance those capabilities. Such a system will increase the safety of U-space even as it accommodates the increasing capacity of drone traffic.

Participation in U-space system. U-space services will be provided everywhere the services are required or needed, particularly as it will reduce the air risk calculation under SORA. A threshold question is which drone operations are not required to participate in a U-space system. As stated above, DAE believes that any BVLOS operation should be part of a U-space system. In areas with high density of traffic, broader participation will be necessary. However, in sparsely populated or remote areas, certain operations may operate without participating in a U-space system (i.e. filing a flight plan and obtaining authorisation, as well as communicating with other drone operators through one or more USPs). In these areas, remote ID broadcast technology could be leveraged to support separation between UAS.

Qualifications of USPs. DAE expects industry and ANSPs to be eligible to serve as USPs, provided they satisfy the requirements to perform their respective functions. DAE supports establishing criteria to approve a USP's participation in the U-space system. Qualification criteria should be based on technical standards developed in consultation with industry and ANSPs; U-space standards such as those developed by ASD-STAN and ASTM should be used when applicable. DAE favors a single EU-wide approval framework that can be augmented by Member State CAAs with any necessary jurisdiction-specific requirements. It is desirable to establish a single set of qualification criteria to avoid varying and inconsistent approval processes among Member States.

Prioritisation. DAE envisions the need to provide priority to certain UAS emergency operations. This could include public (state) aircraft operations or civil operations engaged in search and rescue operations, delivering urgently needed medical supplies (e.g., organs or blood), or assisting first responders, among other applications. Order or priority should be the responsibility of the Commission to establish predetermined policies to be implemented by Member State CAAs.

Digital, rather than analog (voice) interfaces with Air Traffic Control. The U-space system must include a digital interface between Air Traffic Control/ANSPs and USPs. Drones should be permitted to transit between uncontrolled and controlled airspace. Policymakers should consider permitting USPs to facilitate automated approval via an automated interface with ATC. This issue will become more pressing with the advent of

urban air mobility operations, which will feature large drones operating in both uncontrolled and controlled airspace.

Remote ID requirements. At a minimum, participants in the U-space system must be remotely identifiable online from a smartphone or other electronic device. All U-space participants should also be subject to geo-awareness requirements established under the Implementing and Delegated Regulations, with any additional requirements dependent on the risk of the operation.

Payment model for USP services. DAE believes the cost of maintaining a digitised U-space system will be significantly less than current ATM costs, and more so to the extent decentralised U-space services are permitted. A CAA will incur costs to ensure certain safety critical information in its possession is made available through USPs, and reviewing and approving USPs.

USPs will incur nonrecurring investment costs and annual recurring and maintenance costs, reducing the need for CAAs and non-USP ANSPs to incur those costs. Cost structures should reflect that USPs, and not CAAs, will provide ongoing deconfliction, identification or flight planning services.