Call CEF-SESAR-2018-1

Annex I - Technical specifications

Edition date: **31 January 2018**
Edition: **01.00**
Status: **Final**

Abstract

This document comprises the Technical Specifications for the SESAR Open Call for proposals on U-space referenced as CEF-SESAR-2018-1. It contains a detailed description of technical requirements and activities to be covered under any U-space project selected as a result of the Call.

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Acronyms and Terminology

Term	Definition
AGS	Active Geofencing Service
ANSP	Air Navigation Service Provider
ATC	Air Traffic Control
ATM	Air Traffic Management
AIS	Aeronautical information service
BVLOS	Beyond Visual Line Of Sight
CEF	Connecting European facility
DAA	Detect And Avoid
DTM	Drone Traffic Management
EASA	European Aviation Safety Agency
EC	European Commission
EU	European Union
E-VLOS	Extended Visual Line Of Sight
NOTAM	NOTice to AirMen
NPA	Notice of Proposed Amendment
R&I	Research and Innovation
RPAS	Remotely Piloted Aircraft Systems
SESAR (2020)	Single European Sky ATM Research programme 2020
SJU	SESAR Joint Undertaking
SME	Small and Medium Enterprise
SPD 2018-2020	Single Programming Document 2018-2020
TRL	Technological Readiness Level
UAS	Unmanned Aerial Systems
VLD	Very Large-scale Demonstrations
VLOS	Visual Line Of Sight

Definitions

Term	Definition
Action	A related set of activities and tasks awarded as a result of call CEF-SESAR-2018-1. Each Action is financially and technically independent from each other, has a set timeframe and is necessary for the implementation of SESAR within the scope of this Call and the authority of the SJU. The Action is also referred to as "Project" in this document.
Airspace authority	Accredited national entity providing data and updated information linked to the airspace management (restricted areas, temporary restricted zones, etc.) including specific information for drone operations ("no fly" zones, drone tracks etc.).
Call	A request for proposals issued by the SJU that provides the information necessary for applicant(s) to respond with proposed Action(s). In this case the call is CEF-SESAR-2018-1 and is for proposals on U-space.
Drone	A generic term to cover all types of unmanned aircraft systems (UAS); these may be remotely piloted (RPAS - remotely piloted aircraft system) or automated.
Drone operator	An organisation or entity that operates one or more drones for commercial use and determines the mission the drone will perform. Under the Action, this terminology only covers entity using drone to business purposes. *Refers as well to EASA terminology as 'unmanned aircraft system (UAS) operator': any legal or natural person who operates or intends to operate one or more UAS.*
Data or data service provider	An entity that provides information to the U-space service providers especially to support drone traffic management services.
Leisure drone user	Any citizen (natural person) using an open category[1] drone for a private usage.

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[1] See EASA information: *https://www.easa.europa.eu/easa-and-you/civil-drones-rpas*

Term	Definition
Pilot activities	A type of activity within the scope of Studies that provides integrated deployment. Pilot activities open the market, but are still of "experimental nature" and include real-life trials (beyond a simple demonstration). In accordance with Article 2(6) of the CEF Regulation, Studies may include pilot activities that will serve at least one of the following objectives: - to develop, improve or adapt a new technology or an innovative solution and implement it in order to test its feasibility and suitability as well as its added value before deploying it on a larger scale; - to deploy an existing technology, infrastructure or service (i.e. already in use elsewhere but new to a particular sector, system or geographical area) in order to gain experience and/or create market conditions for deployment on a larger scale. The pilot activities of a Study may include the deployment of a certain type of infrastructure or technology but on a limited scale and at a reasonable price and with the objective of testing and validating the viability of the innovative actions proposed for future scale up and roll out. Pilot activities of a study should be of an experimental nature and designed to test the feasibility of an innovative action and its usefulness for future large-scale implementation. They should not be associated with research activities that are not covered by this call. The Pilot activities are also referred to as "Demonstration activities" in this document.
Remotely piloted aircraft -RPAS	A specific type of drone which is operated by a pilot (as opposed to automated drones). The term RPAS includes the air vehicle and the ground station.
Study/Studies	Activities needed to prepare project implementation, such as preparatory, mapping, feasibility, evaluation, testing and validation studies, including in the form of software, and any other technical support measure, including prior action to define and develop a project fully and decide on its financing, such as reconnaissance of the sites concerned and preparation of the financial package, as per Article 2 (6) of the CEF Regulation.
Technology Readiness Level (TRL8)	Actual system completed and "mission qualified" through test and demonstration in an operational environment (ground or space) i.e. end of system development. Fully integrated with operational hardware and software systems, most user documentation, training documentation, and maintenance documentation completed. All functionality tested in simulated and operational scenarios. Verification, Validation (V&V) and Demonstration completed.

Term	Definition
U-space services provider	A legal entity providing services to the end user (the drone operator or leisure drone user) within the U-space ecosystem and in accordance with the applicable legislation.

1. Introduction

1.1 Purpose of the document

This document constitutes the Technical Specifications for the SESAR 2020 Call for Proposals on U-space (reference CEF-SESAR-2018-1) and will become an integral part of any Grant Agreement awarded as a result of this call. It intends to provide a clear and comprehensive view on the activities and expected outcomes of the project(s) and the relevant background information.

These technical specifications not only provide a detailed description of the objectives, challenges, expected impact and technical requirements of the Action but also present the U-space concept and other related technical elements.

1.2 Specific framework associated to the Actions

Actions shall qualify as Studies under CEF and include 'Pilot activities' which are further described in sections 2-4 below.

The technical specifications of this call for proposals were established in close collaboration with the European Aviation Safety Agency (EASA) in charge of the EU regulatory process for drones.

1.3 SESAR Project and objectives

The Development Phase of the SESAR Project aims to ensure the modernisation of the European Air Traffic Management (ATM) system by coordinating and concentrating all relevant research and development efforts in the European Union.

The SESAR Joint Undertaking (SJU) is responsible for the execution of the European ATM Master Plan and in particular for carrying out the following tasks:
- Organising and coordinating the activities of the development phase of the SESAR project in accordance with the European ATM Master Plan, by combining and managing under a single structure public and private sector funding;
- Ensuring the necessary funding for the activities of the development phase of the SESAR project in accordance with the European ATM Master Plan;
- Ensuring the involvement of civil and military stakeholders of the Air Traffic Management sector in Europe and in particular; Air Navigation Service Providers, Airspace Users, Professional Staff Organisations, Airports, the manufacturing industry and relevant scientific institutions and members of the scientific community;
- Organising relevant research and development to be carried out under its authority;
- Ensuring the supervision of activities related to the development of common products identified in the European ATM Master Plan, either through grants to members or other appropriate mechanisms following proposals to achieve specific programme objectives (in accordance with Regulation 1271/2013 [1]).

1.4   Background and context of the Call

The demand for drone services is increasing at a very fast pace, holding enormous promise in terms of business opportunities for Europe, economic growth with the development of a multitude of new and innovative services, as well as societal benefits[2].

The High Level Conference on "Drones as a leverage for jobs and new business opportunities" took place on 23-24 November 2016 in Warsaw, Poland, and was concluded with a "Warsaw Declaration", calling for "*urgent action on the airspace dimension, in particular the development of the concept of U-space*"[3]. The Commission entrusted the SJU with this task and, as a result, a "U-space Blueprint" was delivered by the SJU on 16 June 2017 [2]. The U-space Blueprint gives the key definitions and principles supporting the concept of U-space, an enabling framework for complex drone operations using highly automated drones in all types of operational environments, with a specific attention to dense and complex urban areas. U-space is to be flexible enough to encourage innovation, support the development of new businesses and facilitate the overall growth of the European drone services market while properly addressing, at EU level, safety, privacy, environmental and security issues.

In November 2017, the High Level Conference held in Helsinki stressed "the importance of the role of the private-public partnership approach for R&D (including large scale demonstration of technology) under SESAR and the need to involve all innovative actors including SMEs and new entrants"[4]. The SJU is already leading R&I in the field of drone integration in Europe. It has started addressing the main challenges of safely integrating drones into the European airspace and its ATM environment as documented in the European ATM Master Plan 2015 edition [3]. The objective of the SJU in this domain is to manage development and demonstrations to show drones can operate safely in mixed unmanned/manned aircraft airspace while highlighting the necessary and appropriate regulatory and standardisation measures that will be required to enable full-scale deployment readiness at EU level for an interoperable, harmonised and standardised deployment of U2 services across Europe.

Within the SESAR research pipeline (see Figure 1: SESAR research pipeline), the Actions shall aim at a fast-track integration of developed technologies and concepts towards their deployment in the European ATM system, targeting 'Mission Qualified' TRL8.

Furthermore, the Actions shall aim to:
- Generate further confidence to support buy-in from main stakeholders including regulators for future deployments,
- Significantly reduce the business risks for both operational stakeholders and industry,
- Provide further inputs to related standardisation activities,
- Raise awareness regarding SESAR activities related to ATM performance issues and their results.
- Accompany SESAR pioneers all the way to pre-deployment,
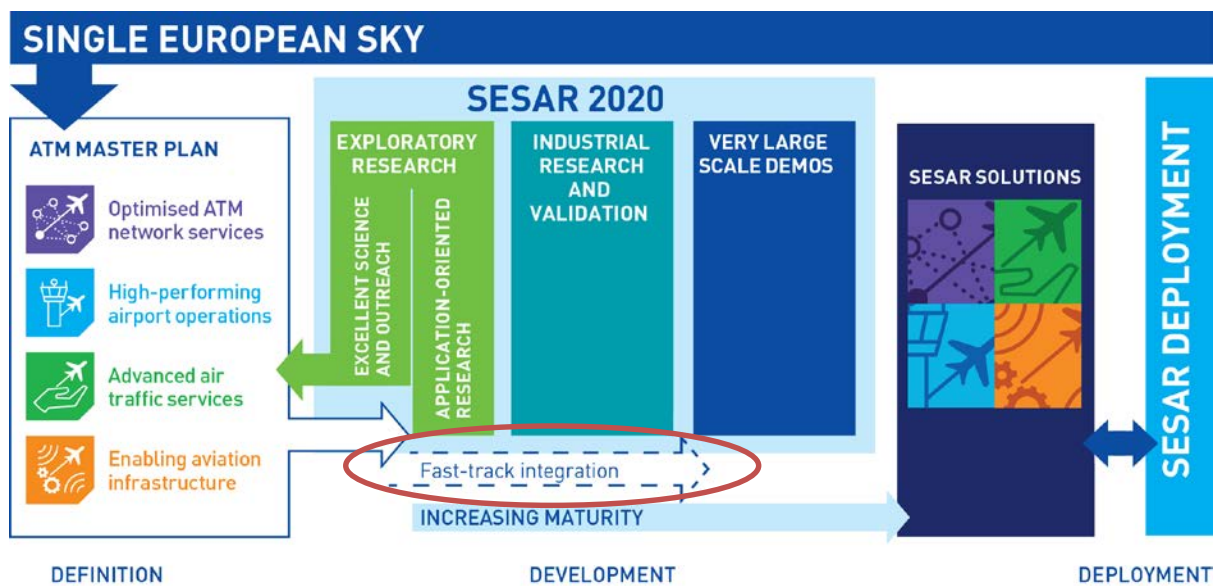- Assess full-scale deployment readiness.

Figure 1: SESAR research pipeline

1.5   Overview of the U-space services concept

The concept of U-space was established in 2017 [2]. U-space is an enabling framework relying on digital services for complex operations using highly automated drones in all types of operational environments, with a specific attention to dense and complex urban areas. U-space is to be flexible enough to encourage innovation, support the development of new businesses and facilitate the overall growth of the European drone services market while properly addressing, at EU level, safety, privacy, environmental and security issues.

The deployment of U-space is linked to the increasing availability of U-space services and enabling technologies and therefore, will be progressive through U-space U1, U2, U3 and U4.

U1 services (U-space foundation services of e-registration, e-identification and initial Geofencing in the U-space system) have been defined in light of EASA NPA 2017-05 Introduction of a regulatory framework for the operation of drones — Unmanned aircraft system operations in the open and specific category[5], are expected to be in operation in 2019.

U2 services (U-space initial services) includes a first block of services to support the management of drone traffic by 2022.

The concept and the main features of U-space is further described in Appendix A and the services and drone capabilities are further described in Appendix B.

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[5] https://www.easa.europa.eu/document-library/notices-of-proposed-amendment/npa-2017-05

1.6   Collaboration with SESAR Projects linked to the Actions

Within the SESAR 2020 programme, some existing projects are either in progress or about to be launched (further details can be found in the SJU Single Programming Document 2018-2020 [4]) which also cover the U-space challenges and have a close link with the main objectives of the Actions. These are the following:

- Nine (9) projects that have been rewarded under and Exploratory Research RPAS call organised in 2016 (ER2-RPAS call with reference H2020-SESAR-2016-1); they have started working and will address issues and challenges linked to the U-space;
- One (1) VLD project awarded in Q3 2017 following the call ER3/Open VLD open call (with reference H2020-SESAR-2016-2) also published in 2016, that should be kicked off in the beginning of 2018;
- One (1) demonstration project on Active Geofencing Service (AGS) under the call with reference SESAR-2017-1 which is expected to be awarded in the beginning of 2018.

Existing information on these projects are published and available in CORDIS[6]. Upon award and during the Action the SJU may complement this with other information coming from intermediate and final stages of the projects.

The actions shall leverage as much as possible the intermediate and final results of the projects listed above as they become available.

Within the scope of all Actions awarded as a result of the Call, results and recommendations shall be shared under the aegis of the SJU with an objective to foster collaboration with other projects and to integrate outcome and results. This shall enable the consolidation of recommendations for standardised deployment and the elaboration of common requirements for the harmonised roll-out of U-space in Europe (see section 4, and in particular section 4.3 for additional information).

Specifically, upon completion of the demonstration activities, each Action is required to share its respective results and to collaborate with the other Actions on the development of consistent recommendations to the SJU for deployment and elaboration of the common requirements for the harmonised deployment of U-space U2 in Europe.

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[6] CORDIS is the Community Research and Information Service of the European Commission, providing information on all EU-funded research projects.

2. Objectives & Scope of U-space Services

This Section of the document describes the objectives and scope applicable to the set of Actions proposed to be awarded under the Call.

2.1 General objectives & Impact

The overall objective of the Actions is "*to comprehensively prepare and de-risk a rapid deployment of U-space initial services (U2) as outlined in the U-space Blueprint. U2 provides the initial set of key services building on the foundation services (U1) by adding game-changing improvements enabling initial beyond visual line-of-sight operations (BVLOS) in rural, urban and sub-urban environments and facilitating the processes for authorisations for some drone operations*"[7]. As such, the scope of each Action shall focus on U-space U2 while not excluding other applications of the U3 and U4 services. Their objective shall in particular be to provide significant and tangible outcomes to prepare harmonised deployment of U2 services in Europe at the latest by 2022.

In order to achieve the objective, the SJU intends to co-finance between 5 and 10 demonstration sites across 5 different EU Member States, each site will support one or more U-space operator configuration and demonstrations.

Each Action shall comply with the demonstration scenarios described in the technical scope described in Section 3. Each Action shall exchange results with all other Actions to ensure there is collective progress towards the harmonised and standardised full-scale deployment of U2 services at EU level.

The Actions shall collectively provide evidence on the safety, as well as operation and technical impact of U2 services to ease wide-scale roll-out in Europe, building on the U1 services to be deployed by 2019. They shall also prepare for operational deployment of U2 services by providing the SJU their respective recommendations on the performance requirements supporting the risk-based approach adopted for drone operations and where relevant identifying standardisation and regulatory needs.

The results will make a significant contribution to the impacts of:
- Boosting EU collaboration and generating confidence from investors, innovators and regulators;
- Significantly reducing the business risks for key U-space investors;
- Putting the EU at the forefront of global standards setting in the domain;
- Raising awareness regarding SESAR activities related to U-space and showing tangible progress on technology and services with an objective to integrate results at EU level and in the context of the wider SJU work programme;
- Showing that drone operations are envisaged in a safe and secure framework to reduce/mitigate the risks linked to public acceptance;
- Confirming the full-scale deployment readiness at EU level for an interoperable, harmonised and standardised deployment of U2 services across Europe.
- Significantly contributing to the EU regulatory process for drones placed under the aegis of EASA.

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[7] As mentioned in the SESAR JU Single Programming Document 2018-2020 (see reference [4])

2.2 Specific challenges & U-space services Scope

Drones operators and new market opportunities require access to the airspace to operate drones in all kind of environments. Major operations are expected to be performed by drones with a high level of automation, operating BVLOS. Although many of the required technological elements to enable such drone operations already exist, the enabling framework and the services required to make effective use of them are only just beginning to emerge and their performance and scalability has yet to be fully demonstrated.

The core ambition of the Actions is to prepare for operational deployment of U-space U2 at European level. Operational deployment of U-Space U2 includes the implementation of:
- A range of services including drone traffic management (DTM) services[8] to be provided to multiple drone operators;
- A functional architecture supporting these services within the U-space ecosystem;
- An appropriate interface with actors interacting with U-space such as law enforcement, security authorities and other public services;
- Applicable standards supporting the definition and operation of the services and the exchanges between the different actors;
- Appropriate European and national regulatory frameworks.

The challenge for each Action is to demonstrate at minimum the U-space U2 framework in which automated services will be implemented in a safe and efficient way in particular in urban areas.

To achieve this, each Action will demonstrate, in a live-flying environment, at least the set of U-space initial services (U2) on the top of foundation services (U1); this being provided to multiple drone operators for drone operations in all environments (including urban).

As a consequence, the following objectives shall be taken into account:
- Ensure an adequate level of safety for all airspace users and people on the ground as of the beginning of its operational deployment; this implies performance and if applicable technical requirements on core services and by extension on its service providers;
- Ensure the identification of the performance requirements attached to these services (e.g. in terms of accuracy, latency, range, integrity, availability, continuity…);
- Assess (where applicable) the adequacy of existing systems, solutions or services that can fulfil the performance requirements in the aviation domain, but as well in other domains such as telco or automotive;
- Identify any applicable performance gaps and provide recommendations on how they could be addressed;
- Ensure efficiency of the U-space system by using procedures and processes targeting preparation and actions before the flight (e.g. de-confliction at planning level, procedural interface with ATC);
- Facilitate access to airspace to drone operators and enable BVLOS operations as well as initial operations in urban and sub urban environments;
- Identify the needs for standardisation as well as for harmonised rules and procedures to enable harmonised and safe U-space operations across Europe with an objective to ensure interoperability and harmonised deployment supported by EU Standards and Regulation;
- Address requirements linked to security (including cybersecurity), privacy and environment;
- The need to accommodate specific operational constraints and fulfil specific requirements linked to the mission and the operating environment.

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[8] See appendix B1

3. Technical Requirements

3.1 Technical Requirement structure

Each Action shall comply with the following requirements gathered into three (3) layers as follows:

- The first layer is the **common basis**, which lists the minimum requirements to be met by all actions (see section 3.2);
- The second layer addresses **two (2) focus areas for demonstrations** which are the prioritised topics to be addressed as part of the demonstration activities[9]. Each Action shall address **at least one (1) focus area** but are encouraged to address both (see section 3.3);
- The third layer addresses **options** which applicants may consider to include one (1) or more of these options in their proposed Action to help show the preparedness for more advanced U-space services (U3-U4) as a part of the demonstration activities proposed (see section 3.4). Actions including the third layer will be positively evaluated.

3.2 First layer: the common basis

In this section, the mandatory technical requirements composing the common basis are described and the main element of each requirement has been highlighted.

1. All Actions shall include **one (1) or more flying demonstration(s)** putting together several clearly identified objectives and shall cover all elements (a-i), described below.

   a. Given the current status of drone regulation, it is recognised that it may not be possible to conduct the flying exercises in non-segregated airspace, although it is encouraged to do so, where possible. In the case that demonstrations take place in segregated airspace, the environment must be so designed as to be representative of non-segregated airspace.
      - ➢ **Demonstration(s) shall occur in a real-life environment; using actual or emulated non-segregated airspace.**

   b. Although the set-up of U-space U2 aims at enabling BVLOS operations, there is a need to assess the compatibility of all types of operations including VLOS[10] and envisage different levels of requirements according to the mission and the operating environment.
      - ➢ **Demonstration(s) shall include both types of operations BVLOS and VLOS.**

   c. The level of drone automation is an important parameter in the progressive evolution of U-space where drones can have functionalities being completely or partly automated (e.g. for navigation, decision making and management of failure).
      - ➢ **The drones used for the demonstration(s) shall be partly or fully automated.**

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[9] 'Demonstration activities' is a general term covering the flying demonstration(s) and trials described in this document.
[10] The term VLOS operations also covers extended VLOS- E-VLOS

d. U-space U2 services will be implemented on the top of the U1 foundation services. The compatibility of these blocks of services and potential need for enhancement of U1 services shall be addressed and assessed.

   ➢ **Demonstration shall include U1 services and assess their compatibility with U2 services**.

e. The Action shall demonstrate at least U-space U2 core services[11] while not excluding possible other applications of the U3 and U4 services. It shall demonstrate how the core services together with associated drone capabilities[12] could support safe operations of drones. . Meanwhile, it is anticipated these U2 core services could be complemented by additional services[13] not necessarily critical for safety but that could further support the objectives for U-space U2 deployment as described in section 2.2. Projects may therefore cover additional services they consider relevant for the fulfilment of U-space U2 deployment.

   ➢ **Demonstration(s) shall include at least U-space U2 core services and associated drone capabilities (as listed in appendix B.1 and B.3).**

f. Because U2 is expected to enable new business opportunities, it is important that the demonstration(s) include realistic missions expected to be facilitated or enabled by U2 services, such as long range linear surveying (linear infrastructure inspections, surveillance of borders etc.), light delivery (e.g. delivery of medical assets, delivery in remote areas, delivery of private parcels in sub urban areas etc.), or urban mobility.

   ➢ **Demonstration(s) shall include realistic missions corresponding to anticipated business opportunities.**

g. The efficiency of strategic de-confliction and the level of tactical intervention of the DTM service provider needs to be assessed in scenarios involving multiple and simultaneous flights.

   ➢ **Demonstrations shall include at least 5 drones operating simultaneously in the same geographical area.**

h. U-space services consist of the drone traffic management services as well as additional supporting services for the end user (e.g. information services) which may be provided by different entities. The interoperability of these different types of U-space U2 services from different providers and their large scale implementation potential at European level, including cross border operations, must be demonstrated.

   ➢ **Demonstrations shall target at least one of the following two scenarios:**
      o **Scenario 1: Demonstrations shall include simultaneously a minimum two (2) U-space services providers providing different services in the same geographical area.**
      o **Scenario 2: Demonstrating of two sites inter-operating over a defined common cross border area using different U-space services providers. Demonstrations shall include simultaneously, one U-space services provider providing all services in one site and demonstration of cross**

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[11] As listed and defined in appendix B.1
[12] As listed and defined in appendix B.3
[13] Examples are provided in appendix B.2

> border operations to a different site with a different U-space services provider.

  i. U-space services shall be demonstrated in such a manner as to show their scalability and applicability to different types of missions and different types of drones.
-   ➢ **Demonstration(s) shall include:**
  -    ○ **two (2) or more drone operators, and**
  -    ○ **the use of drones from two (2) or more different manufacturers.**

2. Apart from setting up at least one (1) flying demonstration, actions are required to set up trials at smaller scale to test some aspects and de-risk the flying demonstration (based on recognised risk assessment methodologies) or/and to gather evidence to support recommendations or performance requirements. These trials could occur in segregated areas.
   - ➢ **All Actions shall include a series of trials to de-risk the flying demonstration(s)** or/and to gather evidence to support recommendations or performance requirements**.**

3. Demonstration activities are crucial for all projects and they will be conducted in specific conditions that require ad hoc agreements and authorisations. Beneficiaries shall identify the region/portion of airspace and if possible the specific location of the demonstration(s) and highlight risks and the potential obstacles (issues & risks) in the proposed Action.
   - ➢ **All Actions shall include a plan to ensure adequate participation/involvement of national civil authority in charge of delivering authorisations for drone operations, and other relevant authorities (national or local) to implement the demonstrations.**

4. There is a need to develop standardisation and regulatory needs for U2 deployment at EU level. The outcome of the activities will be further integrated in the context of the broader work programme of the SJU; consequently, Actions shall, in cooperation with other Actions awarded as a result of this call, deliver the relevant material required for securing this integration as well as the future deployment steps. Regulatory provisions and standards for U2 deployment will have to be structured, in particular, to contribute to and support the parallel prototype regulatory process for drones placed under the aegis of EASA.
   - ➢ **All Actions shall coordinate with other projects and deliver the relevant material required for securing future regulatory provisions and standards for U2 deployment.**

3.3 Second layer: focus areas for demonstrations

The focus areas for demonstrations are specific topics to be added on the top of the common basis. As explained in section 3.1, **each Action shall address at least one focus area** and projects may choose to address both.

There are two (2) focus areas to be considered for this Call:

- **Focus area 1: Two (2) or more U-space service providers providing the drone traffic management service in a shared airspace.**

It is a key tenet of U-space that the market will be as open as possible, and this includes the provision of U-space services. Consequently, it should not be assumed that, for any geographical area, there will be only one DTM service provider. Where there are multiple DTM service providers, which could be an architecture called a "federated service provision", there will be a need for careful and thorough cooperation and interfacing between the service providers in order to support safe and efficient operations while respecting the freedom of all operators.

Each State, or region will be free to choose an architecture that suits their particular needs but an important aim of this Call is to test the 'federated service provision' in order to identify key issues and to test, with actual operations, how multiple service providers can cooperate to provide the best possible U-space services.

This focus area deals with the provision of **drone traffic management services** (DTM) services by two or more different service providers interacting with each other in a common area of interest. This is delivered in addition to the separate provision of other U-space U2 services (e.g. information services) as specified in the common basis (see section 3.2.1 h) above).

  ➢ **All Actions under focus area 1 including "two (2) or more U-space service providers providing drone traffic management services in a shared airspace" shall include at least the following capabilities: sharing of information and data, management of strategic de-conflict, management of changes and updates during the flight, standardisation and regulatory needs.**

- **Focus area 2: Urban U-space, a framework for urban traffic management of drones**

Actions under this focus area shall set up their demonstrations and especially the flying demonstration in an urban environment.

There is a strong interest in investigating specific safety requirements and associated drone capabilities linked to safe operations of drones in urban areas where the economic growth is expected to be the most important.

This focus area aims at identifying and assessing specific performance requirements for drone operations in urban environments, including the mandatory services, minimum requirements on drones and specific procedures that would be applicable.

  ➢ **All Actions under focus area 2 including "Urban U-space, a framework for urban traffic management of drones" shall include at least the following capabilities: urban airspace design, airspace management, emergency management service, risk assessment.**

3.4 Third layer: options

As explained in section 3.1, these options help show the suitability of the U2 as a migration path to more advanced services and applicants may consider including one (1) or more of the following options as part of the demonstration activities:

  i. Demonstrations of some U-space enhanced services (U3) as defined and listed in appendix B.4;

ii. Drone operations in controlled airspace especially close to airports (including airspace design and procedural interface with ATC);

iii. Inclusion of operations performed by sport aviation/general aviation or rotorcraft in the flying demonstration(s);

iv. Inclusion of leisure drone user(s) in demonstration activities to show that the general public can pursue their hobbies in this shared environment, and also benefit from some of the U-space services;

v. Inclusion of a new and/or innovative communication data link;

vi. Demonstration of synergies with European Innovation Partnership on Smart Cities and Communities (EIP-SCC)[14] and/or between at least two (2) of the sectors covered by CEF regulation;

vii. Use of Vehicle to Infrastructure communication (V2I) communication as the ability for drones to share information with infrastructure components;

viii. Use of Vehicle to Vehicle (V2V) communication as the ability for drones to communicate information to each other;

ix. Use of Detect and Avoid (DAA) solution, as the ability for drones to detect cooperative and non-cooperative conflicting traffic, or other hazards, and take the appropriate action to comply with the applicable rules of flight.

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[14] http://ec.europa.eu/eip/smartcities/index_en.htm

4. Key Outputs

4.1 Management activities and deliverables

In accordance with the need for an interoperable, harmonised and standardised deployment of U2 services across Europe, beneficiaries shall cooperate, under coordination of the SJU, with the beneficiaries of actions awarded by the SJU under call CEF-SESAR-2018-1.

Important aspects related to deliverables and communication / collaboration activities as well as the key milestones set for the projects are highlighted hereunder:

For each project, there shall be at least two (2) deliverables: a study plan and a study report, for which templates will be provided at the first coordination meeting.

- The Study Plan shall include at least:
    - o all the tasks to be performed in preparation to the demonstration activities: airspace design, overall risk assessment, relevant ad hoc procedures and processes, contingency plans, authorisations obtained from the relevant authorities, etc.
    - o the source, quality, frequency of update, transmission and general management of the data coming from data or data service providers which are not specific actors of the U-space system;
    - o a description of the way the connectivity is expected to be ensured during the demonstration activities (including level of performance expected);
    - o a communication and dissemination plan with a specific focus on the demonstration stage.

- The Study Report shall include results of the demonstration activities, and be delivered to the SJU in 2 iterations (the first iteration focusing on the outcome of the demonstration activities) in accordance with the fixed milestones in section 4.3. The report shall be publishable and shall cover all demonstration activities conducted within the project. It shall include at least:
    - o A publishable stand-alone executive summary;
    - o Achievement against the objectives and technical scope applicable to the Action;
    - o A list of assumptions made, if applicable;
    - o Results of performance measurements during the demonstration activities;
    - o Results of the risk assessment/analysis;
    - o Possible impact of U-space U2 framework on security, privacy and environment;
    - o Recommendations developed from demonstration activities performed;
    - o Recommendations linked to exchange of results from other Actions as well as significant operational and technical inputs to enable harmonised U2 deployment in Europe covering at least airspace and procedure design, regulation, standardisation, technical and performance requirements;
    - o Appendixes addressing: Safety Plan or Safety Report, Security Plan or Security Report, Human Performance Assessment Plan or Human Performance Assessment Report, Technical and Interface & Service requirements to be proposed for Standardisation.

Any additional aspects requiring further details of the study plan or of the study report will be mutually agreed at the first coordination meeting, as required.

In addition, a final financial report will be required in compliance with the Model Grant Agreement and will be submitted at the completion of all activities once confirmation is provided by the SJU.

All deliverables shall follow a SESAR template that will be delivered by the SJU at a first coordination meeting after grant signature along with additional guidelines on deliverable timing, communication and working arrangements with the SJU.

4.2   Meetings with the SJU

During the period of the Action and after grant signature, the Action shall arrange for at least two (2) mandatory coordination meetings to take place at the SJU premises in Brussels.

- First coordination meeting with the SJU to take place as soon as possible after grant signature;
- Final coordination meeting with the SJU to take place after acceptance of all deliverables by the SJU and before the end of March 2020.

An additional mid-term coordination point shall be agreed with the SJU at the first coordination meeting.

4.3   Communication and Collaboration activities

Projects shall prepare and deliver, as part of the study plan, a robust communication and dissemination plan describing result disseminations and communication activities expected to be undertaken during the project duration. In particular, special attention should be brought to the organisation of the live demonstrations for which promotion and on-site logistics to welcome visitors should be anticipated.

For the full duration of the SESAR Development Phase, the beneficiaries shall provide the SJU with access to the results of the project activities in order to ensure a broad integration of the results with other components of the SESAR Project and other initiatives from the European Commission such as 'Smart Cities'. In addition, to enable the achievement of the objectives and challenges described in section 2 (in particular to contribute to and support the parallel prototype regulatory process for drones), the beneficiaries shall also provide access to the results of projects to beneficiaries of other related initiatives under fair and reasonable conditions.

Exchange of documentation and inter-project collaboration will be facilitated by the SJU and shall be implemented through a collaboration portal established by the SJU. Further information on use of the tool will be provided by the SJU at the first meeting after signature of a grant agreement.

To ensure consistency with the SESAR brand, project consortia shall contact the SJU Communications Sector when preparing Communication and Dissemination activities. The following SJU email address shall be used for this purpose: communications@sesarju.eu.

4.4   Fixed milestones

In support of their Studies, Actions shall perform full demonstration activities within their host EU Member State by August 2019 and deliver to the SJU an initial study report, concentrating on the results of the demonstration activities, in September 2019.

After completion of all studies performed under the Action, a final Study Report shall be delivered to the SJU by no later than end of January 2020. The Action shall remain open to address any SJU

comments on the final study report in the period up to the end of February 2020, leading to all activities being completed, at the latest, by the administrative closure meeting in March 2020.

In the period from September 2019 to February 2020, Actions shall provide recommendations to the SJU and contribute to the elaboration of the common requirements for the harmonised deployment of U-space in Europe under the aegis of the SJU. In addition, the Actions should also provide recommendations on rules and standards needs for the set-up of appropriate rulemaking framework in particular under the aegis of EASA. These findings shall be documented through the initial and final versions of the Study Report submitted to the SJU for comment and approval.

The fixed milestones are listed below:

Milestone Ref.	Title	Latest Date
1	Submission of Study Plan	February 2019
2	Completion of demonstration activities – flying.	August 2019
3	Submission of initial Study Report (demonstration activities)	September 2019
4	Submission of final Study Report	January 2020
5	Administrative closure meeting	March 2020

5. References

[1] Commission Delegated Regulation (EU) No 1271/2013 of 30 September 2013 on the framework financial regulation for the bodies referred to in Article 208 of Regulation (EU, Euratom) No 966/2012 of the European Parliament and of the Council.

[2] U-Space Blueprint, SESAR Joint Undertaking, 2017.

[3] European ATM Master Plan, SESAR Joint Undertaking, 2015.

[4] SESAR 2020 Single Programming Document 2018-2020, SESAR Joint Undertaking, 2017.

Appendix A   U-space concept

The U-space Blueprint presents the key definitions and principles of U-space which has been further developed in the scope/framework of the MP addendum on drones.

- U-space is a set of new 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 provides an enabling framework to support routine drone operations, as well as a clear and effective interface to manned aviation, ATM/ANS service providers and authorities;
- The U-space framework comprises an extensive and scalable range of services delivered by service providers. These services do not replicate the function of ATC, as known in ATM, but deliver key services to organise the safe and efficient operation of drones and ensure a proper interface with manned aviation, ATC and relevant authorities.

U-space services could be of different kind: they could include supporting services for drone operators such as flight planning assistance and also constitute more structured services such as flight planning management or capacity management. In that meaning, the Call makes a distinction between U-space core services which are safety critical and demand/business driven additional services (for example, bringing added value to the mission or supporting the Drone Operator in his tasks and responsibilities). Within the list of core services there are identified services supporting the traffic management of drones. They are called "Drone traffic management services" or "DTM services".

The progressive deployment of U-space is linked to the increasing availability of blocks of services and enabling technologies. Over time, U-space services will evolve as the level of automation of the drone increases, and the connectivity defined as advanced forms of interaction with the environment is enabled; these interactions will be mainly through digital information and data exchange.
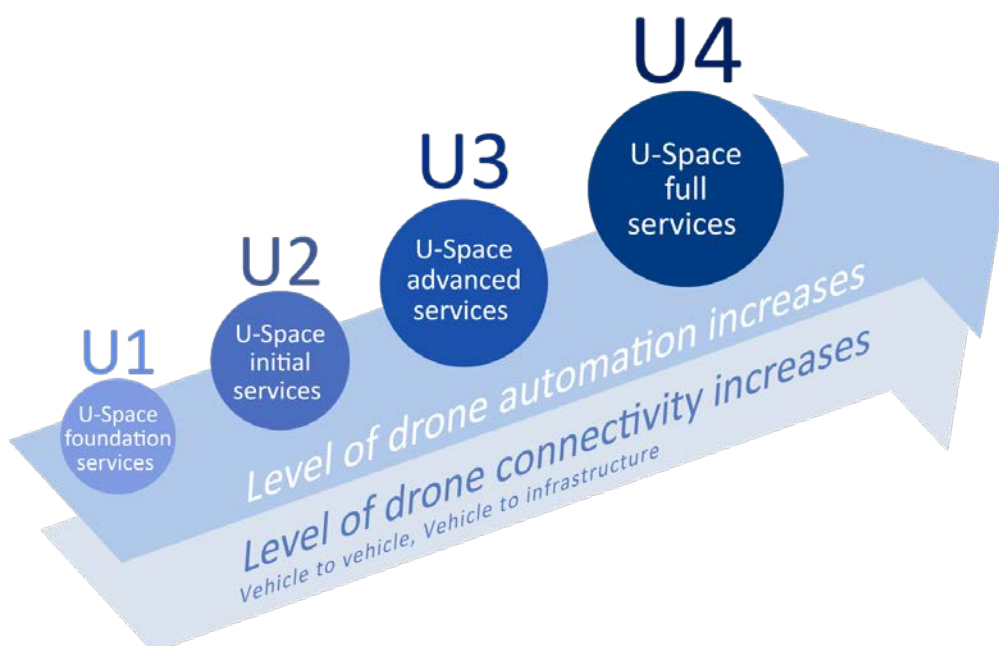

Figure 2: Progressive deployment of U-space services

- **U1 - U-space foundation services** provide e-registration, e-identification and initial geofencing.
- **U2 - U-space initial services** support the management of drone operations and include flight planning, flight approval, tracking, airspace dynamic information, and procedural interfaces with air traffic control.
- **U3 - U-space advanced services** support more complex operations in dense areas and may include capacity management and assistance for conflict detection. Indeed, the availability of automated DAA functionalities, in addition to more reliable means of communication, will lead to a significant increase of operations in all environments.
- **U4 - U-space full services**, particularly services offering integrated interfaces with manned aviation, support the full operational capability of U-space and will rely on very high level of automation, connectivity and digitalisation for both the drone and the U-space system.

U-space main actors and their definitions are listed below.

- <u>Authority</u>: There could be different understanding under that name. For this Call there's a need to identify 2 types of Authority:

  o The authority giving permit to fly to drone operators using a category of drones for a specific mission.
  This authority would for example give an authorisation to fly Drone Dr1 in a particular portion of airspace to execute a specific mission. This authorisation is issued before the D day of flying by the national competent authority.

  o The authority providing reliable data and updated information inked to the airspace management (restricted areas, temporary restricted zones, etc.) especially specific information for drone operations ("no fly" zones, drone tracks etc.).
  According to national organisation, this role could be attributed to one single Authority or qualified entities designated by the States. Either it is one Authority or any entity designated by the State providing the airspace data or information, they will be called "airspace authority".

- <u>ATC</u>: the entity providing air traffic control services in a given portion of airspace[15] and the aircraft that are under its management or operating under its rules.
- <u>Drone Operator</u>: an organization or entity that operates one or more drones for commercial use and determines the mission the drone will perform. In this Call, this terminology only covers entity using drone to business purposes. As such, this terminology does not cover citizens owning their personal drones in Open category[16] and flying for leisure. To avoid potential confusion, these users will be called "leisure drone user".
- <u>Leisure drone user:</u> any citizen using an open category drone for a private usage. It's up to national regulation but it is likely that these drones will be use in VLOS operations.
- <u>U-space services provider</u>: an entity providing services to the end user (the drone operator or leisure drone user); it might use information from different sources identified as data or service providers. These data or service providers are not specific to the U-space ecosystem but, there might need to be recognised as reliable or qualified to provide these data relevant for U-space. Although each U-space service will be provided by a U-space service provider, this is not a one-to-one mapping, as it is likely that a service provider may be able to provide, as part of their portfolio,

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[15] The three control services are Control, Information and Alert
[16] See EASA typology: https://www.easa.europa.eu/easa-and-you/civil-drones-rpas

many U-space services. A provider may also bring in other providers to provider a wider set of services to create their business model.

- **Data or data service provider**: an entity that provides trustworthy information to the U-space service providers, especially to support drone traffic management services. These providers are not specific to the U-space ecosystem as they could provide data for different organisations for different domain. For example, a company providing 3D modelling of a city could provide these data for car industry as well as drone industry.

Appendix B   U-space services and drone capabilities

B.1 List of U-space U2 core services

Weather information
The service provides drone operators with forecast and actual weather information either before or during the flight; it can also collect and make available weather information from different stakeholders.

Drone aeronautical information management
This service provides the operator with aeronautical information considered relevant for drone operations. It will connect to the Aeronautical information service (AIS) to guarantee coherent information provision for manned and unmanned operators.

Tactical geofencing
Compared to U1 pre-tactical geofencing, tactical geofencing brings the possibility to update the operator with geofencing information even during the flight. This service could be available for any drone operator/user with different levels of requirements.

Drone traffic management services

- **Flight planning management:** This service covers the reception of a flight notification or a flight plan and provides the appropriate answer according to the characteristics of the mission and applicable regulations.
  Strategic de-confliction: The service provides de-confliction assistance to drone operator at strategic level (when the flight plan is submitted, it is compared to other known flight plans and a de-confliction in time or route could be proposed). This service could be mandatory or optional according to the operating environment.
- **Tracking:** it is the ability of a service provider to maintain track-identity of individual drones. It relies on ground and air systems. The performance requirements of the service will vary in accordance with the specific requirements of each application.
- **Monitoring:** Subject to appropriate data-quality requirements, this service retrieves data from the tracking service and fuses it with other surveillance information including information related to non-cooperative obstacles & vehicles in order to create air situation for authorities, service providers, and operators. This service may include conformance monitoring.
- **Traffic information:** This service provides the drone operator with traffic information coming from any kind of monitoring services.
- **Procedural interface with ATC:** The service is a set of defined procedures for some mission types where there may be an impact on ATC; for example, crossing certain types of controlled airspace under prescribed conditions. The procedures ensure clear and unambiguous operation of the drone, and provide an appropriate flow of information between the drone operators and ATC. Such procedures will allow drones to fly in controlled airspace and near airports with more flexibility and may include procedural approval/rejection based on agreed rules.
- **Emergency management:** The service receives emergency alerts from operators (e.g. loss of control), and informs relevant actors of the ecosystem who could be, drone operators operating drones nearby, ANSPs, police, airport authorities. The service also provides the drone operator with assistance information to manage the emergency situation (e.g. location of landing pads).

B.2 Examples of U-space U2 non-core services

Assistance for flight planning: Service which support the drone operator in fulfil his flight plan or flight request to the relevant entity

Assistance for flight authorisation: service which support operator in the request to the relevant Authority for an authorisation for certain types of mission according to the Regulation in place.

B.3 List of drone capabilities

Command and control: Ability of drones to communicate with their ground control station to manage the conduct of the flight, normally via a specific data link.

Communication, Navigation and Surveillance: Ability for drones to meet the Communication, Navigation and Surveillance performance requirements for the specific environment in which they will operate. This capability involves the combination of on-board sensors and equipment (e.g. data link, voice radio relay, transponder, laser, GNSS, cellular etc.) as means of achieving the required performance.

Emergency Recovery: Ability of drones to take account of failure modes, such as C2 link failure, and take measures to ensure the safety of the vehicle, other vehicles and people and property on the ground. This includes identification of possible problems (auto-diagnostic) and all equipment required to manage solutions.

Telemetry: Ability to transmit measurement data from the drone to drone operator and/or service provider to meet the demands of relevant services.

B.4 List of U-space U3 services

- **Dynamic geofencing:** compared to tactical geofencing in U2, the dynamic geofencing targets the drone itself and then this service requires data link connectivity to a geofencing system that allows the data to be updated during the flight;
- **Collaborative interface with ATC:** the service provides a mechanism to ensure proper effective coordination when drone operations using U-space services impact ATC. It encompasses shared situational awareness and procedures to enable a two-way dialogue supporting the safe and flexible operation of drones in airspace where ANS are provided;
- **Tactical De-confliction:** this service provides information to the operators or the drones to ensure separation management when flying. The differences with the strategic de-confliction described in U2 are twofold: the drone may receive the information and this de-confliction is set for the in-flight phase. It will be necessary to appropriately define the boundaries with the use Detect & avoid capabilities;
- **Dynamic capacity management: u**pon the definition of drone density thresholds (that can be dynamically modified), the service monitors demand for airspace, and manages access to that airspace as new flight notifications are received. This service may be coupled with the flight planning management service. There should be appropriate set of rules and priorities for slot allocation when a portion of airspace is expected to reach its capacity limits. Apart from the demand and capacity balancing, the service could manage capacity due to non-nominal occurrences, such as weather hazards or emergency situations.