CALL FOR PROPOSALS SESAR-2017-1

ANNEX I

TECHNICAL SPECIFICATIONS

Abstract

This document comprises the Technical Specification Document for the 2017 SESAR 2020 call for proposal on Geofencing (SESAR-2017-1). It contains a detailed description of the project to be awarded.

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Introduction and background

Purpose of the document

This document constitutes the technical Specifications for the 2017 SESAR 2020 Geofencing Open Call (SESAR-2017-1).
It is designed to offer to potential applicants a comprehensive description of the Call requirements. It contains a detailed description of the project to be awarded under the Call as well as the specific Call conditions.

Introduction of the drone topic within the SESAR programme

SESAR Programme and Objectives

The SESAR programme 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 SJU is responsible for the execution of the European ATM Master Plan[1] 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 associations, 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; and
- 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.

The SESAR programme includes projects extending through Exploratory Research, Industrial Research and Validation and Very Large Scale Demonstrations (VLD), as shown in figure 1.

The Very Large Scale Demonstrations (VLD) are designed to help fill the gap between the development and deployment phases and in particular, 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, in particular for changes included in the Common Projects;
- 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; and
- Assess full-scale deployment readiness.

[1] https://www.atmmasterplan.eu

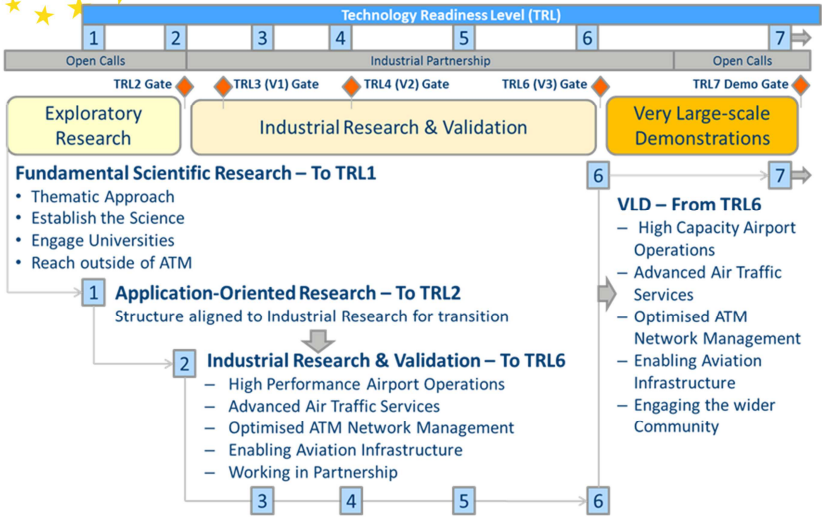

Figure 1: ER and VLD activities within SESAR programme

This call covers demonstration activities, whose general objectives are similar to theVLD ones. As such, the demonstrations will build on mature technologies and will aim at reaching TRL6/7 to de-risk deployment activities.

"The safe integration of all vehicles" in the ATM Master Plan

SESAR is already leading R&I in the field of safe integration of drones in the airspace. It corresponds to align with the need to operate safely in a mixed unmanned/manned aircraft airspace and ATM environment. At the same time, appropriate regulatory and standardisation measures need to be put in place.

In 2012, experts in the field were called upon by the European Commission to develop a European roadmap for the integration of unmanned aircraft (drones), which was officially launched in June 2013. This roadmap identified a step-by-step approach for the safe integration of drones into the non-segregated ATM environment in Europe as of 2016.

The SESAR programme is playing an important role in developing this roadmap, to further research and specifywhat needs to be done to ensure the safe and seamless integration of drones with manned aircraft operations.

The SJU first launched a series of SESAR demonstration activities in which operators, manufacturers, ANSPs and regulatory authorities worked together in real operational environments to identify operational, technological and regulatory gaps. The insights and results from these demonstrations have helped shape the SJU's R&I programme.

In addition, the programme SESAR seeks to leverage developments from other industry sectors with similar infrastructure and relevant technology, such as telecommunications or connected cars in the sector of automotive. Knowing what is on the horizon allows being prepared for technology transfer opportunities and being ready to adapt SESAR R&I activities when needed.

In addition, in 2016, the SESAR JU investigated current and future drone market trends with the aim to develop a 2050 market outlook for drones and their economic impact. The "SESAR European Drones Outlook Study" was made public on 23 November 2016.

This year a partial update of the Master Plan, is conducted so as to reflect and integrate the importance of drones in the SESAR Programme and bring them to a further level of maturity within SESAR 2020 programme.

The U-space concept and its deployment

The demand for drone services is growing fast, with the potential to generate significant economic growth and societal benefits[2], as recognised in the 2015 EU Aviation Strategy[3], and more recently in the 2016 SESAR Drones Outlook Study and Warsaw Declaration on drones[4] which calls for "urgent action on the airspace dimension, in particular the development of the concept of U-space".

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 aims at providing an enabling framework to support routine drone operations, as well as a clear and effective interface to manned aviation, ATM/ANSservice providers and authorities.

Ultimately, U-space is expected to enable complex drone operations with a high degree of automation to take place in all types of operational environments, including urban areas. U-space must 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 and security issues, respecting the privacy of citizens, and minimising impact on the environment.
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. They could include the provision of data, supporting services for drone operators, such as flight planning assistance, and more structured services, such as tracking or capacity management. Three services which will rely on agreed EU standards have already been identified as "foundation services": electronic registration (e-registration), electronic identification (e-identification) and geofencing.

The progressive deployment of U-space is linked to the increasing availability of blocks of services and enabling technologies.

- **U1 - U-space foundation services** provide e-registration, e-identification and geofencing.
- **U2 - U-space initial services** support the management of drone operations and may 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.

Ongoing initiatives linked to the topic of this call

Activities within SESAR programme

[2] SESAR Drone Outlook Study (2016)
[3] http://ec.europa.eu/transport/modes/air/aviation-strategy/innovation
[4] The High Level Conference on 'Drones as a leverage for jobs and new business opportunities' took place 23-24 November 2016 in Warsaw, Poland and concluded with the so-called "Warsaw Declaration".

Eight projects have been awarded under an Exploratory Research RPAS Call in 2016[5]; they are currently in the project initiation phase, and will address some issues and challenges linked to the U-space.

Additional VLD projects are expected to be awarded in Q4 2017 following the open ER/VLD Call[6]also launched in 2016.

Moreover the SESAR JU expects to launch a new VLD call on U-space early 2018. Projects will be awarded before the end of 2018.

The awarded project from this Call shall be aware of these projects, will coordinate with themand leverage as much as possible the intermediate and final results as they become available during its duration.

Activities/initiatives outside SESAR framework

EASA NPA 2017-05 (A) 'Introduction of a regulatory framework for the operation of drones – Unmanned aircraft system operations in the open and specific category'covers some aspects of geofencing, and a dedicated working group on geofencing has been set up.

All of this shall be taken into consideration by the awarded project.

[5] H2020-SESAR-2016-1.
[6] H2020-SESAR-2016-2.

Objectives of the call

General objectives

This call scope focuses solely on an Active Geofencing Service (AGS) and covers a specific Preparatory Action of the European Parliament. It is targeting demonstrations of web-based Geofencing solutions that use location signals to prevent drones from flying in no-fly zones. No-fly zones can be generated, monitored and controlled by the authorities responsible.

The SJU is looking to award 1 project for this purpose, of a maximum duration of 15 months, covering the following scope: **Integrating Remotely Piloted Aircraft Systems (RPAS) in the European airspace using an Active Geofencing Service (AGS)** – which will demonstrate the benefits of an Active Geofencing Service for drones for operations below 150 metres (500 feet) and propose the necessary deployment actions to fully deliver the benefits claimed.

In reference to the SESAR JU Single Programming Document 2017[7], this topic covers Section 3.1.6.

Specific challenges

Drones can endanger airspace users, or threaten people and installations on the ground, by flying in areas where they are not authorized, for example near airports or over sensitive public assets such as nuclear power stations. This can be due to operator error, system malfunction or through deliberate action for nefarious purposes. The challenge of this demonstration is to show how an AGS could reduce the risk of such unauthorized activity, thus increasing the safety and security related to drone operations. The AGS forms one of the Foundation Services (U1) for the implementation of U-space, as defined in the U-space blueprint[8]. It builds on the geofencing capability as described in EASA NPA 2017-05[9].

[7] http://www.sesarju.eu/sites/default/files/documents/adb/2016/SJU%20Single%20Programming%20Document%202017%20vFinal%2014.12.2016.pdf
[8] https://www.sesarju.eu/u-space-blueprint
[9] https://www.easa.europa.eu/document-library/notices-of-proposed-amendment/npa-2017-05

Description of activities

A geofence is a virtual boundary between 2 volumes of airspace, defined by geographical coordinates, altitudes and time. Geofencing is a function that describes a geofence, supports collaborative security and aims at alerting and preventing aerial intrusion into that protected volume. An AGS enables and manages a geofencing function through provision, by a service provider, of current, accurate and updated information that defines the validity and nature of airspace restrictions for which a geofence is required, and where this information is periodically checked on board the drone to prevent unauthorized crossing of the geofence.

Many drone types are now being equipped with a geofencing capability, and some manufacturers also provide access to a supporting geofencing service. It is not in the scope of this demonstration to develop new drone systems or new software packages, but configuration and modification of existing systems may be undertaken to support the specific needs of this Call.

The aim of this demonstration is to demonstrate, in depth, all aspects relevant to providing an AGS for drones flying below 500 feet above ground level using live-flying drones. A web-based platform shall display to the drone operator the geographical extent, time and altitude limits and, where appropriate, classification of relevant geofenced volumes. It shall also show the current location of the drone, and its planned trajectory, in relation to these volumes and shall validate compliance with appropriate rules and regulations. The system shall also alert the drone operator in case of imminent transgression, and support actions preventing the drone from operating against the conditions of the geofenced volume. Where special conditions apply, the service shall also permit authorized drones to cross the geofence, subject to the conditions of that volume.

The platform shall generate geofence boundaries on the basis of nationally-published ‘no-drone zones’, such as surrounding airports, military establishments or nuclear power stations, and in accordance with aviation regulations and other aeronautical information, including more dynamic information such as restricted volumes published in NOTAMs, or created by the emergency services.

‘No-drone zones’ are defined and published by the authorities responsible, and the demonstration shall demonstrate how this information is obtained, validated and passed to the drone operator by the AGS in an accurate and timely fashion, including the provision of updates when information changes. This shall include the active participation of an ANSP or other aeronautical information service provider, as well as demonstration of technical connectivity and operational procedures agreed between the parties. It is clearly not possible to guarantee demonstration of an actual implementation of a geofenced volume created by the emergency services in response to a real emergency, but this capability shall be demonstrated either by inclusion of the emergency services in a live exercise, or by demonstration of a functioning end-to-end information-sharing mechanism, supported by procedures agreed with one or more emergency services.

Applications should include the participation of a minimum of 2 service providers proposing two different AGS solutions and a minimum of 2 drone operators that would operate in the same portion of airspace at the same time. It shall be noted that an AGS provider could also be a drone operator. For further details, please see sections 6 and 8 of the call for proposals.

It shall be possible to classify geofenced zones according to any applicable conditions. A classification system shall be proposed and justified, citing any supporting international activity at creating such classifications. The AGS shall demonstrate how it behaves in the case of each category of geofenced volume.

The AGS must also stipulate the precise mechanism (for example geodetic model and altitude datum) of defining the zone, both on the web-based platform and on board the drone, to ensure coherence between air and ground elements of the system.

The AGS shall define performance indicators in order to assess or quantify, at least the latency, the integrity, the availability and continuity of the service.

With appropriate communication and dissemination actions, the applicants will promote the demonstrations and inform the general public to promote its buy-in.

The demonstration trials shall be conducted with at least 50 drone flights. The flying programme shall include the demonstration of the behavior of drones in all likely situations, including in the case of contingencies, such as link loss. At least the following scenarios shall be demonstrated, showing a quantified analysis of how the system performed during the test flights:

- Prevention of a drone entering a fixed 'no-drone zone';
- Prevention of the drone from entering 'no-drone zones' created by an ANSP or other competent authority;
- Compliance by the drone with conditions of entry, should that drone be authorized to operate within a geofenced volume from which other drones are debarred (This shall include demonstration of the communication mechanisms between operator, service provider and authority, as well as the associated operational procedures);
- Compliance by a drone with rules that contain that drone within a geofenced volume;
- The simultaneous use of several drones of different types (fixed-wing, multi-rotor) and from different drone manufacturers;
- The operations of several drones from different drone operators operating at the same time close to an identified geofenced zone;
- How a flight-planning system could be integrated into the AGS, showing that the route to be defined takes into consideration geofenced volumes, and prevents the definition of a flight that would infringe such volumes;
- Operations in both rural and urban environments;
- Alerts being provided to a drone operator when a drone approaches a geofence including, for example, the definition and operation of buffer zones around geofenced volumes; and
- Behaviour of the drone, with reference to geofenced volumes, in the event of a lost link.

Optionally, the demonstration should show:

- How geofenced data could be updated on the drone during flight;
- If the AIXM standard already used in ATM could be extended to cover the drone operations (protocols and standards for data transfer); and
- How the AGS service provider could monitor the drone trajectory in receipt of this service.

It is important to recognize that, as well as having accurate and timely information on the extent of geofenced volumes, the drone system itself must be able to fly sufficiently accurately. To this end, the accuracy with which the drone can maintain navigation and altitude precision shall be quantified and demonstrated, including any variations possible due to, for example, distance from mobile telephone masts, weather conditions or GNSS performance.

The demonstration shall also address cyber-security, showing how the system protects itself from unauthorized interference to ground and air elements. In addition, the demonstration shall show links to and/or dependencies on other related drone services, such as registration and identification.

The demonstration is encouraged to propose or even demonstrate additional capabilities related to provision of an AGS, especially where this would provide input to the definition of more advanced AGS services, as envisaged by future U-space services.

It would be advantageous to involve EASA and/or the State National Supervisory Authority in the demonstration, in order to promote delivery of a service that is compliant with evolving regulation. Furthermore, the project must liaise with the competent authorities to enable the conduct of the demonstration flights within the current regulatory environment.

There is no need for such authorities to be directly involved in any consortium, but proposals should show how they intend to cooperate with them. In the conclusions to the demonstration report, the project shall make recommendations for standardization and/or regulatory action that may be needed to implement U-space geofencing services.

An AGS will increase the safety of airspace users, as well as the safety and security of people and installations on the ground, by preventing unauthorized flight in sensitive or restricted areas.

The demonstrations shall provide recommendations on standardization and regulatory needs, as well as operational and technical requirements, to support the operational deployment of an AGS as described above.

The demonstration activities shall cover the full demonstration lifecycle. This includes development of the concept of the demonstrations, participation in periodic meetings with the SJU, production of all the documentation related to the demonstration (most notably including the demonstration plan and the demonstration report, as mentioned in section 5), and results dissemination and communication activities.

Project management requirements

Detailed information on the project management and the execution framework is available in Annex IV - Project Execution guidelines for the VLD Geofencing call (SESAR-2017-1).

Acronyms and Terminology

Term	Definition
AGS	Active Geofencing Service
ANS	Air navigation service
ATC	Air traffic Control
ATM	Air traffic management
AIXM	Aeronautical information exchange model
CAA	Civil Aviation Authority
CFS	Certificate on the financial statement
DAA	Detect and avoid
EASA	European Aviation Safety Agency
EC	European Commission
ER	Exploratory Research
EUROCAE	European Organisation for Civil Aviation Equipment
GNSS	Global Navigation Satellite System
ICAO	International Civil Aviation Organization
NAA	National Aviation Authority
NOTAM	Notice to airmen
NPA	Notice of proposed amendments
NSA	National Supervisory Authority
R&I	Research and Innovation
RIA	Research and Innovation Action
RPAS	Remotely Piloted Aicraft Systems
SESAR (2020)	Single European Sky ATM Research Programme (2020)
SJU	SESAR Joint Undertaking
SME	Small and Medium Entreprise
SPD	Single Programming Document
TRL	Technological Readiness Level

VLD	Very Large Scale Demonstrations