SESAR JOINT UNDERTAKING

Single Programming Document 2019-2021

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Abstract

This document is the **third amended version** of the Single Programming Document of the SESAR Joint Undertaking (SESAR JU) for the 2019-2021 period.

It provides multi-annual (2019 to 2021) and annual (2019) programming components and forms the multi-annual and annual work programmes of the SESAR JU. This Single Programming Document replaces the *Single Programming Document 2018-2020* insofar as it refers to the years 2019 and 2020.

FINAL DOCUMENT – THIRD AMENDED VERSION

Founding Members

EUROPEAN UNION EUROCONTROL

SESAR JOINT UNDERTAKING

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Foreword

The SESAR Joint Undertaking (SESAR JU) is a key enabling organisation for the modernisation of European and global air traffic management, and the coordination and concentration of all air traffic management-related research and innovation efforts in the EU.

Since its establishment in 2007, the SESAR JU, together with its Members and partners, has provided a significant return on the original EU investment. It delivers high-performance solutions in accordance with the *European Air Traffic Management Master Plan* and its performance ambition in terms of capacity, cost-efficiency, environmental efficiency and safety. It thus stimulates growth across the aviation sector and generates employment. It also firmly contributes to other tangible societal benefits such as decarbonisation and the reduction of aviation's environmental footprint.

By successfully implementing the SESAR 2020 Programme, the SESAR JU leverages digital technology in air traffic management. It will continue to provide the most efficient way of implementing research and innovation for Europe, further contributing to the delivery of the Single European Sky and the broader EU Aviation Strategy, while providing investors with a sound return on investment. Additionally, the SESAR JU continues to reinforce the role of the EU as a global actor in the field of aviation.

The SESAR JU's *Single Programming Document 2019–2021* (SPD 2019-2021) builds upon previous successes and outlines the ongoing roadmap to the successful implementation of the SESAR 2020 Programme and of the other SESAR JU missions over the next three years. This document describes six strategic areas of operation (the ones already described in the SPD 2018-2020) that the SESAR JU will pursue during the reporting period.

While delivering on its strategic objectives, the SESAR JU will remain committed to strengthening its effective and efficient organisation by continually improving its processes, procedures, performance and risk management, and ICT infrastructure, and by investing in its talented people.

Florian Guillermet

Executive Director

SESAR Joint Undertaking

Document history

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			• Description of the contribution of EUROCONTROL as a Founding Member of the SESAR JU (Section II paragraph 3.2.2.1) and adjustment of the presentation of EUROCONTROL's in-kind contributions from gross to net in table 42, • Alignment of the multi-annual budget figures of the SESAR JU (Section II, paragraph 3.2.2.2; Annexes I and II) with the official EU 2020 draft budget, • Alignment of the IR-VLD Wave 2 call objectives for 2019 with the latest call planning (Section III, chapters 2.3 and 2.4), • Inclusion of planned activities related to the reinforcement of the SESAR JU's financial management system (Section III, paragraph 2.6.2; Annex X), • Addition of the column for 'Modifications in year N+1 in application of flexibility rule' in the Staff Establishment Plan; alignment of the number of posts: for 2019 with the adopted EU 2019 budget; for 2020 with the updated 2020 budget request of the SESAR JU and for 2021 with the latest available forecasts (Annex III, Table 2), • Minor editorial and non-substantial adjustments of the text, figures and tables throughout the document.
04.00	26/07/2019	Approved	Adoption of the third amended version related to the modifications listed in the previous document history entry (for edition 03.01).

List of acronyms and definitions

Acronym	Long name/definition
4D	four-dimension
ABAC	accrual-based accounting
ACAS	Airborne Collision Avoidance System
ADB	Administrative Board
ADS-B	automatic dependent surveillance — broadcast
ADS-C	automatic dependent surveillance — contract
AeroMACS	Aeronautical Mobile Airport Communications System
A/G	air/ground
AI	artificial intelligence
AIM	aeronautical information management
AMAN	arrival management
AMQP	advanced message queuing protocol
ANSP	air navigation service provider
A-PNT	alternative position, navigation and timing
AR	assigned revenue
ASBU	aviation system block upgrade
ATC	air traffic control
ATFCM	air traffic flow and capacity management
ATM	air traffic management
ATN	aeronautical telecommunication network
ATS	air traffic services
ATSU	Air Traffic System Unit
AU	airspace users (civil)
BVLOS	beyond visual line of sight
CA	contractual agent
CCO	continuous climb operations

CDO	continuous descent operations
CDTI	cockpit display of traffic information
CEF	Connecting Europe Facility
CNS	communication, navigation and surveillance
Conops	Concept of operations
CSA	coordination and support action
DART	data-driven aircraft trajectory
DCB	demand and capacity balancing
DFMC	dual-frequency multi-constellation
DMAN	departure management
DMSC	Delivery Management Sub-Committee (see definition in Section II, Paragraph 2.1.5.3)
DME	distance measurement equipment
EASA	European Union Aviation Safety Agency
EDA	European Defence Agency
E-OCVM	European operational concept validation methodology
E-TMA	extended TMA (terminal manoeuvring area)
EATMA	European ATM (air traffic management) architecture
eFPL	extended flight plan (flight and flow information for the collaborative environment/flight information exchange model-based flight plan)
EGNOS	European Geostationary Navigation Overlay Service
ER	exploratory research
EU	European Union
EUR	Euro (currency)
EUROCAE	European Organisation for Civil Aviation Equipment
FAA	US Federal Aviation Administration
FCI	future communication infrastructure
FIS-B	flight information service — Broadcast
Flightpath 2050	report of the High Level Group (HLG) on Aviation and Aeronautics Research established by the European Commission in December 2010, setting out a new vision for the aviation sector by 2050

GA	general aviation
GA/R	general aviation and rotorcraft
GANP	global air navigation plan (from the International Civil Aviation Organisation)
GAP	Grant Agreement Phase
GAST	GBAS approach service type (of different types GAST-C, GAST-D, GAST-F)
GBAS	Ground-Based Augmentation System
G/G	ground/ground
GNSS	global navigation satellite system
GSA	European GNSS Agency
H2020	Horizon 2020 framework programme
HMI	human–machine interface
IA	innovation action
IAS	Internal Audit Service of the European Commission
ICAO	International Civil Aviation Organisation
ICT	information and communication technologies
IFR	instrument flight rules
IGS	increased glide slope
INAP	integrated network management and extended ATC (air traffic control) planning function
IOP	interoperability
IPS	internet protocol suite
IR	industrial research and validation
JU	joint undertaking
KTN	Knowledge Network Transfer
L-DACS	L-band Digital Aeronautical Communications System
LPV	localiser performance with vertical guidance
LVC	low visibility conditions
MAWP	multiannual work programme of the SESAR 2020 Programme, as adopted by the SESAR JU Administrative Board through decision ADB(D)05-2015
MC/MF	multi constellation/multi frequency

Members	Two founding members (the European Union and EUROCONTROL) and 19 stakeholder members, of which all apart from the EU are signatory to a membership agreement or accession agreement
MET	meteorological/meteorology
MGA	SESAR JU Model Grant Agreement
MoC	memorandum of cooperation
MPC	ATM Master Planning Committee (see definition in Section II, Paragraph 2.1.5.4)
MSP	multi-sector planner
MUAC	The Maastricht Upper Area Control Centre
NAA	National Aviation Authorities
NM	network manager
NMf	network management function (organised as integrated regional/subregional/local layers and supporting collaborative network management)
NMOC	network manager operations centre
NOP	network operations plan
OSI	open systems interconnection
OTSC	Operations and Technical Sub-Committee (see definition in Section II, Paragraph 2.1.5.3)
PC	Programme Committee (see definition in Section II, Paragraph 2.1.5.3)
PCP	pilot common project
PinS	point in space
PWS	pairwise separation
R & D	research and development
R & I	research and innovation
RBT	reference business trajectory
RIA	research and innovation action
RNP	required navigation performance
ROT	runway occupancy time
RPAS	Remotely Piloted Aircraft System
RSP	required surveillance performance
SBAS	Satellite-Based Augmentation System

SC	The Scientific Committee (see definition in Section II, Paragraph 2.1.5.5)
SE	system engineering
SES	single European sky
SESAR	Single European Sky ATM (Air Traffic Management) Research
SESAR 2020	The SESAR 2020 research and innovation programme, also referred to as the SESAR 2020 Programme or SESAR 2020 R & I Programme It is the coordinated set of activities described in this document and being undertaken by the members and managed by the SESAR JU
SESAR JU	Single European Sky Air Traffic Management Research Joint Undertaking
SMO	standard-making organisation
SNE	seconded national expert
SNI	simultaneous non-interfering
SWIM	system wide information management
TA	temporary agent
TBO	trajectory-based operations
TMA	terminal manoeuvring area
TRL	technology readiness level
UAS	unmanned aerial system
UDPP	user-driven prioritisation process
U-space	A set of new services relying on a high level of digitalisation and automation of functions and specific procedures designed to support safe, efficient and secure access to airspace for a large numbers of drones, with an initial look at very low-level (VLL) operations
UTM	unmanned traffic management
VFR	visual flight rules
VLD	very large-scale demonstration
VLL	very low-level
VLOS	visual line of sight
WOC	wing operations centre

Table 1: List of acronyms

Mission Statement

The mission of the Single European Sky Air Traffic Management Research Joint Undertaking (SESAR JU), created under Article 171 of the Treaty establishing the European Community[1], is to develop a modernised air traffic management (ATM) system for Europe, which will prevent crippling congestion of the European sky and reduce the environmental impact of air transport. Established in 2007 as a joint undertaking (JU)[2], the SESAR JU is responsible for the modernisation of the European ATM system by coordinating and concentrating all ATM-relevant research and innovation (R & I) efforts in the EU. It aims to develop the next generation of ATM system capable of ensuring the safety and fluidity of air transport worldwide over the next 30 years. The SESAR JU is also responsible for ensuring international collaboration on ATM modernisation, under the principles established by the European Union.

Founded by the European Union and EUROCONTROL, in 2009 the SESAR JU became a Community Body. It was augmented by 15 stakeholder Members and then in 2016 a further four members acceded to membership, all committing to further achieve the mission of the JU to 2024. Together with their partners and affiliate associations, the Members represent over 100 organisations from across the ATM community, from civil and military air navigation service providers (ANSPs), to airports, civil and military airspace users (AUs), staff associations, academia and research centres. Through these partnerships and further collaboration with staff associations, regulators and the larger scientific community, the SESAR JU unites the skills of some 3.000+ experts to fast-track research leading to change in European ATM in accordance with a Master Plan, aligned with the EU Aviation Strategy and in accordance with the Single European Sky (SES) regulation.

As an integral part of the SESAR project, the SESAR JU is the technological pillar of the SES policy and contributes to SES targets by defining, developing and validating innovative technological and operational solutions for managing air traffic in a more efficient manner. With an initial budget of EUR 2,1 billion of which EUR 700 million was from the EU[3] (up to 2016), the SESAR JU was then extended with an additional approximately EUR 1,6 billion of which EUR 596,3 million is from the EU[4] (up to 2024). Since 2007, the SESAR JU has established a contiguous research 'pipeline to innovation', comprising of three distinct strands of activities with the aim of seeing a flow of R & I activities meeting stakeholder needs and citizen expectations: Exploratory Research (ER), Industrial Research and

[1] Now Article 187 of the Treaty on the Functioning of the European Union (TFEU) following entry into force of the Treaty of Lisbon which amended the Treaty on European Union and the Treaty establishing the European Community on 1 December 2009

[2] The SESAR JU was established under Council Regulation (EC) 219/2007 of 27 February 2007 (as modified by Council Regulation (EC) 1361 / 2008 (SESAR JU Regulation) and last amended by the Council Regulation (EU) 721/2014)

[3] The EU contribution of EUR 700 million up to 2016 was established for EUR 350 million under FP7 (the 7th EU Framework Programme for Research and Innovation) and TEN-T (the EU programme for the upgrade of transport infrastructure)

[4] The EU contribution of EUR 585 million up to 2024 is established under the Horizon 2020 programme.

In addition, following the delegation agreement EC/SESAR JU ref. MOVE/E3/DA/2016-669/SI2.743803 signed on 06/12/2016, SESAR JU has been entrusted in 2016 the implementation of an action 'Integrating remotely piloted aircraft systems (RPAS) in European airspace with and active geo-fencing service (AGS)' and received EUR 500 000 on budget line 06.027712 (see Section II, Paragraph 3.2.1)

Furthermore, the SESAR JU has been mandated by the European Commission to procure a study to develop a proposal for the future architecture of the European airspace (delegation agreement EC/SESAR JU ref. MOVE/E3/DA/2017-477/SI2.766828 signed on 10/11/2017), with a delegated budget of EUR 800 000

The European Commission has given an additional mandate to the SESAR JU to organise U-space demonstrations, through delegation agreement EC/SESAR JU ref. MOVE/E3/DA/2017-564/si2.771010 signed on 13/12/2016 with a delegated budget of EUR 10 million from the Connecting Europe Facility (CEF) fund

Validation (IR), and Very Large-Scale Demonstrations (VLDs). These activities are carried out in line with the European ATM Master Plan – the main planning tool for ATM modernisation in Europe – which the SESAR JU is responsible for maintaining.

The SESAR JU is linked to the European Commission's Mobility and Transport policy and makes a positive contribution to the mission expressed in terms of Decarbonisation, Digitalisation, Investment and People objectives.

In addition, the SESAR JU operates in close coordination with other European organisations with direct links to the SESAR Project, including the European Union Aviation Safety Agency (EASA) and the SESAR Deployment Manager.

Section I – General Context

1 High-level policy objectives: achieving the EU Aviation Strategy

In December 2015, the publication of *An Aviation Strategy for Europe* (the EU Aviation Strategy)[5] provided additional focus and momentum towards completion of the SES to generate growth for European economy, foster innovation and allow passengers to profit from safer, cleaner and cheaper flights, while offering more connections. The Strategy contributes directly to the European Commission's priorities of Jobs and Growth, the Digital Single Market, Energy Union and the EU as a global actor with the published strategy containing many explicit references to the SESAR project and to the SESAR JU.

The Aviation Strategy poses challenges and enablers as represented in the figure below.

Figure 1: Key infographics from 'An Aviation Strategy for Europe'

In this framework, the SESAR JU acknowledges the objectives for the modernisation of ATM. To this end, SESAR also remains a flagship project identified within the European Commission's 'Flightpath 2050', a roadmap for the provision of a clean, competitive, safe and secure European aviation industry. SESAR's positive contribution to meeting the needs of citizens, and markets and to maintaining a competitive advantage for Europe is key to the continued successful evolution of ATM.

[5] http://ec.europa.eu/transport/modes/air/aviation-strategy

Within the SES legislative framework, the SESAR JU contributes to achieving the SES's High-Level Goals formulated in 2005 with a vision to deliver the following performance improvements by 2035:

- enable a three-fold increase in capacity which will also reduce delays both on the ground and in the air;
- improve safety by a factor of 10;
- enable a 10 % reduction in the environmental impact of flights;
- reduce the cost per flight by 50 %.

The SESAR JU transfers the result of its ATM research and innovation activities in the form of SESAR Solutions[6] made available for deployment, and therefore makes a positive contribution to the achievement of the SES as well as the wider ambition of FlightPath2050 and the EU Aviation Strategy. The contribution of the SESAR Programme to achieving the SES4s High-Level Goals, as reformulated under the SESAR performance ambitions in 2012, appears in Figure 4 later in this document.

2 Drivers shaping the European aviation landscape: targets for air traffic management

Aviation, in particular air transport supported by ATM, is a key driver of EU economic growth, jobs and trade, and essential for the life and mobility of its citizens. However, the current ATM system is still highly fragmented and largely reliant on ageing technology, leading to inefficiencies of EUR 4 billion annually. The role of the SESAR JU, in steering the SESAR R&I programme, is to define and develop solutions that meet what is needed and build a more connected, greener, safer ATM system, as well as ensuring that the latter is standardised as needed and made globally interoperable.

This work is undertaken through the SESAR R & I programme (called 'the SESAR 2020 Programme' for the period from 2015 to 2022), coordinated by the SESAR JU and performed by the industry at large. The activities performed by the industry are funded mostly through the Horizon 2020 Framework Programme (H2020), which means that the SESAR JU operates in accordance with H2020 rules and processes, adapted for use by partnerships, for all its activities relating to the awarding and management of these grants. The European Commission also grants the SESAR JU with additional tasks under a variety of legislative frameworks; all of the activities are integrated into the SESAR 2020 Programme.

Besides the role of technology and innovation, the EU Aviation Strategy also recognises the need to secure Europe's leading role in international aviation. To this end, the SESAR JU also works closely with the European Commission and EUROCONTROL on building and executing a coordinated plan of action involving non-EU countries and the international aviation body known as the International Civil Aviation Organisation (ICAO).

[6] SESAR Solutions are referred to as 'Candidate SESAR Solutions' as long as they are under development in the Industrial Research phase of the SESAR innovation pipeline (see figure 3). Once validated at V3 level of maturity, they are packaged and referred to as 'SESAR Solutions'

The challenges for ATM are captured and maintained in a European ATM Master Plan (currently 2015 Edition[7]) – this forming the main planning tool for ATM modernisation in Europe. Some of these challenges and solutions are described below.

The **number of flights increased** by 80% between 1990 and 2014, and this figure is forecast to grow by a further 45% between 2014 and 2035. Although slower than previously expected, the increase in traffic will still place pressure on an already congested network, which is facing saturation. Up to August 2018, this saturation produced an average delay of over two minutes per flight (four times the performance target set for Reference Period 2)[8] and the latest version of the Network Operations Plan (NOP) of the Network Manager (NM) projects an even poorer delay performance than the previous edition, emphasising the gravity of the situation. The situation calls for the introduction of additional automated tools and revised data communications that enable improved ANS operations productivity, thereby increasing the available en-route capacity and handling more traffic in a safer way. Airports are also reaching saturation with this growth and require solutions to help maximise their capacity in all weather conditions, such as satellite-based tools for accurate navigation and landing (e.g. Galileo and the European Geostationary Navigation Overlay Service (EGNOS), the adoption of which can be further accelerated).

The **European economic recovery remains relatively slow in some EU Member States**, which challenges the aviation and ATM industries to increase their productivity, sustainability and competitive edge. Technology and innovation are key enablers, allowing for medium-term development of leaner and more modular systems that are easier to upgrade and more interoperable with each other. Virtualised control centres and use of remote towers will also allow for a more efficient and flexible use of resources, substantially improving the cost-efficiency of service provision and relieving congested airspace.

To these well-known challenges, driving manned aviation efforts towards step changes in ATM performance, should be added the latest, rapid and substantial challenges created by the need to successfully carry out the digital transformation of aviation so as to create a 'Digital Sky', supported by a high degree of automation, connectivity and virtualisation of services. This new ambition setting new targets for ATM consists of a number of elements, which are summarised in the following paragraphs.

Drones are rapidly changing the landscape of aviation and this change is happening at a speed and on a scale that have never been seen before. Clear standards and low-cost system solutions which support interoperability (IOP) will allow the integration of drones alongside other AUs in an efficient manner, while also ensuring safety and security (e.g. via geo-fencing, where EGNOS/Galileo specific services can bring added value). The drone market is steadily growing and is poised to generate significant economic growth and societal benefits. The challenge will be to create a framework that will facilitate this growth, while at the same time handling the increased drone traffic safely, efficiently and securely: this challenge is covered by the notion of U-space[9].

[7] In 2018, the European ATM Master Plan is under revision and there will be a new edition of it in early 2019 – see Section II, Paragraph 2.2.1 and Section III, Paragraph 2.1.2

[8] Source: report of the Performance Review Body of the Single European Sky *PRB Advice to the Commission in the setting of Union-wide performance targets for RP3* (final report dated 30 September 2018)

[9] See Warsaw declaration, calling for a number of well-coordinated actions to develop the EU drone ecosystem. This declaration was followed by the development of the U-space blueprint by the SESAR JU, a document which sets out the vision for U-space

Increased connectivity and digital information exchange in ATM can also increase the risk of cyber-attacks. This requires innovative solutions to protect critical information systems and to ensure that secure data exchanges allow stakeholders to collaborate effectively and reliably.

Automation and Artificial Intelligence (AI): in order to increase the capacity and the performance of the overall system, automation levels will need to increase for both air traffic and flight operations. In this way, supporting the use and development of automation technologies in aviation is one of SESAR JU's priorities.

A **new ecosystem for aviation** is taking shape, which forms an opportunity to strengthen the alignment between the priorities of the EU Aviation Strategy and the EU's aviation research and innovation. Embracing a new era through innovation and digital technologies is highlighted as a key area for action in the Strategy. This evolution will be characterised by more autonomous transport and the digitalisation of the enabling infrastructure that will be based on data processing and services[10]. The traffic management operations will evolve from a vertical integration to horizontal integration with common attributes such as performance levels and resilience, relying on those secured digital services, ensuring aviation's integration into a multi-modal mobility network based on a 'digital journey' concept supported by cyber-secured information management technology and a digital market ecosystem. SESAR is already identifying six key functionalities to enable this evolution:

- **Higher levels of autonomy and connectivity** of all aircrafts coupled with a smarter, more automated management of traffic, and enabled by an 'intranet of flight';
- **Mobile, terrestrial and satellite-based communications**, which are used to provide real-time vehicle trajectory information, shared between vehicles and with the ground infrastructure;
- **Cyber-secured digital and automated tools** provided on board the air vehicle itself, or as part of the ground-based infrastructure;
- **Virtual technologies** to decouple the physical infrastructure such as sensors, communication or navigation devices from the services that are provided to manage the airspace;
- High-tech **video, synthetic and enhanced sensor technologies** to operate air traffic services for airports or to enable aircraft to land in low-visibility conditions;
- **Big data analytics and open source data usage** to encourage the creation of new services and to allow for better flight planning, airport operations and increased predictability of the overall traffic;
- **System flexibility** to handle the increasing number of air vehicles, such as drones;
- **Traffic management digital services** to handle the increasing number of air vehicles, such as drones in the U-space context.

Furthermore, in the coming years, European citizens will live in smart cities, travelling door-to-door using green autonomous vehicles and communicating with smart devices. Aviation is very much part of this intelligent transport system and will have to rely on technological advances to transform its services and enable seamless travel and transport for all.

The evolution of aviation towards digital can be depicted in the following figure:

[10] This evolution towards the digitalisation of transport was highlighted by the European Commission in the Digital Transport Days Declaration of 10/11/2017

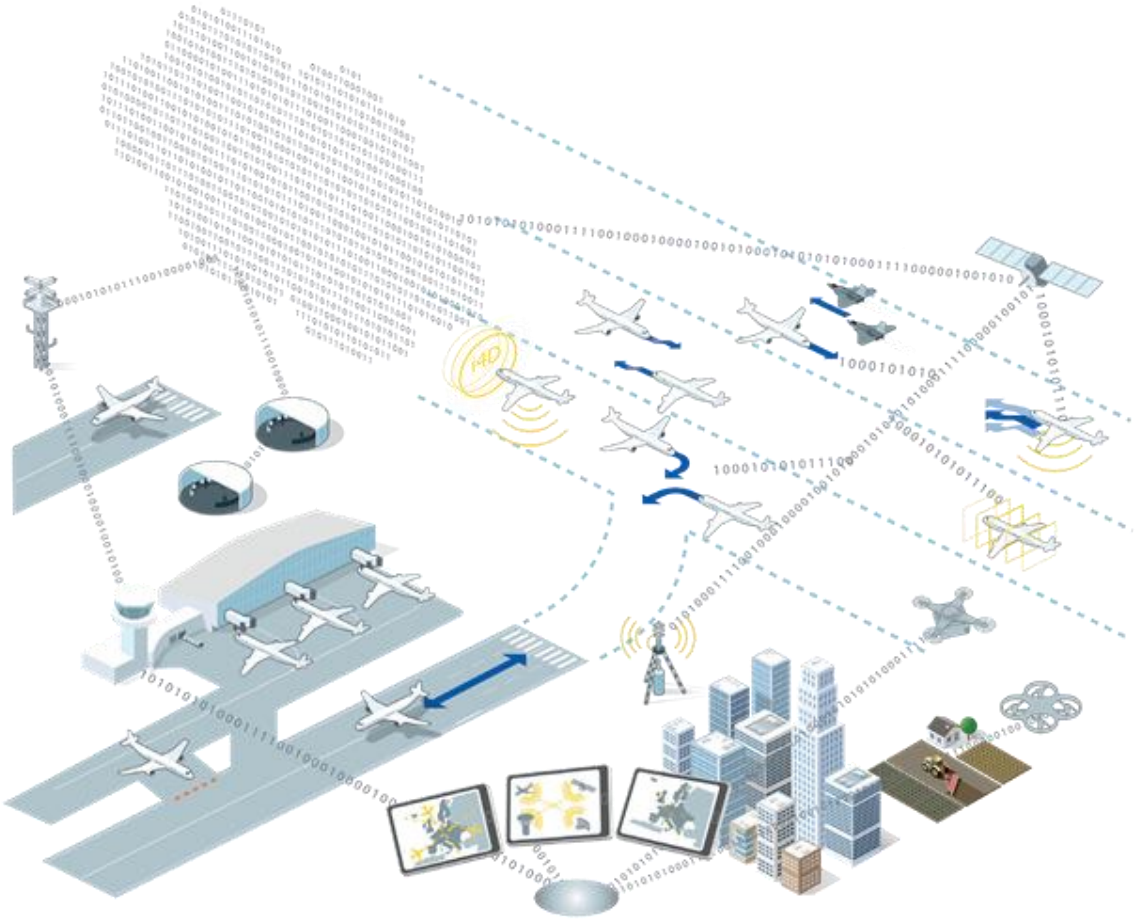

Figure 2: A new ecosystem for aviation

Section II – Multi-annual programming 2019 – 2021

This section provides stakeholders with a general overview of the activities planned by the SESAR JU in order to fully execute its mandate and deliver its long-term strategy. It is structured around the multi-annual objectives for the period from 2019 to 2021 that reflect the mandate of the SESAR JU and its priorities. This section is updated on an annual basis as a rolling plan, giving due consideration of the EU frameworks the SESAR JU operates within. It replaces the Single Programming Document 2018-2020 insofar as it refers to the years 2019 and 2020.

1 Multi-annual objectives

1.1 The SESAR innovation pipeline

The second SESAR R&I programme (SESAR 2020 Programme) is structured in three main R & I phases that aim to deliver a pipeline of innovation, which matures operational and technology solutions through the European Operational Concept Validation Methodology (E-OCVM), a well-established control and monitoring process linked to the technology readiness level (TRL).

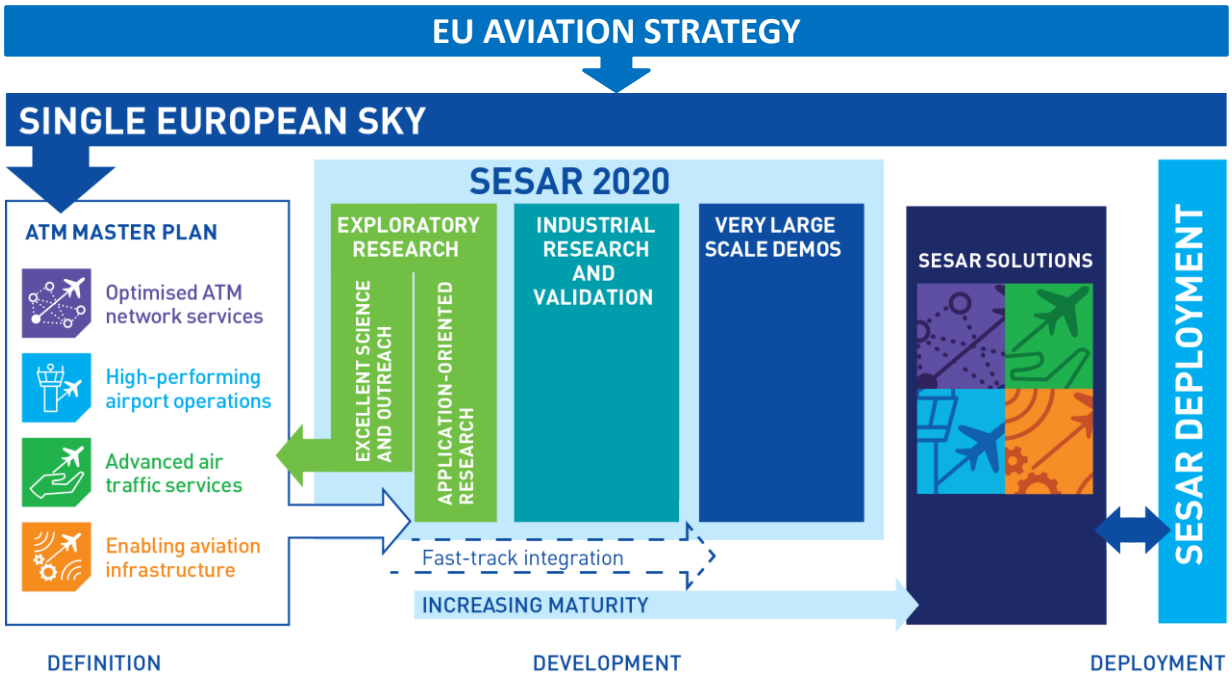

Figure 3: SESAR's innovation pipeline – from the EU Aviation Strategy to SESAR Solutions

This pipeline starts with the EU Aviation Strategy and the SES objectives (see Chapter 1) which feed into the European ATM Master Plan, the main planning tool defining the ATM modernisation roadmap and priorities maintained and updated on a regular basis. Exploratory Research (ER) addresses both transversal topics for future ATM evolution and application-oriented research. According to the four Key Features defined in the Master Plan, it is then expanded with contributions from the SESAR JU Members that undertake Industrial Research and Validation (IR). As per the European ATM Master Plan, this will ultimately deliver results in the form of SESAR Solutions that will contribute to firmly

establishing the performance benefits in preparation for deployment. The SESAR JU then further exploits the benefits of the partnership in demonstrating on a large scale the concepts and technologies in representative environments (VLD for Very Large-Scale Demonstration activities). In some cases, for instance where technology is mature in sectors other than ATM, fast-track integration from Application-Oriented Research to Demonstration activities is possible.

1.2 The four SESAR Key Features

In the European ATM Master Plan, SESAR Solutions have been categorised according to four key areas of ATM (Key Features), which form a coherent way to present the solutions over the time span of the multi-annual work programme (MAWP) and across all ATM in Europe as explained in Section II, Chapter 2 and in Section III of this document.

High-performing airport operations

The future European ATM system relies on the full integration of airports as nodes into the network. This implies enhanced airport operations, ensuring a seamless process through collaborative decision-making, in normal conditions, and through the further development of collaborative recovery procedures in adverse conditions. In this context, this Feature mainly addresses the need for increased airport capacity through the enhancement of runway throughput, integrated surface management, total airport management and airport safety nets.

Advanced air traffic services

The future European ATM system will be characterised by advanced service provision, underpinned by the development of automation tools to support controllers in routine tasks, making it possible to better address the traffic demand with increased en-route available capacity. The Feature reflects this move towards further automation with activities addressing enhanced arrivals and departures, separation management, enhanced air and ground safety nets and trajectory and performance-based free routing.

Optimised ATM network services

An optimised ATM network must be robust and resilient to a whole range of disruptions, including meteorological and unplanned events relying on a dynamic and collaborative mechanism. This will allow for a common, updated, consistent and accurate plan that provides reference information to all planning and executing ATM actors. This makes it possible to better consider the expected traffic demand in advance with the aim of making the required en-route capacity available. It also makes it possible to link the en-route and airport plans and capabilities to consider traffic demand from gate to gate and optimise the network capacity accordingly.

This feature includes activities in the areas of advanced airspace management, advanced dynamic capacity balancing (DCB) and optimised AU operations, as well as optimised ATM network management through a fully integrated NOP and airport operations plans via system-wide information management (SWIM).

Enabling aviation infrastructure

The enhancements described in the first three Key Features will be underpinned by an advanced, integrated and rationalised aviation infrastructure, providing the required technical capabilities in a resource-efficient manner. This feature will rely on enhanced integration and interfacing between aircraft and ground systems, communications, navigation and surveillance (CNS) systems, SWIM, trajectory management and Common Support Services. Furthermore, the safe integration of drones in all categories of airspace and the development of U-space is a new policy priority which is reflected in the dedicated addendum to the Master Plan delivered in 2017[11] and in a dedicated call for proposals organised by the SESAR JU in 2018 (see Paragraph 2.5 in this section and Section III, Paragraph 2.4).

1.3 The European Master Plan performance framework

The SESAR JU results in the 2019-2021 period will continue to contribute to the achievement of the SES and the European ATM Master Plan vision and ambition across the six main performance areas illustrated below.

Figure 4: Six performance areas of the Single European Sky[12]

The realisation of the SESAR vision will not only bring significant direct and quantifiable performance gains to ATM, air transport and aviation, but is also expected to deliver wider benefits for the EU economy and society in general. It is estimated that cost savings and the value of all performance benefits presented in figure 4 would amount to recurring benefits ranging from EUR 8 billion to EUR 15 billion per year by 2035 (source: *European ATM Master Plan*, 2015 edition) compared to a baseline where SESAR would not be deployed.

[11] *European ATM Master Plan: Roadmap for the safe integration of drones into all classes of operations*. This document is available on the SESAR JU website

[12] Source: *European ATM Master Plan:*, edition 2015 (performance improvement ambitions are baselined against the situation in 2012)

1.4 SESAR delivery: Upgrade phases of the European air traffic management system

The delivery of these results in the form of SESAR Solutions as defined above in Paragraph 1.1 will contribute to the various phases, which are depicted in the figure below, of the upgrade of the ATM system as outlined in the Master Plan:

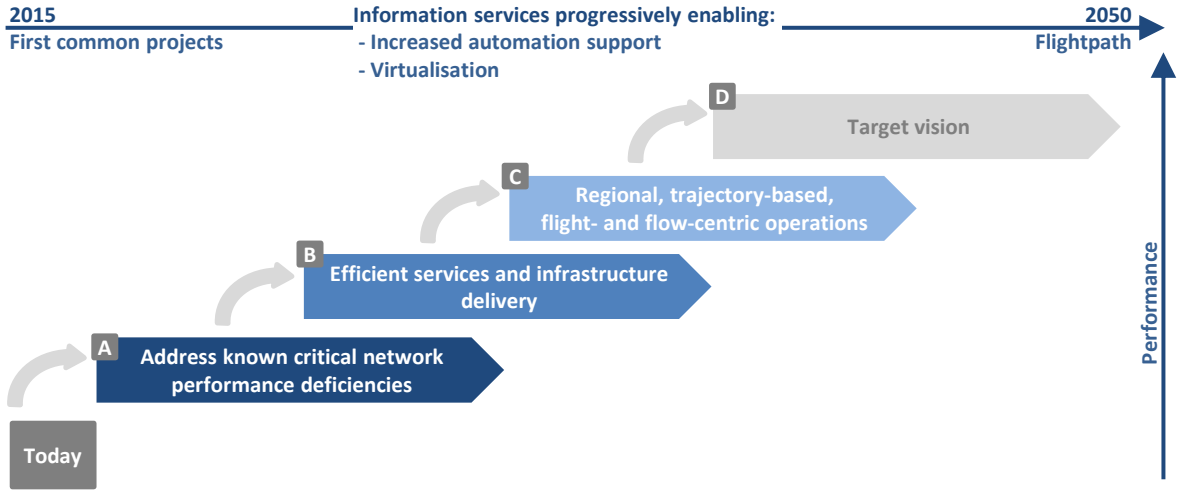

Figure 5: European ATM system upgrade phases as per ATM Master Plan

Until 2018, the primary objective of the SESAR Solutions delivered was to contribute to phases A & B, while preparing the ground for those Solutions that will be further developed in the next period. From 2019 to 2022, driven by the 2019 update of the ATM Master Plan and building on the results of Wave 1 and the Exploratory Research outcome, candidate SESAR Solutions will be delivered under Wave 2 of the SESAR 2020 Programme. A mix of these will be further developed up to pre-industrialisation (V3 or TRL6 then recognising SESAR Solutions, covering phase C) in continuation of those delivered under Wave 1, and will bring new topics with new concepts developed within the Exploratory Research projects. For the latter, development may be required beyond SESAR 2020 for the further maturation of the scientific and technical challenges of the SESAR Target Vision (phase D).

Section II, Chapter 2.4 provides the list of candidate SESAR Solutions under development as well as their contribution to the European ATM system upgrade phases and to the Performance Areas of the Single European Sky.

2 Multi-annual programme

2.1 Introduction

The SESAR JU's multi-annual programme aims for the continued effective delivery of the SESAR 2020 R&I programme. As outlined in the SESAR JU's multi-annual work programme (MAWP) adopted by the SESAR JU Administrative Board (ADB) in July 2015[13], the SESAR 2020 Programme has been designed to encourage the implementation of the SESAR innovation pipeline outlined in Chapter 1.1.

This chapter provides information on the Strategic Areas of Operation according to which the SESAR JU MAWP is established. In the following paragraphs, each Strategic Area of Operation is then described in terms of its activities, source and structure of funding and governance. This structure also allows for the reporting provided during the year at the ADB level and ultimately in the Consolidated Annual Activity Report.

2.1.1 Six Strategic Areas of Operation

In continuity with the plan established in 2018 and building on the structure of the SESAR 2020 Programme set out in the MAWP, the six Strategic Areas of Operation each constitute a strategic objective the SESAR JU will follow in the period from 2019 to 2021:

- Strategic Area of Operation **#1 – Provide Strategic Steering for the SESAR programme**: the SESAR JU will continue to provide strategic steering for the SESAR R&I programme in particular through the link with the SES policy framework and the maintenance of the European ATM Master Plan, and the provision of guidance on the SESAR concept, architecture and performance. This strategic area of operation is described in more detail in Chapter 2.2 in this section, and in Section III, Chapter 2.1;
- Strategic Area of Operation **#2 – Deliver Exploratory Research**: within the pipeline for innovation (see figure 3 in Paragraph 1.1 above), the first phase concerns Exploratory Research (ER), further categorised into those elements/projects dealing with relevant fundamental scientific subjects (Excellent Science & Outreach) and those which investigate the initial applications of such science for the ATM sector (Application-oriented research). This strategic area of operation is described in more detail in Chapter 2.3 in this section, and in Section III, Chapter 2.2;
- Strategic Area of Operation **#3 – Deliver Industrial Research & Validation**: the second phase of the pipeline for innovation is the Industrial Research & Validation (IR) phase which includes applied research, pre-industrial development and validation projects, and is delivered by the Members of the SESAR JU. This phase is further split into two waves: Wave 1 covering the 2016-2019 period and Wave 2 (to be launched in 2019) to cover the period currently planned from 2019 to 2022. It aims for the progressive delivery of a number of specific operational or technical improvements – candidate SESAR Solutions – systematically validated to support a decision on their individual implementation and/or synchronised deployment. Wave 1 and Wave 2 together allow the ambitions of the Master Plan to be covered for the Development phase.
  Chapter 2.4 in this section and Chapter 2.3 in Section III describe this strategic area of operation in more detail;

[13] The multi-annual work programme was adopted by the Administrative Board in 2015 (decision ADB(D)-05-2015)

- Strategic Area of Operation **#4 – Deliver Very Large-Scale Demonstration activities**: the third phase of the pipeline for innovation deals with Very Large-Scale Demonstrations (VLDs) which are designed as demonstrations of particular programme concept elements and SESAR Solutions. These demonstrations bridge the gap between the development and deployment phases of SESAR and are delivered through work undertaken by SESAR JU Members, supplemented by open calls for proposals to ensure the widest possible stakeholder participation.
    - In some cases, results of Application–oriented Exploratory Research can be passed on to the third phase 'VLD activities' directly; this is particularly the case when a technology is mature in sectors other than ATM and when the focus is more on the adaptation of that mature technology for ATM than on developing the technology (for instance activities related to U-space in the annual work programme section).

  This strategic area of operation is described in more detail in Chapter 2.5 in this section and in Section III, Chapter 2.4;
- Strategic Area of Operation **#5 – Deliver SESAR Outreach**: in addition to the continued steering and delivery of the ATM Master Plan and SESAR Solutions, the SESAR JU ensures the global outreach of the results achieved in the SESAR 2020 Programme, in full coordination with the European Commission and EUROCONTROL. This strategic area of operation is described in Chapter 2.6 in this section and in Section III, Chapter 2.5;
- Strategic Area of Operation **#6 – Deliver effective financial, administrative and corporate management**: the SESAR JU must ensure that it operates fully in accordance with its obligations, while also striving to continually improve its financial, administrative and corporate management as these elements of the SESAR JU's operations remain integral to the delivery of its mission and values. This area also addresses the follow-up of audit recommendations and is outlined in further detail in Chapter 2.7 in this section and in Section III, Chapter 2.6.

2.1.2 Research topics to be addressed within the 'innovation pipeline'

Within the 'innovation pipeline', the activities of the SESAR JU and its Members as well as other Programme participants are designed to cover the full spectrum of the research topics to be addressed by the SESAR 2020 Programme, which, in its current state, is depicted in the following figure. Based on the initial description established as part of the SESAR 2020 MAWP in 2015, the SESAR JU constantly maintains this structure. It is expected that ATM Master Plan maintenance, and in particular the Master Plan update campaign carried out in the 2018-2019 period, may result in refinements of the structure of research topics.

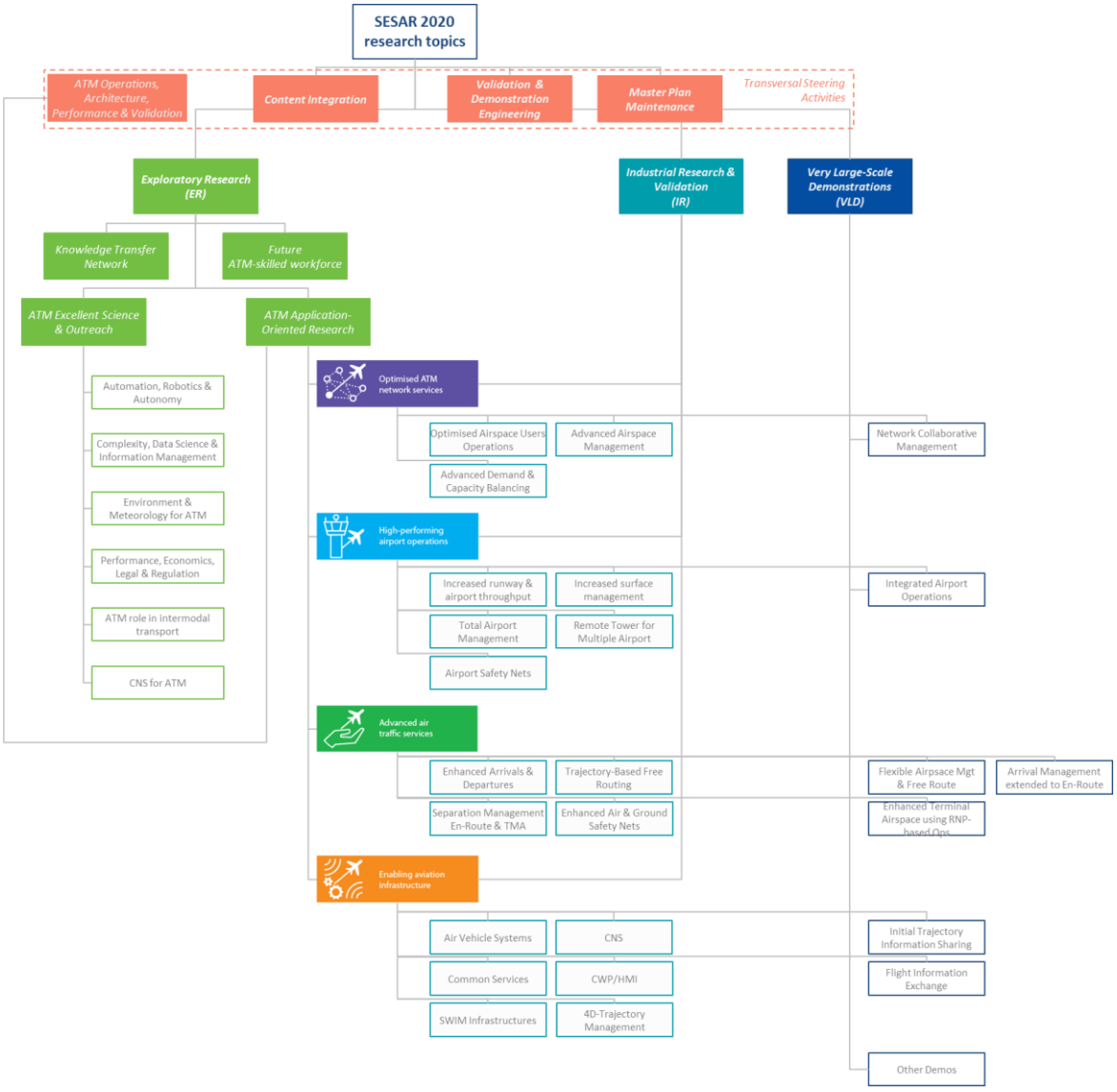

Figure 6: Structure of research topics covered by the SESAR 2020 Programme (as of the beginning of 2019)

Furthermore, in addition to the activities mapped out in the figure above, in 2017[14], the European Commission entrusted the SESAR JU with the management of U-space related activities at the EU level.

[14] Letter from the European Commission to the Members of the Administrative Board of the SESAR Joint Undertaking dated 26/07/2007 with reference MOVE.DDG2.E3/OV – nd/ Ares(2017)

2.1.3 Funding the 'innovation pipeline'

The SESAR JU receives funds from the EU that vary in origin in order to execute the SESAR 2020 Programme. These funds have been delegated to the SESAR JU under four different legal frameworks, namely Horizon 2020, the Connecting Europe Facility (CEF) and two types of assigned revenues, each referring to the execution of grants (following calls for proposals) or studies (following calls for tender). The three phases of the pipeline and the steering of the programme will be delivered using this variety of instruments: Exploratory Research and part of the Very Large Scale Demonstrations being secured using open Calls for proposals, and the Industrial Research & Validation and remaining part of Very Large Scale Demonstration using Calls restricted to Members of the SESAR JU.

The relationship between the various programme phases of the SESAR 2020 Programme and the various Call activities is outlined in the following figure and is described in more detail in Chapters 2.2 to 2.5 of this section.

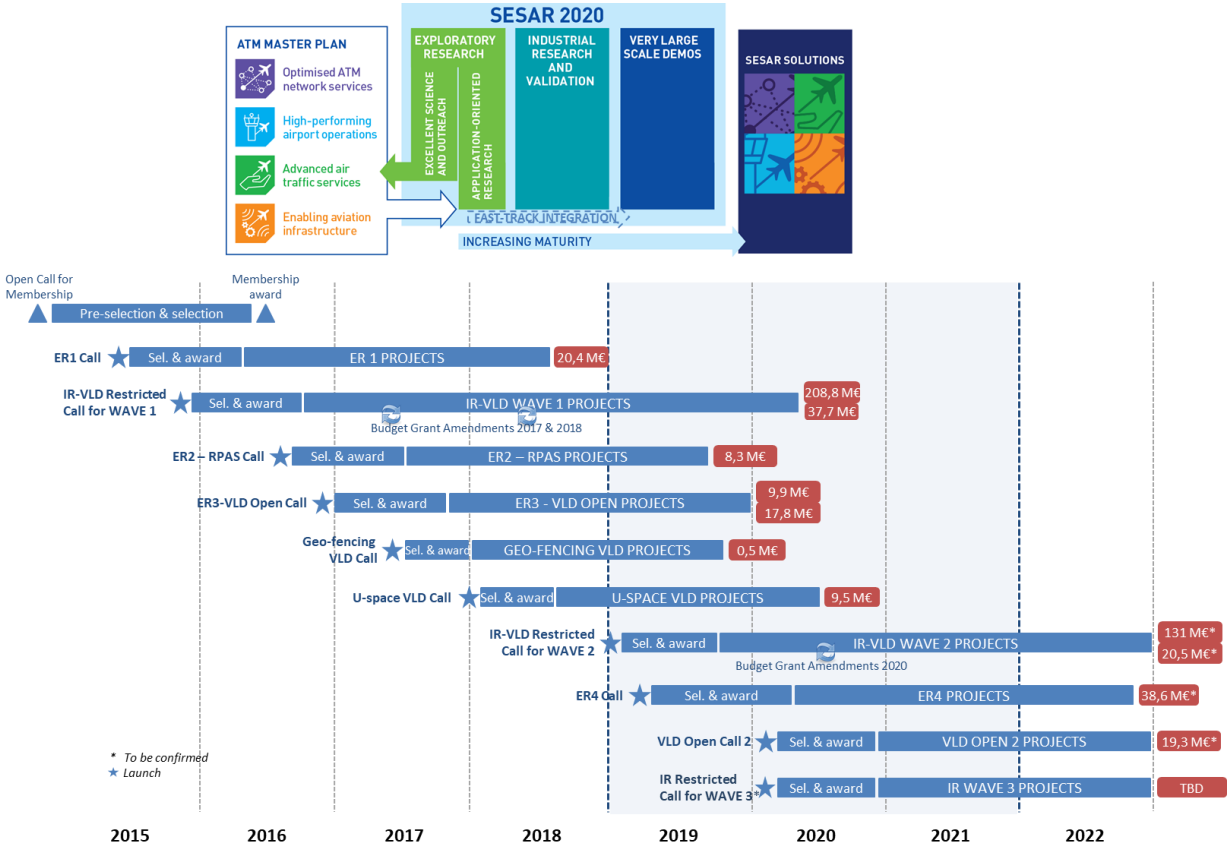

Figure 7: Call activities of the SESAR 2020 Programme over the 2015-2022 period

The implementation of these calls for proposals is subject to availability of corresponding EU budget in due time.

In addition to the calls for proposals listed above, the SESAR JU undertakes studies in relation to the technical topics relevant to the technological pillar of the Single European Sky. Out of these, the list of procurement actions relating to support activities the SESAR JU will undertake in 2019 appears in Annex IX 'Procurement plan for 2019'.

2.1.4 Overview of the SESAR 2020 Programme Work Breakdown Structure at the end of 2018

As a result of the calls for proposals already completed at the end of 2018, the SESAR 2020 Programme is composed of the following 85 projects which implement the research topics presented in Paragraph 2.1.2 (figure 6): topics of the Exploratory Research are covered by several projects, while in general topics of the IR and VLD are covered by one project each.

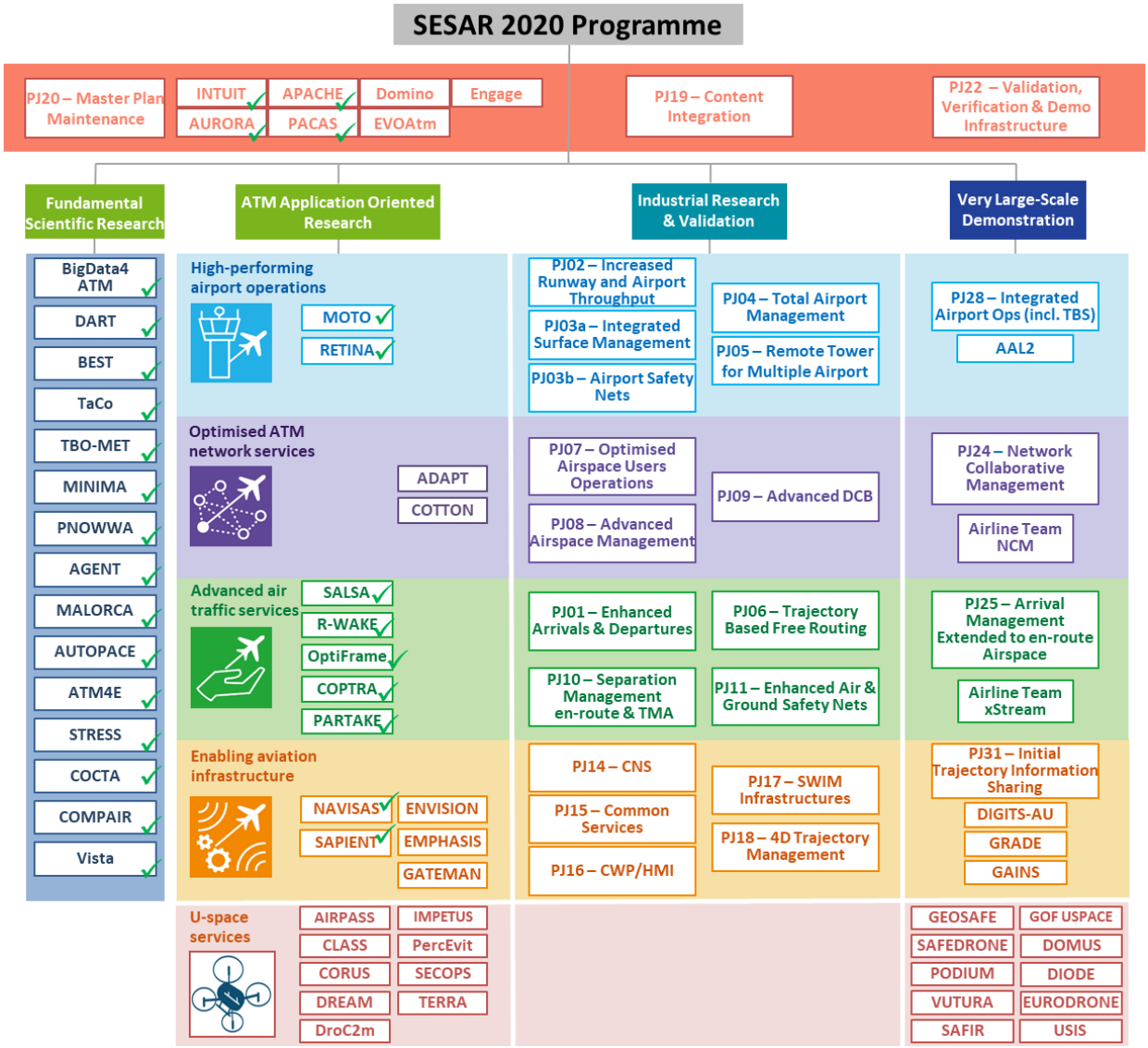

Figure 8: SESAR 2020 Programme portfolio of projects matching the research topics at the end of 2018 (projects in execution or closed)

As can be seen in the figure above in relation to figure 6, most of the research topics of the SESAR 2020 Programme are covered by projects in execution or closed (projects closed, i.e. the ones that have completed their activities, at the end of 2018 are marked with the symbol ✓). The approach for covering the remaining topics is presented in Section III, Chapters 2.1 to 2.5.

2.1.5 Governance of the SESAR 2020 Programme

The governance of the SESAR 2020 Programme is as follows:

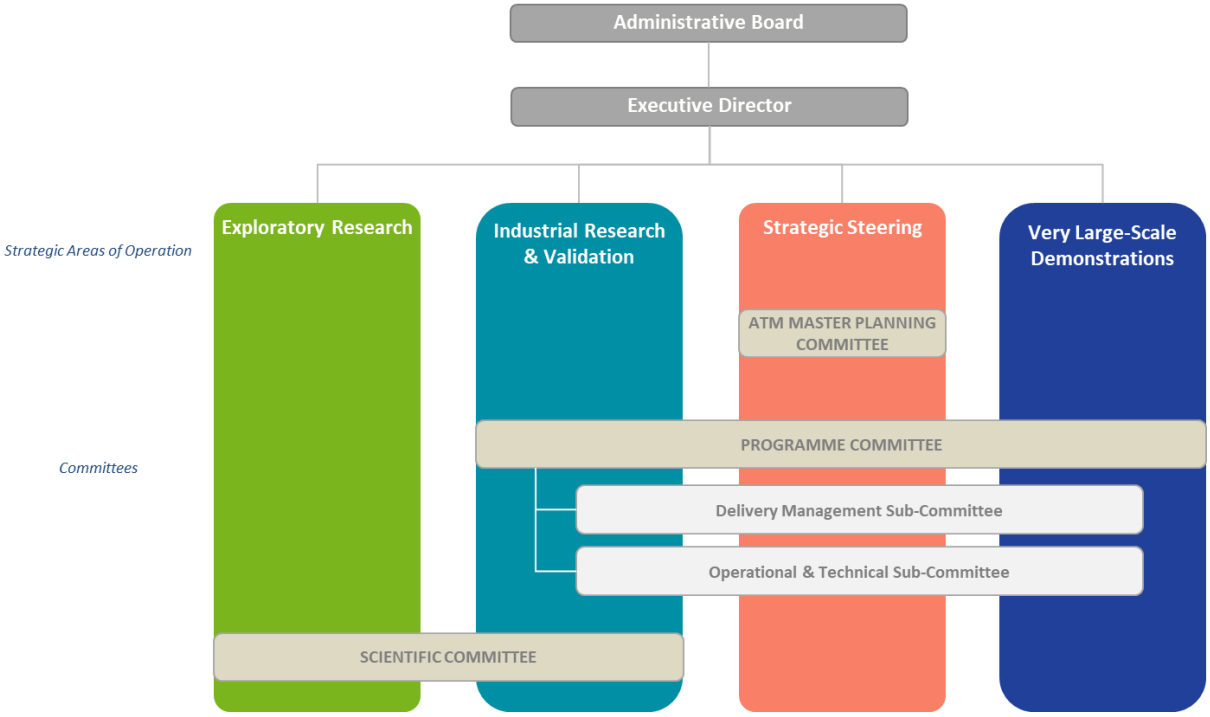

Figure 9: Governance of the SESAR 2020 Programme

2.1.5.1 Administrative Board

The Administrative Board is the main governance body of the SESAR JU. It has overall responsibility for the strategic orientation and effective operation of the SESAR JU and supervises the implementation of its activities in accordance with Article 5 of the Statutes. In accordance with the SESAR JU Founding Regulation, the ADB is chaired by the European Commission, representing the EU, with the EUROCONTROL representative as Vice Chairperson and constituted by a representative from each Member of the Joint Undertaking[15], the Military, Civil Airspace Users, ANSPs, equipment manufacturers, Airports, ATM Staff and the scientific institutions/community.

2.1.5.2 Executive Director

Appointed by the Administrative Board, the Executive Director is responsible for the day-to-day management of the JU and is its legal representative. He or she directs the execution of the SESAR 2020 Programme within the guidelines established by the Administrative Board to which he or she is responsible. He or she provides the Administrative Board with all information necessary for the performance of its functions. This includes, in particular, the drawing-up and providing of regular updates on the global and annual work programme of the JU, including an estimate on programme costs, and the assurance that the activities of the JU are carried out with complete independence and without any conflicts of interest. He or she also submits to the Administrative Board any proposal involving changes in the design of the SESAR project.

[15] The list of Members of the SESAR JU appears in annex XI

2.1.5.3 Programme Committee

The Programme Committee (PC) is composed of representatives of each of the stakeholders Members of the SESAR JU including one representative of EUROCONTROL. In addition to this, there is one representative of civil AUs and one of the European Commission as permanent observers. The secretariat and chairmanship roles are performed by the SESAR JU.

By representing their organisations, the PC stakeholders Members and EUROCONTROL commit to implementing decisions taken by the PC affecting the SESAR Programme on technical and contractual matters.

The PC will continue to support the SESAR JU Executive Director in the SESAR 2020 Programme delivery, covering the Industrial Research and Validation and VLD phases of the programme.

It will be supported by two sub-committees: a Delivery Management Sub-Committee (DMSC) focusing on the management of the programme and of the various contributions, and an Operations and Technical Sub-Committee (OTSC) focusing on the content steering of the activities.

2.1.5.4 ATM Master Planning Committee

This Committee (MPC) is composed of representatives of the European Commission, EUROCONTROL, civil users of airspace, the European Defence Agency (EDA) representing the military, ANSPs, equipment manufacturers, airports, professional staff organisations in the air traffic management sector, EASA, the European Organisation for Civil Aviation Equipment (EUROCAE), the Network Manager and the SESAR Deployment Manager.

These representatives have been put forward to the Executive Director by the relevant ADB Members for formal appointment to the Committee. The Committee will provide advice to the Executive Director on the progress of the execution and the implementation of the European ATM Master Plan, and will monitor coherence between its three levels. In particular, it will monitor and identify potential gaps or opportunities for improving Master Plan priorities and advise the Executive Director of measures they see are needed.

2.1.5.5 Scientific Committee

The Scientific Committee (SC) supports the SESAR JU Executive Director in ensuring the scientific excellence of the SESAR 2020 Programme. In particular, this Committee will, under the chairmanship of the SESAR JU, monitor, in terms of content and results, the Exploratory Research activities of the SESAR 2020 Programme and transition to Industrial Research and Validation, while also providing the Executive Director with scientific advice covering the whole range of SESAR JU's SESAR 2020 research activities.

The committee seats were filled by an open call for scientists and researchers from across the research community and a representative from each of the Founding Members (European Commission on behalf of the EU and EUROCONTROL). The current membership will be extended until February 2021.

In order to foster transition between Exploratory Research and Industrial Research and Validation, an observer seat is reserved for a representative of the PC.

2.2 Strategic Area of Operation 1: Provide strategic steering for the SESAR programme

Under the leadership of the SESAR JU, all SESAR 2020 R&I activities are undertaken within a common framework. As introduced in the SESAR 2020 Programme research topics diagram (figure 6), this framework applicable to the industrial research and validation relies on the elements described below:

- Maintenance of the **European ATM Master Plan**;
- **Content Integration** activities aiming for transversal steering of the programme through the **Concept of Operations (ConOps)**, **Architecture** activities, and the **Performance** framework;
- **Validation and Demonstration engineering** activities aiming at the specification of long-term shared developments on the verification and validation infrastructures, as an enabler for validation activities.

In 2019, in continuation of the activities carried out in the period from 2016 to 2018, the following projects will support the execution of this framework, as depicted in figure 8: PJ.20 'ATM Master Plan maintenance', covering the maintenance of the ATM Master Plan, PJ.19 'Content integration', covering the required coordination of IR projects to develop the ConOps, architecture and performance, and alignment with the ATM Master Plan, and PJ.22 'Validation, Verification and Demonstration Infrastructure', covering the maintenance of programme-wide Verification and Validation infrastructure information. Four projects of the Exploratory Research phase, relating to ATM operations, Architecture, performance & Validation (namely: PACAS, INTUIT, AURORA, APACHE) have delivered their results and are closed, while the three new ones (Domino, EVOAtm and Engage) are yet to deliver their results. Paragraph 2.2.3 provides a high-level description of these projects and the related funding.

In 2020 and 2021, the execution of the Strategic Steering framework is dependent on the results of IR-VLD Wave 2 call for proposals (with reference H2020-SESAR-2019-1) which will take place in 2019 (see Section III, Chapter 2.1 for the process relating to the Wave 1-Wave 2 transition). Considering discussions held in the PC and calling for a reduction in the budget for Transversal Steering projects, a new approach has been agreed based on the following key principles:

- Overall effort to be reduced;
- Top-down approach to strategic steering to be continued;
- Programme execution/Solutions development in line with the ATM Master Plan to be ensured;
- Continuing activities to be distinguished from specific (ad-hoc) needs.

As a result, the SESAR JU has identified three management modes for strategic steering activities:

- Mode 1 addressing the Transversal Activities with H2020 projects (i.e. PJ.19 W2 Content Integration, Performance management and Business case Development and PJ.20 W2 'Master Planning'). A more detailed description of the two projects can be found in Section III, Paragraph 2.6.1.2.4 under Work Area I;
- Mode 2 for ad-hoc activities organised by the SESAR JU for the execution of specific tasks when required and in a short period of time (e.g. evolution of validation strategy, evolution of methodologies such as cyber security, management of operational issues across the programme);
- Mode 3 for service requests, using provision of the SJU-EUROCONTROL agreement. The services would cover the maintenance and support to the architecture framework to fit the needs of the SESAR 2020 Programme (e.g. European ATM architecture (EATMA) release,

guidance, access to the repository) and the delivery of training and coaching to EATMA practitioners working in solution projects (modelling of operational and technical content).

The strategic steering projects work very closely with the SESAR JU in order to provide an additional level of independence and external assistance to de-risk the delivery of SESAR Solutions.

In this role, the SESAR JU benefits from additional support from AUs, Professional Staff Organisations and National Aviation Authorities (see Paragraph 2.2.5). They mainly provide the SESAR JU with reports about validation exercises or candidate SESAR Solutions deliverables.

In addition to these projects, and in continuation of the work done in previous years, the SESAR JU will carry out a variety of activities in the period from 2019 to 2021 to assist stakeholders in other areas relating to the technological pillar of the SES. These are presented in Paragraph 2.2.4.

2.2.1 ATM Master Plan maintenance

Within the framework of the EU Aviation Strategy and of the SES, the European ATM Master Plan is the main planning tool for defining SESAR-related modernisation priorities ensuring that the SESAR Concept of Operations (see below) becomes a reality. The Master Plan is an evolving roadmap building on SESAR results and solutions and a strong collaboration between all EU ATM stakeholders going beyond the Members of the SESAR JU. Not only does it set out an overview of the actions needed to deliver a high performing ATM system, but it also explains why and by when these actions should be taken. The Master Plan update campaign for 2018-2019 has made it possible to strengthen the link between the performance ambitions of SESAR and the SES performance scheme. Contacts have been made with the SES Performance Review Body, allowing convergence between master planning tasks and the SES performance target setting. In the next period, the SESAR JU will seek to maintain and further develop such collaboration.

The ATM Master Plan maintenance activities therefore consist in the following:

1. Maintaining the consistency of the three levels of the European ATM Master Plan: level 1 Executive View, level 2 Planning and Architecture View, and level 3 Implementation View;
2. Updating the Master Plan on the basis of the results of the R & I activities, through major updates every 2-3 years approximately;
3. Monitoring the implementation of the Master Plan and the leverage of opportunities and emerging ideas.

The governance of the ATM Master Plan maintenance is ensured by the support provided to the SESAR JU Executive Director by the MPC. This committee is composed of representatives of the European Commission, EUROCONTROL, the Network Manager, civil AUs, the military, ANSPs, ground equipment manufacturers, airborne equipment manufacturers, airports, professional staff organisations in the ATM sector, the SESAR Deployment Manager, EASA and EUROCAE. It provides advice to the SESAR JU Executive Director on the progress of the execution and the implementation of the European ATM Master Plan, and monitors coherence between its three levels. In particular, it monitors and identifies potential gaps or opportunities for improving Master Plan priorities and advises the Executive Director of required measures.

Providing input to the MPC, project PJ.20 supports the SESAR JU in the maintenance of the ATM Master Plan. PJ.20 is expected to deliver the following results over the period from 2019 to 2021:

Transversal Deliverables	2019	2020 & 2021
Update of Master Plan Level 1	Major update	Will be determined in the context of the IR-VLD Wave 2[16]
Update of Master Plan Level 2	Yearly update	
Update of Master Plan Level 3	Yearly update	
Update to Standardisation Roadmap	Yearly update	
Update to Regulatory Roadmap	Yearly update	
Consolidated Business Cases	Yearly update	

Table 2: ATM Master Plan maintenance deliverables in 2019-2021

Further information on the follow-on activities of the update of the European ATM Master Plan conducted in 2018 and delivered in the first part of 2019 is provided in Section III, Chapter 2.1.

2.2.2 Content integration and transversal programme steering

Activities related to the **SESAR Concept of Operations** and the **ATM architecture** ensure that the overall SESAR ambition level outlined in the European ATM Master Plan can be implemented by operational and technical teams working on the development activities with clear validation targets and targeted operation scenarios in mind. It is also at this level that the desired evolution of the high-level architecture is cross-checked with the results of the validation activities.

Delivered with the support of project PJ.19 and PJ.22, Content Integration and Transversal Programme Steering activities include the following:

- The **SESAR Concept of Operations (ConOps)**: the goal of the ConOps is to ensure that the SESAR 2020 concept is developed in a simple and implementable manner. The concept has been structured in several operational phases, which correspond to manageable, implementable and valuable collections of operational improvements that the ATM community can articulate and identify with. This introduces an incremental approach to concept development, validation and deployment, improving the likelihood of successful implementation.
- The **SESAR reference Architecture and technical system strategy**: the SESAR reference Architecture and Technical System Strategy defines the principles for the future ATM single European architecture, in support of setting out a vision for ATM stakeholder decision makers and providing guidance for projects on system design and architectural issues. Similar to the ConOps, it envisages several 'to-be' architectures that represent the target evolution of the European ATM system over time and derive from the baseline architecture evolution established in the first programme. Following the SESAR Reference Architecture, the various architecting activities within the SESAR Programme are consolidated and made consistent in the European ATM Architecture repository (EATMA) repository,
- Considering the need to ensure the traceability between the technical and operational requirements together with ensuring analysis of the coverage and completeness of the validation objectives, a **System Engineering Data Management Framework** captures all the

[16] Cf. Section II, Chapter 2.4.2

required data in order to deliver when needed **traceability matrices** as input to the SESAR Solution maturity assessment.

The expected delivery of these transversal activities is as follows:

Transversal Deliverables 2019-2021	2019	2020 and 2021
Concept of Operations		Will be determined in the context of the IR-VLD Wave 2 Call[16]
Concept of Operations Update	X	
Validation Strategy Update	X	
Architecture Description Document	X	
ATM Information Reference Model	X	
ATM Information Reference Model Update 2	X	
Information Service Reference Model	X	
SESAR Lexicon	X	
Performance Framework		
Validation Targets		
Consolidated Performance Assessment and Gap Analysis		
EATMA guidance material and report	X	
EATMA Portal and model release notes	X	
Integrated Roadmap Data Set	X	
Validation Data Management Platform and Services	X	
Validation Data traceability and coverage reports	X	
Validation & Demonstration Platform Development methodologies	X	

Table 3: Concept, Architecture and Performance Steering activity deliverables in 2019-2021

2.2.3 Strategic Steering activity funding and call management

Strategic Steering activities are supported by projects funded through Exploratory Research and Industrial Research & Validation calls for proposals – see Chapters 2.3 and 2.4 – as follows:

Ref.	Project title	Short project description	Call for proposals	Status (2019)	Max. total co-financing value (in EUR)
PJ.19	Content Integration	'Content Integration' (CI) activities aim to coordinate and integrate operational and technical solutions, and as such to support and guide the processes to ensure their	H2020-SESAR-2015-2	Ongoing	7.395.142

Ref.	Project title	Short project description	Call for proposals	Status (2019)	Max. total co-financing value (in EUR)
		completeness, consistency and coherency from a holistic perspective as expressed in the SESAR CONOPS			
PJ.20	Master Plan maintenance	The European ATM Master Plan has three levels (Executive, Planning and Implementation) that require synchronised monitoring and alignment. The work consists in maintaining, updating and publishing the Master Plan as and when necessary, and in managing the Master Plan update campaigns		Ongoing	3.327.676
PJ.22	Validation and Demonstration Engineering	Development of the Validation and Verification Infrastructures and Platforms development required for supporting SESAR Validation Exercises		Ongoing	2.051.356
Four ER projects (**APACHE, AURORA, INTUIT, PACAS**) under the open ER 1 call (with reference H2020-SESAR-2015-1)[17]					
Three ER projects (**Engage, EVOAtm, Domino**) under the open ER 3 call (with reference H2020-SESAR-2016-1)[18]					

Table 4: Identification of Strategic Steering activities and related funding

A new approach to the steering activities carried out by the SJU Members in support of the SJU has been defined for Wave 2. This new approach is presented in Section II, Paragraph 2.4.2.

Furthermore, as introduced in Section II, Paragraph 3.2.2.2, in addition to direct funding (Title III – Operational expenditure), the SESAR JU also dedicates a proportion of its running costs (Title I – Staff expenditure and Title II – Infrastructure and operating expenditure) to carry out the programme steering activities. The overall funding of Strategic Area of Operation #1 is indicated in Annex I. Support contracts / agreements / working arrangements with additional stakeholder groups are funded through dedicated budget subject to procurement actions.

2.2.4 Other activities carried out to assist stakeholders in matters relating to the technological pillar of the SES

This paragraph puts an emphasis on subjects which are of particular importance for the SES initiative and with which the SESAR JU will continue to assist its stakeholders by providing a technical contribution to technological matters, as per the agreement between the EU and the SESAR JU[19]. In the period from 2019 to 2021, on top of the SESAR 2020 Programme delivery, the SESAR JU will assist

[17] See Paragraph 2.3.1.1

[18] See Paragraph 2.3.1.3

[19] *General Agreement between the European Union, represented by the European Commission, and the SESAR JU*. See Annex I on 'Entrusted tasks' in particular

the European Commission on the integration of new air vehicles into the ATM environment and U-space.

Indeed, the Vilnius and Helsinki Conferences have clearly highlighted that unlocking drone operations in Europe has become an urgent priority for Europe, with the hard deadline of 2019 for U1 services. The SESAR JU was entrusted by the European Commission with managing the U-space related activities at EU level[20] and signed a specific delegation agreement[21] to perform demonstration activities to validate systems that support U-space services.

Following this mandate, the SESAR JU organised several projects relating to U-space that are ongoing. Furthermore, to encourage close cooperation with several bodies and institutions, a supporting role as a U-space Content Integrator has been set up with the aim of providing support to the SESAR JU in:

- Defining a 'fast track' methodology for validation, and the monitoring of its application;
- Contributing to the support of the delivery of the U-space SESAR Solutions;
- Providing coordination support for the definition of proposed harmonised standards and regulation for U-space services across Europe.

This U-space content integration function is supported by EUROCONTROL under specific service request from the SESAR JU based on the 'SESAR JU-EUROCONTROL Agreement'. This function is performed in the context of an 'EU Demonstrators Network' led by the European Commission. The figure below depicts the overall relationship between this set of services, provided in support of the SESAR JU coordination of U-space and drone integration projects:

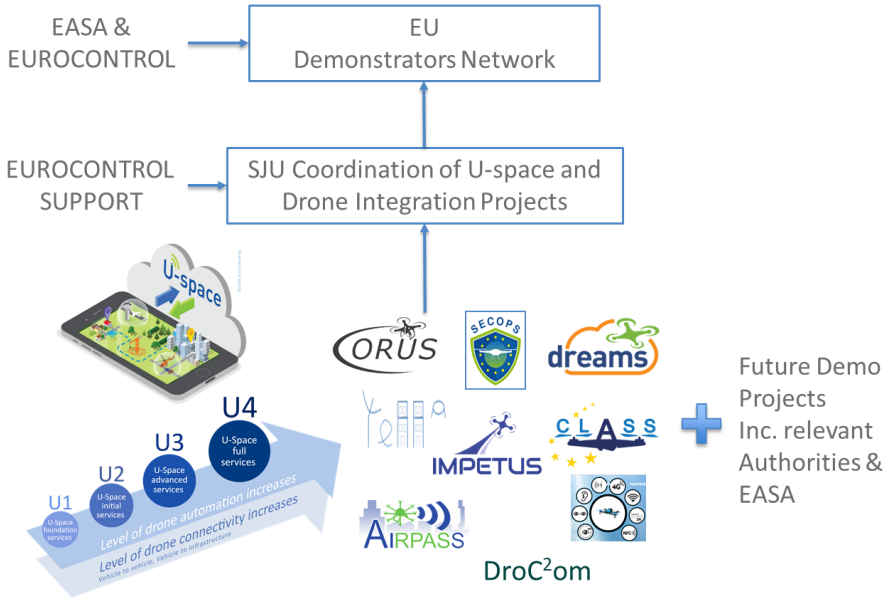

Figure 10: Coordination and integration of U-space integrated initiatives at EU level

[20] Letter to the Members of the Administrative Board of the SESAR Joint Undertaking - MOVE.DDG2.E3/OV-nd/Ares(2017)

[21] The European Commission has given an mandate to the SESAR JU to organise U-space demonstrations through delegation agreement EC/SESAR JU ref. MOVE/E3/DA/2017-564/si2.771010 signed on 13/12/2016 with a delegated budget of EUR 10 million from the Connecting Europe Facility (CEF) fund

Furthermore, following the delivery to the European Commission of the Airspace Architecture Study in February 2019[22], the European Commission requested the SESAR JU, in close coordination with the Network Manager and EUROCONTROL, to establish a transition plan for implementing the recommendations of the study, with a strong focus on the short term to address and mitigate the looming 'capacity crunch'. The paragraph 2.1.3 in Section III (see below) presents this activity which will be completed within 2019.

2.2.5 Support contracts and agreements / working arrangements

In addition, in order to provide strategic advice to the SESAR JU and to help in steering the SESAR 2020 Programme, the SESAR JU has set up five main agreements with additional stakeholder groups and an external support:

- The Airspace Users' support contracts (with civil AUs);
- The Professional Staff Organisations working arrangements;
- The Authorities working arrangements (with National Aviation Authorities);
- The Airports support contract;
- The SESAR Development Support Service contract, covering industrial support, programme management support and the provision of a collaborative programme management platform.

The SESAR JU is also developing relationships with stakeholders in the ATM in relation with the challenge of the digitalisation of aviation, especially on U-space.

Furthermore, in steering the SESAR 2020 Programme, the SESAR JU devotes significant efforts to playing an active role in the inter-agency networks, H2020 networks and transversal implementation of European Commission's regulations.

[22] See also SESAR JU's Consolidated Annual Activity Report 2018

2.3 Strategic Area of Operation 2: Deliver Exploratory Research (ER)

As outlined in the SESAR 2020 Programme research topics presented in the introduction to Chapter 2 (figure 6), Exploratory Research is structured around four areas:

- **Two transversal activities**, as follows:
  - The '**Future European ATM skilled work-force**' will develop the mechanism to provide the required European ATM education and training as well as networking capability which can uniquely be created through SESAR and in the ATM Community as well as establishing effective knowledge transfer mechanisms,
  - The '**Knowledge Transfer Network**' (KTN) will assess and coordinate project results to contribute to the identification of innovative ideas, concepts and models that can support the identification of ATM system concept trade-offs new technology validation at system level and requirements definition and consolidation. The ATM research community will be able to share research results.
- **Two research areas**, as follows:
  - **ATM Excellent Science & Outreach** aims at bridging the gap between ATM research and the wider research community and providing the necessary scientific support to ATM change with a particular focus on bringing the ATM capacity to the level required to comply with the expected traffic growth, either directly or through connection to other funded research areas in other disciplines or sectors, under the following topics:
    - Automation, Robotics and Autonomy,
    - Complexity, Data Science and Information Management,
    - Environment and Meteorology (MET) for ATM,
    - Performance, Economics, Legal and Regulation,
    - ATM role in intermodal transport,
    - CNS for ATM;
  - **ATM application-oriented research** will help mature new concepts for ATM beyond those identified in the European ATM Master Plan and will help to mature emerging technologies and methods to the level required to feed the applied research conducted in the SESAR JU. This part of Exploratory Research will be structured around the four Key Features of the programme and the transversal needs to ensure that there is a flow of ideas and results in a structured manner across the whole programme.

Exploratory Research is fully funded by the European Union under the H2020 framework and has a total funding of EUR 85 million which includes a dedicated proportion of direct funding (Title III – Operational expenditure through open calls for proposals) and a proportion of SESAR JU running costs (Title I – Staff expenditure and Title II – Infrastructure and operating expenditure) to carry out the Exploratory Research activities. The overall funding of Strategic Area of Operation #2 (Exploratory Research) for the period from 2019 to 2021 is indicated in Annex I.

A sequence of four calls for proposals covers the full spectrum of Exploratory Research activities over the period from 2015 to 2022, as depicted in the following figure:

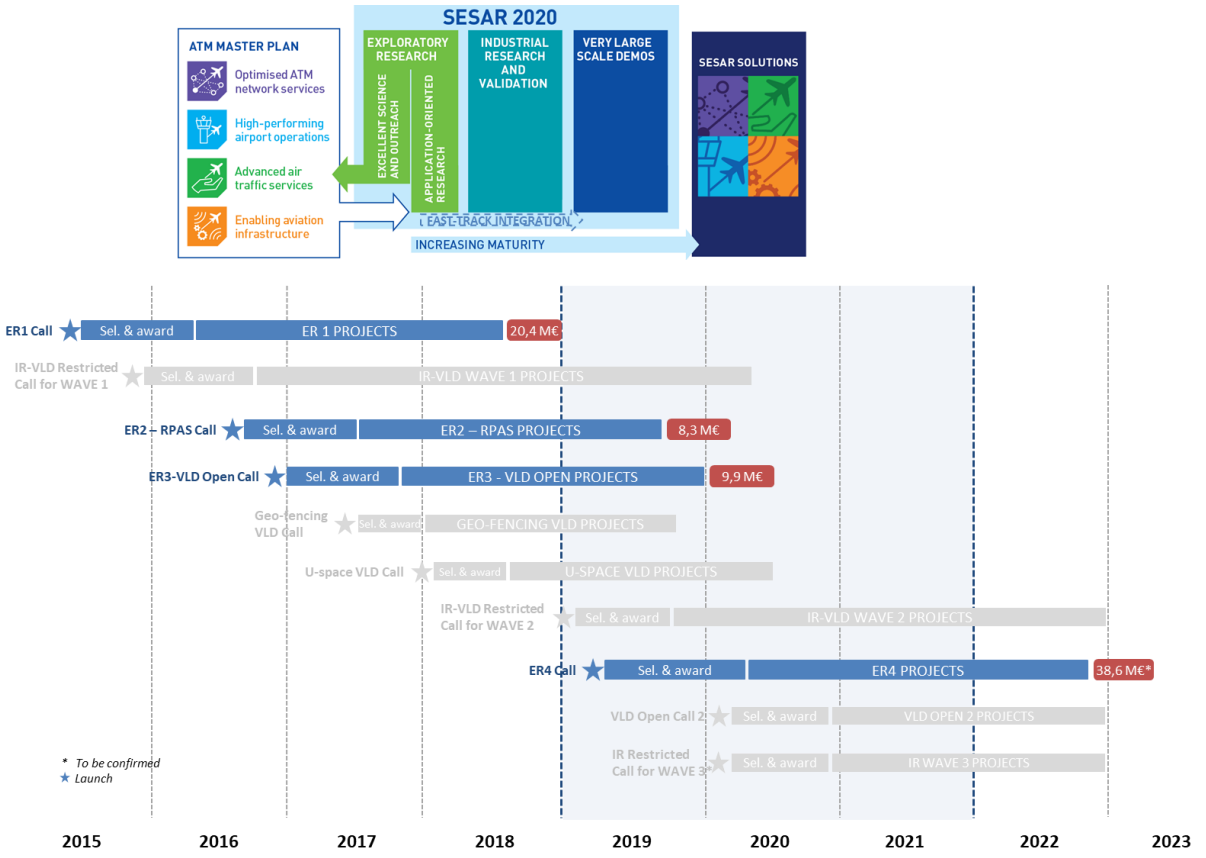

Figure 11: Sequence of ER calls and related funding from 2015 to 2022

As depicted in this figure, during the 2019-2021 period, the SESAR JU will do the following for Exploratory Research activities:

- Supervise and ensure the delivery of results by the projects launched under the ER2-RPAS (Remotely Piloted Aircraft Systems) call for proposals (with reference H2020-SESAR-2016-1) and ER3 call for proposals (within the call with reference H2020-SESAR-2016-2), which should close by the end of 2019 (with the exception of three projects for which the target closure date is in Q3 2020),
- Execute (in 2019-2020) the transfer of results of the ER1 projects into Wave 2 and ER4 projects (see Section III, Paragraph 2.1.1),
- Run the procedure for the ER4 call for proposals (with reference H2020-SESAR-2019-2), evaluate the received proposals and award the grants, sign the related grant agreements, then launch and supervise the awarded projects. The current plan is that these projects would be launched in late 2019 or at the beginning of 2020, with closure no later than Q4 2022 (of which 6 months for reporting, dissemination of results (see below in Section III, Paragraph 2.5.2) and closure).

2.3.1 Calls already closed and projects already launched at the end of 2018

As outlined in the SESAR 2020 Programme research topics presented in the introduction to Chapter 2, Exploratory Research activities cover Application-oriented research focusing on the four Key Features of the ATM Master Plan, as well as Fundamental Scientific Research activities:

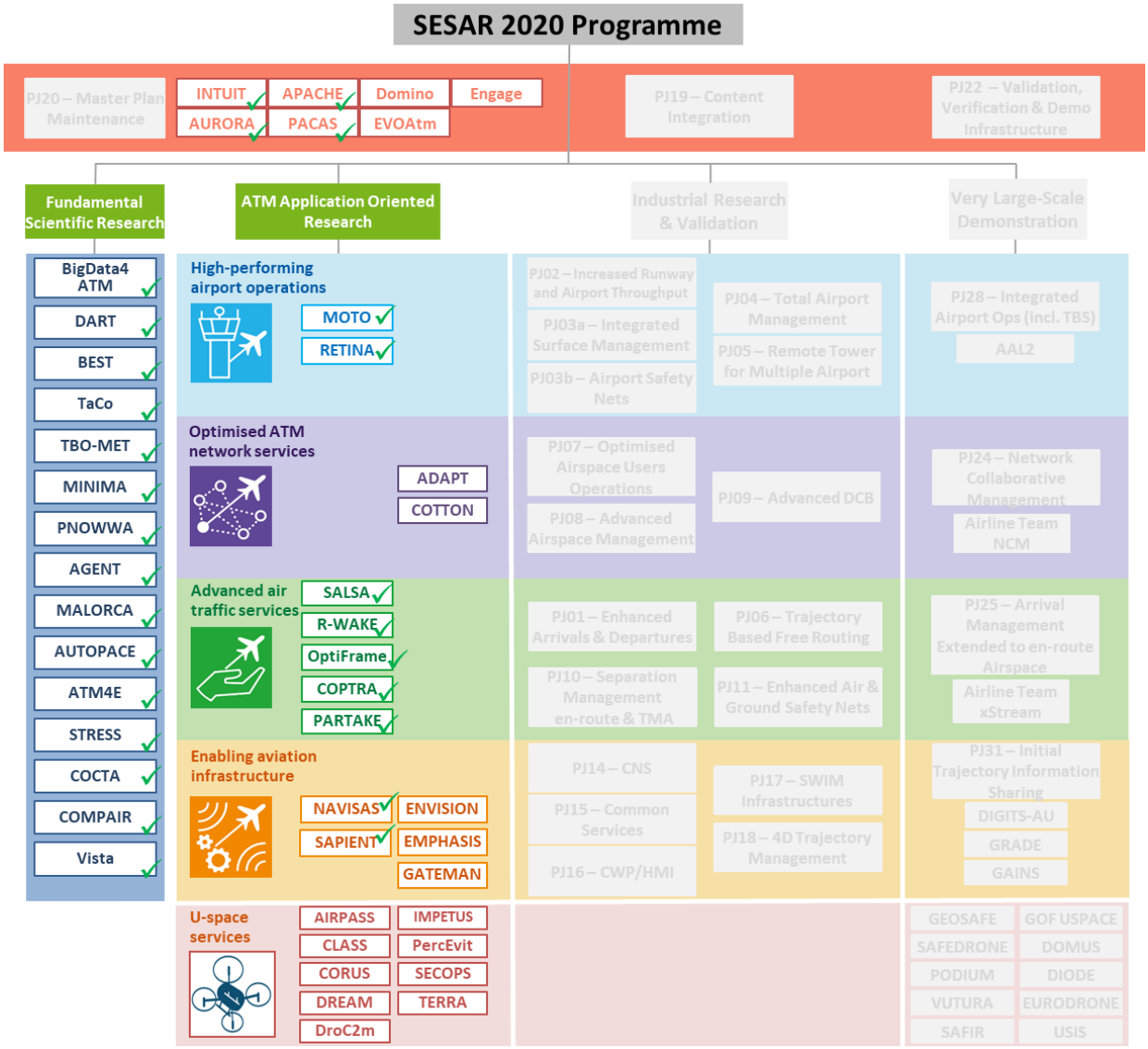

Figure 12: SESAR 2020 Programme portfolio of Exploratory Research projects matching the research topics at the end of 2018

For the grants relating to ER1 and ER2-RPAS, the SESAR JU will comply with all provisions of the H2020 Work Programme 2016-2017[23]. For the grants relating to ER3, the SESAR JU will comply with all provisions of the H2020 Work Programme 2018-2020[24].

2.3.1.1 ER1 call with reference H2020-SESAR-2015-1

In 2015, the first ER call for proposals within the SESAR 2020 Programme, fully funded under Horizon 2020, was launched to enable continued work on conducting and consolidating innovative activities in order to achieve tangible results under the scope of ATM Excellent Science & Outreach and ATM application-oriented research (see ER research topics in figure 6). Out of the total maximum co-financing level of EUR 20,6 million, the outcome of the call was an award for EUR 20,4 million and the

[23] European Commission Decision C(2016)4614 of 25 July 2016

[24] European Commission Decision C(2017)7124 of 27 October 2017

selection of 28 ER1 projects which have been closed in 2018 (see summary of these projects in Annex XII).

2.3.1.2 ER2–RPAS call with reference H2020-SESAR-2016-1

In 2016, the second ER call for proposals within the SESAR 2020 Programme, fully funded under Horizon 2020, was launched to address the domain of Remotely Piloted Aircraft Systems (RPAS) and unmanned vehicles (unmanned aerial system – UAS).

- The **UAS/RPAS integration operational issues** project will deliver the SESAR Traffic Management (U-space) Concept Definition addressing the operational concept to enable the operation of drones of all capabilities in the very low-level (VLL) environment, including urban drone operations, the role of autonomy and operational mitigations to command and control failure/corruptions. The required interface with air traffic control (ATC) and the role of incursion protection against protected areas will be addressed. The SESAR U-space concept definition will address operational needs and provide a functional breakdown of U-space;
- The **RPAS integration technical issues** projects will deliver emerging technology options to support drone operations and integration in the very low level and visual flight rule domains. Emerging technologies and applications for U-space from advanced fields such as IT, telecoms, intelligent systems or robotics will be fast-tracked into providing solutions to specific problems that are essential for the near-term development of the EU drone industry. It should also help bridge the gap between SESAR U-space research and the wider scientific community and will provide the science necessary to support the safe integration of VLL drones, considering higher levels of automation (see figure 6).

Out of the total maximum co-financing level of EUR 9 million, the outcome of the call was an award for EUR 8,3 million and the selection of nine ER2-RPAS projects which were launched into execution at the beginning of 2018, delivering the following objectives by the end of-September 2019:

Ref.	Project Title	Short Project Description	Max. total co-financing value (in EUR)
AIRPASS	Advanced Integrated RPAS Avionics Safety Suite	Drones appear in a large variety of types, configurations and sizes. They are operated in a large variety of operational environments (i.e. locations, classes of airspace). However, it is essential that they interoperate with other drones as well as with manned aircraft This project addresses the on-board technologies for drones that are required in order to implement the Unmanned Traffic Management (UTM) concept for drone operations at Very Low Level and within the Visual Flight Rules environment. The project will cover Detect And Avoid systems for cooperative and non-cooperative traffic, auto-pilot systems as well as Communication, Navigation and Surveillance systems. This project will identify the available CNS infrastructure and on-board technologies to formulate an implementation approach. Based on this, an on-board system concept will be developed and evaluated	986.224

Ref.	Project Title	Short Project Description	Max. total co-financing value (in EUR)
CLASS	CLear Air Situation for uaS	CLASS (CLear Air Situation for uaS) will mature ground based technologies for a real-time Unmanned Aerial System Traffic Management System to monitor and separate Unmanned Aerial System traffic	909.973
CORUS	Concept of Operations for EuROpean UTM Systems	Building on current state-of-the-art technologies, CORUS (Concept of Operations for EuROpean UTM Systems) will develop an operational concept enabling safe interaction between all AUs in Very Low Level considering contingencies and societal issues	800.000
DREAMS	DRone European AIM Study	The DREAMS project aims at contributing to the definition of the European UTM Aeronautical Information Management (AIM) operational concept, by exploring need for and feasibility of new processes, services and solutions for drone AIM within the new UTM concept	710.435
DroC2om	Drone Critical Communications	DroC2om addresses Drone Critical Communications. The key objective of the DroC2om project is to contribute to the definition of integrated cellular-satellite data-link specifications for UASs	1.270.543
IMPETUS	Information Management Portal to Enable the inTegration of Unmanned Systems	IMPETUS will research the application of the 'micro-services' paradigm as a flexible and cost efficient solution for lifecycle support of the expected high variety of drones and missions	899.160
PercEvite	PercEvite - Sense and avoid technology for small drones	PercEvite addresses Sense and avoid technology for small drones for autonomously detecting and avoiding 'ground-based' obstacles and flying objects. To avoid ground-based obstacles, we aim for a lightweight, energy-efficient sensor and processing package that maximises payload capacity This project should close in Q3 2020	899.008
SECOPS	An Integrated Security Concept for Drone Operations	SECOPS deals with an Integrated Security Concept for Drone Operations. SECOPS' objective is to push drone technology forward by ensuring that security risks in the Unmanned Traffic Management concept are mitigated to an acceptable level	909.294
TERRA	Technological European Research for RPAS in ATM	TERRA addresses the research topic on ground-based technology, focusing on the performance requirements associated with the UTM concept, and identifying the technologies (existing and new) which could meet these requirements	937.000

Table 5: ER2-RPAS projects outline (under the call for proposals with reference H2020-SESAR-2016-1)

2.3.1.3 ER3 within the call for proposals with reference H2020-SESAR-2016-2

A third ER call for proposals (within the call for proposals with reference H2020-SESAR-2016-2 ER/VLD Open) was launched at the end of 2016. Out of the total maximum co-financing level of EUR 10 million for Exploratory Research, the outcome of the call was an award of EUR 9,9 million and the selection of eight projects[25] relating to Exploratory Research. This will lead to the delivery of results in the domains of Transversal Exploratory Research (contributing to the Transversal Steering activities, see Paragraph 2.2.4) and ATM application-oriented research topics covering the four Key Features of the ATM Master Plan (see below), which build on and complement the research topics already included in the ER1 call. The grants awarded in that context have been delivering results since 2018 and will continue to do so by December 2019. These are as follows:

Project reference	Project Title	Short Project Description	Max. total co-financing value (in EUR)
Transversal Steering			
Engage	Knowledge Transfer Network	The network aims to stimulate the transfer of exploratory research results to ATM application-oriented research. The network will establish a knowledge hub, in which members across the research community are continually involved. This will include an observatory and will undertake the role of devising and maintaining the long-term roadmap development of innovative and interdisciplinary ATM concepts beyond SESAR 2020. The knowledge hub will be the one-stop, go-to source for information in Europe This project should close at the end of 2021	3.971.875
EVOAtm	Evolutionary ATM. A modelling framework to assess the impact of ATM evolutions	The project aims to build a framework to better understand and model how architectural and design choices influence the ATM system and its behaviours, and also how the expected ATM overall performances drive the design choices. The EvoATM project will model a specific part of the ATM system, combining the agent-based paradigms with evolutionary computing	968.880

[25] A total of sixteen grant agreements were signed as a result of the call with reference H2020-SESAR-2016-2 comprising both ER and Open VLD, and two additional grant agreements are in the grand agreement preparation phase on VLD

Project reference	Project Title	Short Project Description	Max. total co-financing value (in EUR)
Domino	Novel tools to evaluate ATM systems coupling under future deployment scenarios	The project will develop a set of tools, a methodology and a platform to assess the coupling of ATM systems from a flight and a passenger perspective. The platform will allow ATM system designers to gain insight into the impact of applying new mechanisms. It will provide a view of the impact of deploying solutions in different ways, for instance., harmonised versus local / independent deployment and information on the criticality of elements in the system, and how this might be different for different stakeholders	805.125
 **Optimised ATM network services**			
ADAPT	Advanced prediction models for flexible trajectory-based operations	The project proposes strategic models to predict the volume, flexibility and complexity of traffic demand taking into account both individual flights and network infrastructure (i.e. sectors and airports). The aim is to enable early flight information sharing in order to identify potential network bottlenecks and the degree of flexibility of all flights. At the tactical level, the extent to which strategically assessed pre-departure and en-route flight flexibility mitigates actual network congestion, will be evaluated	997.250
COTTON	Capacity Optimisation in TrajecTory-based OperatioNs	The project aims to maximise the effectiveness of capacity management processes in trajectory-based operations taking full advantage of available trajectory information Specifically, the projects explore the integration of demand and capacity and flight centric solutions	622.523

Project reference	Project Title	Short Project Description	Max. total co-financing value (in EUR)
	Enabling aviation infrastructure		
EMPHASIS	EMPowering Heterogeneous Aviation through cellular SIgnalS	The project aims to increase safety, reliability and interoperability of general aviation and rotorcraft (GA/R) operations, both with commercial aviation and with emerging drones operations. These aspects are envisaged to be critical elements to secure and improve airspace access for GA/R users in the future airspace environment and improve the operational safety of their operations This project should close in Q3 2020	937.130
ENVISION	Enhanced Situational Awareness through Video Integration with ADS-B Surveillance Infrastructure on Airports	The project aims to make use of technical progress in CCTV cameras, light detection and ranging technology and image processing techniques, and aims at taking advantage of reduced equipment costs, to provide regional and local airports with safe and affordable surface movement surveillance capabilities	983.083
GATEMAN	GNSS Navigation Threats Management	Global Navigation Satellite Systems (GNSSs), such as the Galileo constellation, will become the primary means of aircraft navigation in the mid and long term. However, GNSS signals are vulnerable to threats, especially jamming and spoofing, which may cause the total loss of navigation. The project will research multiple measures that could be deployed on most aircrafts to manage these threats, either on their own or in collaboration with other aircraft	565.744

Table 6: ER3 projects outline (within the call for proposals with reference H2020-SESAR-2016-2)

2.3.2 Calls for proposals activities on Exploratory Research to be organised in the 2019-2021 period

A further ER call for proposals will be launched in 2019 ('ER4 call'). After completion of the call procedure and successful award of grants, the ER projects in that context should be launched into execution in late 2019 or early 2020, with an expected closure by the end of 2022. This call will build on and complement the research topics already included in the earlier ER calls launched in 2015 and 2016 (see above), especially the ER1 call, in both ATM Excellent Science & Outreach and ATM application-oriented research. Call conditions, which are documented in Section III, Paragraph 2.6.1.3, indicate the topics provided for under the ER4 call for proposals.

In 2019 and 2020, taking account of the outcome of the ER4 call, the SESAR JU will analyse the gap between the overall results expected from ER and the objectives set out by the Master Plan for the SESAR 2020 Programme in relation to Exploratory Research.

2.3.3 Other activities relating to Exploratory Research

SESAR Innovation Days

Since their creation in 2010, the SESAR Innovation Days (SIDs) have become a landmark event in the European aviation research calendar. The SIDs focus on ER in the field of ATM. The event is not only a vehicle for the SESAR JU to share progress and disseminate results of its ER programme but also for the wider research community to present their work.

As in previous years, the 2019 event will be shaped by scientific papers and presentations, which will be selected based on an open call for contributions, managed by the SESAR Engage network. The event will also feature a poster exhibition and a networking event, which will provide participants with opportunities to learn about other interesting projects and to meet like-minded researchers (see Table 23). The SESAR Young Scientist Awards, which aim to recognise young scientists with high potential contributing to the scientific research in the field of air traffic management and aviation, are also granted during the SIDs.

SESAR Academy

Since the announcement in December 2017, scoping work started in 2018 to establish the charter and basis for launching a SESAR Academy, a new SESAR JU initiative aimed at enhancing the knowledge, and skills of the next generation of aviation professionals and facilitating mobility and industry-relevant learning opportunities. This SESAR Academy is to be established in the course of 2019.

Additionally, starting in 2019, the SESAR JU will use the outcome of ER and the priorities set out in the updated European ATM Master Plan to identify the future research streams and Concept Elements that require the development of new and innovative candidate SESAR Solutions. These Solutions will add to the ones already identified as part of the SESAR 2020 Programme, and will support the execution of the EU Aviation Strategy's long-term vision and the modernisation of aviation beyond SESAR 2020. This activity will secure continuity in the development of knowledge and the maintenance of the innovation pipeline.

2.4 Strategic Area of Operation 3: Deliver Industrial Research and Validation (IR)

During the reporting period, SESAR 2020 Industrial Research and Validation (IR) activities will facilitate the migration of ideas from Exploratory Research and have them further extended in applied research, and finally pre-industrial development, validation, large scale demonstration and then final preparation for deployment. Therefore, the main objective of this Strategic Area of Operation is to deliver SESAR Solutions derived from the ATM Master Plan and identified in the SESAR JU's multi-annual work programme.

This is done through projects run under two calls for proposals restricted to the 19 SESAR JU Members and EUROCONTROL. The total EU funding available for these calls under H2020 is EUR 339,8 million in direct costs (Title III – Operational expenditure, of which EUR 319,7 million for IR and EUR 20,1 million dedicated to Strategic Steering activities – see Chapter 2.1 above), as depicted in the figure below.

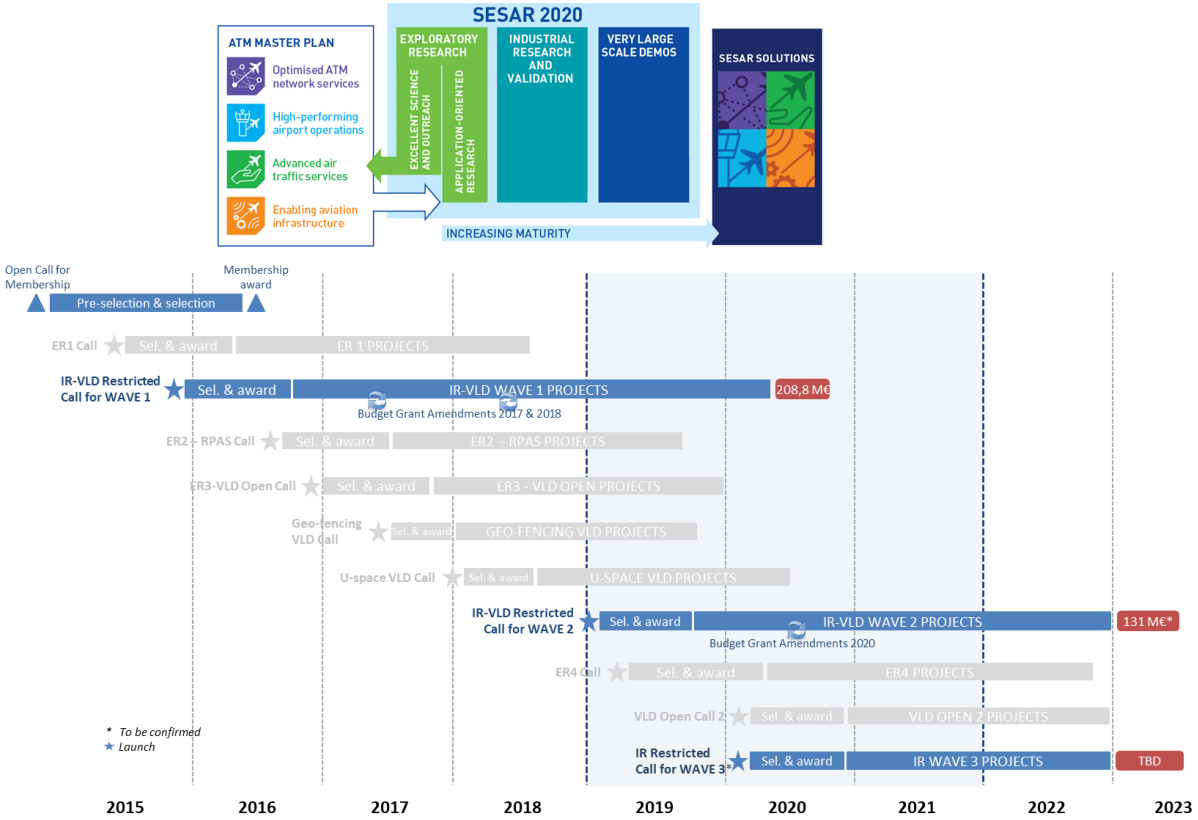

Figure 13: Sequence of IR calls for proposals and related funding from 2015 to 2022

The exact amount of each call is to be confirmed, especially to take into account the results of the grant amendment procedure on grants established under the call for proposals with reference H2020-SESAR-2015-2 in 2018 and the result of the call for proposals with reference H2020-SESAR-2019-1 (Wave 2 call). Moreover, considering that unspent budget could be made available at the end of Wave 1 and potentially during the evaluation of the Wave 2 proposals (e.g. proposals not accepted), a last restricted call for proposals (Wave 3 with reference H2020-SESAR-2020-2) would be defined during 2019 and launched in early 2020 with an end date of technical operations (research activities) by the end of 2022.

In addition, a proportion of SESAR JU running costs (Title I – Staff expenditure and Title II – Infrastructure and operating expenditure) is used to carry out the IR activities. The overall funding of

Strategic Area of Operation #3 (Industrial Research and Validation) for the period from 2019 to 2021 is indicated in Annex I.

During the period from 2019 to 2021, the SESAR JU will do the following, in the context of IR activities:

- Supervise and ensure the delivery of Solutions by Wave 1 projects (end result: the SESAR Solutions Packs), as well as the related grant agreements (including Strategic Steering activities which are introduced in Chapter 2.1 above), then close these projects;
- Run the Wave 2 call procedure (with reference H2020-SESAR-2019-1), evaluate the proposals received and award the grants subsequently, then sign the grant agreements and launch the projects; the IR projects under the Wave 2 call are expected to close by the end of 2022. It is also envisaged that the same grant budget amendment procedure used for Wave 1 projects will be applied for Wave 2 projects in 2020,
- Execute (in 2019-2020) the transfer of results of the ER1 call and Wave 1 projects into Wave 2 IR projects,
- If the need is confirmed, define a Wave 3 call in 2019 (with reference H2020-SESAR-2020-2), run the call procedure in 2020, evaluate the proposals received and award the grants subsequently, then sign the related grant agreements, and launch and supervise the awarded projects. The current plan is that these projects would be launched in late 2020 with closure by the end of 2022.

2.4.1 IR Wave 1 (2016-2019) – call for proposals with reference H2020-SESAR-2015-2

In 2019, in continuation of the activities from 2016 to 2018, the candidate SESAR Solutions will be delivered through 17 Industrial Research & Validation (IR) projects. These projects cover the whole scope of IR as described above in the IR research topics, with the exception of the 'Air Vehicle Systems' topic, as part of the 'Enabling Aviation Infrastructure' Key Feature, for which no project has been awarded as a result of the Wave 1 call for proposals. This topic is included in Wave 2 (see Section III, Paragraph 2.6.1.2).

The current plan is to close most of the IR Wave 1 projects by the end of 2019. However, a few projects will get a grant duration extension as a result of exceptional circumstances preventing the completion of the candidate SESAR Solutions validation according to the initial plan. These extensions respecting Article 55 of the annotated model grant agreement, were supported by the PC at its eighth session and can be summarised as follows:

- PJ.02 : request for 3 month extension
  Investigating the method to accelerate wake vortex decay, PJ.02 planned to execute live trial activities at Vienna Airport by introducing wake decay enhancing devices. The execution of the exercise remained subject to approval from the Austrian Aviation Authority. The Aviation Authority decided to get independent expert opinions before approving the deployment of the wake decay devices. This unexpected specific procedure led to the delay, by several months, of the authorisation decision from the NAAs and in turn, put on hold the planned validation activity.
- PJ.07 and PJ.08 : request for respectively 3 and 2 month extension
  On 3 April 2018, the Network Manager reported a failure of the Enhanced Tactical Flow Management System (ETFMS), also with an impact on the associated flight plan system. An investigation was undertaken to ensure the identification of all necessary improvements and to implement them. Consequently, all developments of Network Manager systems were frozen for a few months while awaiting the results of the investigation. Considering that the

validation exercises require the development of the Network Manager validation platform, the decision to freeze development impacted the preparation and planning of the exercises.

- PJ.17 : request for 3 month extension
  The OTSC 02 meeting held on 1 June 2017 concluded that a new version of the Advanced Message Queuing Protocol (AMQP) software shall be implemented. However, SESAR 1 prototypes had been developed following a former AMQP version (AMQP v0.91) and were supposed to be used to support the validation activities of the PJ.17. The unplanned adoption of this new protocol (AMQP v1.0) implied a significant rework of the legacy prototypes, hence generating an unforeseen delay.
- PJ.28 : request for 3 month extension
  The on-board demonstration activities in PJ.28 have to be supported by a complementary project bringing AUs' efforts and expertise, awarded via a specific open call for proposals (H2020-SESAR-2016-2). The award of the complementary project took more time than initially planned, preventing the start of its execution by December 2017.
  Considering that the PJ.28 WP2 'Nice' exercise and WP3 'on-board Traffic Alerts' exercise require AU involvement, the planning of their execution has been shifted by some months, while waiting for the conclusion of the GAP phase for the complementary project and to ensure that the exercises are during a period with relevant traffic.

As outlined in the SESAR 2020 Programme research topics presented in the introduction to Chapter 2, Industrial Research and Validation (IR) is structured around the four Key Features of the ATM Master Plan:

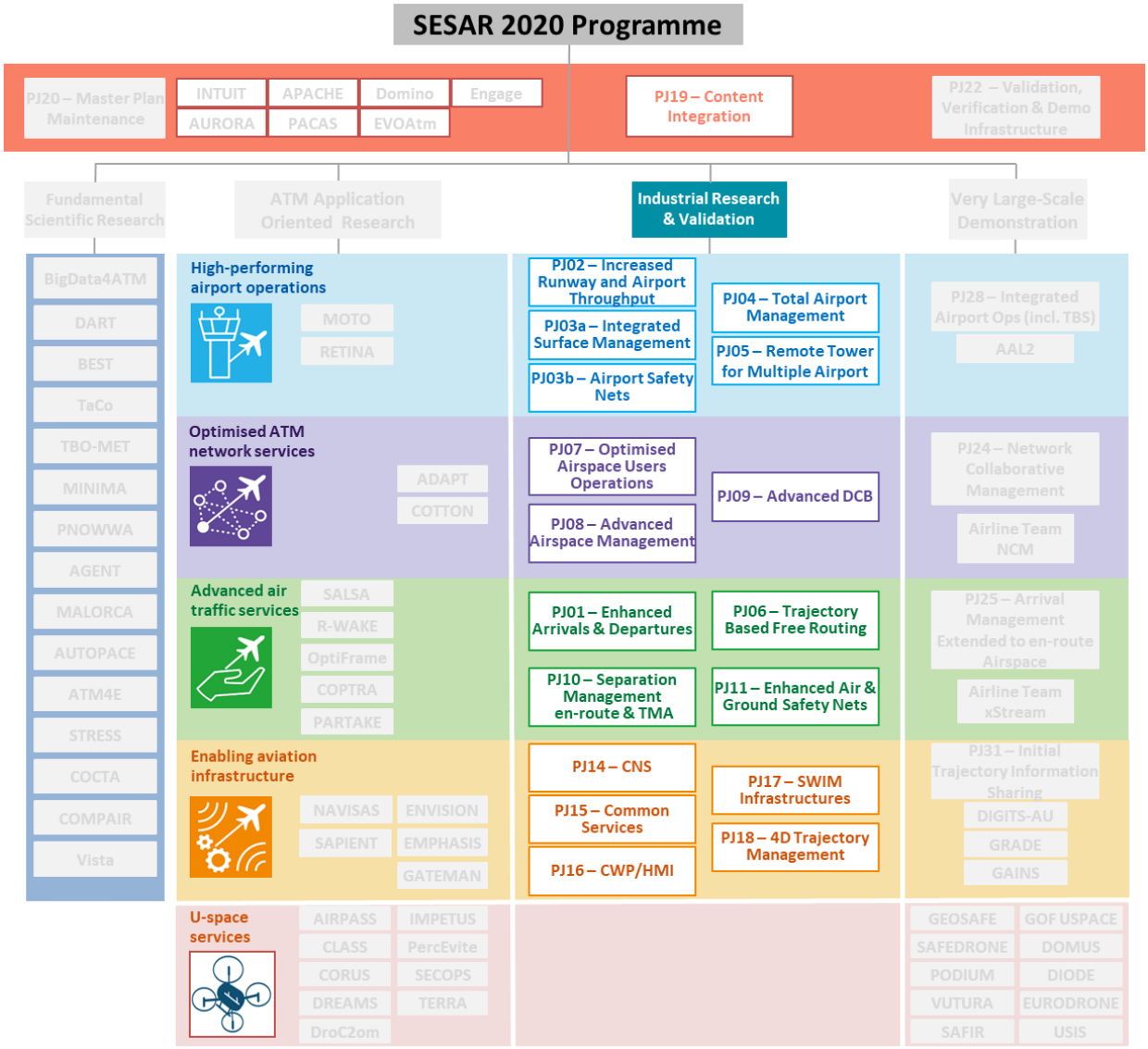

Figure 14: Industrial Research and Validation portfolio of projects matching the research topics as at the end of 2018

For the 2020-2021 period, the execution of the IR is dependent on the results of the IR-VLD Wave 2 call for proposals (with reference H2020-SESAR-2019-1) which will take place in 2019 (see Section III, Chapter 2.3 for the work relating to the Wave 1-Wave 2 transition).

Within IR Wave 1, the SESAR 2020 Programme will comply with all provisions of the H2020 Work Programme 2016-2017. However, it should be noted that the SESAR 2020 Programme will deliver results through the SESAR Solutions and not project by project. Therefore, it is not necessary for all IR projects to provide open access for all data, and therefore IR projects will opt out of the provisions of Annex L 'Open access to research data' in Part 20. General Annexes[26]. This opt-out also aims to protect results that are expected to be commercially or industrially exploited.

[26] Part 20. General Annexes to the Horizon 2020 Work Programme 2016-2017 (European Commission Decision C(2016)4614 of 25 July 2016)

The following paragraphs indicate the candidate SESAR Solutions that will be developed and delivered by the above listed projects through the SESAR Release process. Each entry represents the targeted achievement of an E-OCVM maturity level (V1, V2, or V3); an 'S' represents the target availability date of the SESAR Solution. This information has been established according to the Extended Release Strategy that was developed as part of the MAWP in early 2015, and has been aligned with the updated Extended Release Strategy established with the support of the PC in 2018.[27] Furthermore, the tables below present the ATM System upgrade phase that each candidate SESAR Solution contributes to. These ATM System upgrade phases have been defined in the ATM Master Plan of 2015 and describe how the high-level ATM architecture will be gradually moving from a country-specific architecture to a more interoperable, common and flexible service provision architecture.

2.4.1.1 IR Projects delivering candidate SESAR Solutions within the 'High-Performing Airport Operations' Key Feature

High-performing airport operations

The 'High-Performing Airport Operations' Industrial Research and Validation projects are expected to deliver the following results (candidate SESAR Solutions) in 2019:

Candidate SESAR Solution ref.	Candidate SESAR Solution Title	Maturity level in 2019	ATM system upgrade phase	ATM Master Plan KPAs contributed to
PJ.02-01	Wake turbulence separation optimisation	V3-S (to be delivered in 2020 – grant extension duration)	Phase B – efficient services and infrastructure delivery	• Capacity • Operational efficiency • Resilience • Safety
PJ.02-02	Enhanced arrival procedures	V3-S	Phase B – efficient services and infrastructure delivery	• Capacity • Operational efficiency • Cost-efficiency
PJ.02-03	Minimum-Pair separations based on RSP	V3-S	Phase B – efficient services and infrastructure delivery	• Capacity • Operational efficiency
PJ.02-05	Independent Rotorcraft operations at the Airport	V3-S	Phase C – Regional, trajectory-based, flight- and flow-centric operations	• Capacity • Operational efficiency

[27] This update of the Extended Release Strategy is the results of the review of all projects undertaken in Q1 2018. These projects reviews aimed in particular at identifying any major discrepancies between the SESAR 2020 Programme expectations and the reality of the SESAR Solution development and maturity. As a result, less than a deviation of 10% has been identified which is very good for a research programme.

Candidate SESAR Solution ref.	Candidate SESAR Solution Title	Maturity level in 2019	ATM system upgrade phase	ATM Master Plan KPAs contributed to
				• Predictability • Safety
PJ.02-06	Improved access into secondary airports in low visibility conditions	V2	Phase B – efficient services and infrastructure delivery	• Capacity • Predictability • Safety
PJ.02-08	Traffic optimisation on single and multiple runway airports	V3-S	Phase B – efficient services and infrastructure delivery	• Capacity • Operational efficiency • Predictability • Safety • Resilience • Human Performance
PJ.02-11	Enhanced Terminal Area for efficient curved operation	V1	Phase B – efficient services and infrastructure delivery	• Capacity • Operational efficiency • Predictability • Safety • Cost-efficiency • Flexibility
PJ.03a-01	Enhanced Guidance Assistance to Aircraft and Vehicles on the Airport Surface Combined with Routing	V2	Phase B – efficient services and infrastructure delivery	• Capacity • Predictability • Safety • Human Performance
PJ.03a-03	Enhanced navigation and accuracy in low visibility conditions (LVC) on the airport surface	V2	Phase B – efficient services and infrastructure delivery	• Capacity • Operational efficiency • Predictability • Safety • Resilience
PJ.03a-04	Enhanced Visual Operations	V3	Phase B – efficient services and infrastructure delivery	• Safety • Human Performance • Resilience

Candidate SESAR Solution ref.	Candidate SESAR Solution Title	Maturity level in 2019	ATM system upgrade phase	ATM Master Plan KPAs contributed to
				• Operational efficiency
PJ.03a-09	Surface operations by RPAS	V2	Phase B – efficient services and infrastructure delivery	• Safety • Access and Equity • Interoperability
PJ.03b-01	Enhanced Airport Safety Nets for Controllers	V2	Phase B – efficient services and infrastructure delivery	• Safety • Human Performance • Interoperability
PJ.03b-03	Conformance monitoring safety net for Pilots	V2	Phase B – efficient services and infrastructure delivery	• Safety • Human Performance • Interoperability
PJ.03b-05	Traffic alerts for pilots for airport operations	V3-S	Phase B – efficient services and infrastructure delivery	• Safety • Human Performance • Interoperability
PJ.03b-06	Safety support tools for runway excursions	V2	Phase B – efficient services and infrastructure delivery	• Safety • Human Performance • Interoperability • Cost-efficiency • Capacity
PJ.04-01	Enhanced Collaborative Airport Performance Planning and Monitoring	V3 ongoing	Phase C – Regional, trajectory-based, flight- and flow-centric operations	• Predictability • Punctuality • Operational efficiency • Resilience
PJ.04-02	Enhanced Collaborative Airport Performance Management	V2	Phase C – Regional, trajectory-based, flight- and flow-centric operations	• Capacity • Predictability • Punctuality • Operational efficiency

Candidate SESAR Solution ref.	Candidate SESAR Solution Title	Maturity level in 2019	ATM system upgrade phase	ATM Master Plan KPAs contributed to
PJ.05-02	Remotely Provided Air Traffic Service for Multiple Aerodromes	V3-S	Phase B – efficient services and infrastructure delivery	• Cost-efficiency • Access and Equity • Human Performance
PJ.05-03	Remotely Provided Air Traffic Services from a Remote Tower Centre with a flexible allocation of aerodromes to Remote Tower Modules	V2	Phase C – Regional, trajectory-based, flight- and flow-centric operations	• Cost-efficiency • Access and Equity • Human Performance
PJ.05-05	Advanced Automated MET System for Remote Airport	V2	Phase B – efficient services and infrastructure delivery	• Safety • Predictability

Table 7: Candidate SESAR Solutions delivery within the 'High-Performing Airport Operations' Key Feature in 2019 or 2020

2.4.1.2 IR Projects delivering candidate SESAR Solutions within the 'Optimised ATM Network Services' Key Feature

The 'Optimised ATM Network Services' Industrial Research and Validation projects are expected to deliver the following results (candidate SESAR Solutions) in 2019.

Candidate SESAR Solution ref.	Candidate SESAR Solution Title	Maturity level in 2019	ATM system upgrade phase	ATM Master Plan KPAs contributed to
PJ.07-01	AU Processes for Trajectory Definition	V2 ongoing (to be delivered in 2020 – grant extension duration)	Phase C – Regional, trajectory-based, flight- and flow-centric operations	• Operational efficiency • Predictability • Flexibility • Access and Equity
PJ.07-02	AU Fleet Prioritisation and Preferences (UDPP)	V2 ongoing	Phase C – Regional, trajectory-based, flight- and flow-centric operations	• Predictability • Flexibility • Access and Equity
PJ.07-03	Mission Trajectory Driven Processes	V3 ongoing (to be delivered in 2020 – grant extension duration)	Phase C – Regional, trajectory-based, flight- and flow-centric operations	• Predictability • Security • Access and Equity • Civil/military cooperation and coordination

Candidate SESAR Solution ref.	Candidate SESAR Solution Title	Maturity level in 2019	ATM system upgrade phase	ATM Master Plan KPAs contributed to
PJ.08-01	Management of Dynamic Airspace configurations	V2 (to be delivered in 2020 – grant extension duration)	Phase C – Regional, trajectory-based, flight- and flow-centric operations	• Cost-efficiency • Safety • Operational efficiency • Capacity • Predictability • Human Performance • Cost-efficiency • Flexibility • Civil/Military Cooperation and Coordination • Access and Equity
PJ.08-02	Dynamic Airspace Configuration supporting moving areas	V1	Phase C – Regional, trajectory-based, flight- and flow-centric operations	• Safety • Operational efficiency • Capacity • Predictability • Human Performance • Flexibility • Civil/Military Cooperation and Coordination • Access and Equity
PJ.09-01	Network Prediction and Performance	V2 ongoing	Phase C – Regional, trajectory-based, flight- and flow-centric operations	• Safety • Operational efficiency • Capacity • Cost-efficiency • Predictability • Flexibility • Access and Equity
PJ.09-02	Integrated Local DCB Processes	V2 ongoing	Phase C – Regional, trajectory-based, flight- and flow-centric operations	• Safety • Operational efficiency • Capacity • Cost-efficiency • Predictability

Candidate SESAR Solution ref.	Candidate SESAR Solution Title	Maturity level in 2019	ATM system upgrade phase	ATM Master Plan KPAs contributed to
PJ.09-03	Collaborative Network Management Functions	V2 ongoing	Phase C – Regional, trajectory-based, flight- and flow-centric operations	• Safety • Operational efficiency • Predictability • Cost-efficiency • Capacity • Flexibility • Security • Access and Equity

Table 8: Solutions delivery within the 'Optimised ATM Network Services' Key Feature in 2019 or 2020

2.4.1.3 IR Projects delivering candidate SESAR Solutions within the 'Advanced Air Traffic Services' Key Feature

The 'Advanced Air Traffic Services' Industrial Research and Validation projects are expected to deliver the following results (candidate SESAR Solutions) in 2019:

Candidate SESAR Solution ref.	Candidate SESAR Solution Title	Maturity level in 2019	ATM system upgrade phase	ATM Master Plan KPAs contributed to
PJ.01-01	Extended Arrival Management with overlapping AMAN operations and interaction with DCB and CTA	V2	Phase C – Regional, trajectory-based, flight- and flow-centric operations	• Capacity (TMA) • Predictability • Safety • Cost-efficiency • Operational efficiency
PJ.01-02	Use of Arrival and Departure Management Information for Traffic Optimisation within the TMA	V2	Phase B – efficient services and infrastructure delivery	• Capacity • Predictability • Safety • Cost-efficiency • Operational efficiency • Flexibility
PJ.01-03A	Improved Parallel Operations	V3 ongoing	Phase B – efficient services and infrastructure delivery	• Capacity • Predictability

Candidate SESAR Solution ref.	Candidate SESAR Solution Title	Maturity level in 2019	ATM system upgrade phase	ATM Master Plan KPAs contributed to
				• Safety • Cost-efficiency • Operational efficiency • Flexibility
PJ.01-03B	Dynamic E-TMA for advanced continuous climb and descent operations	V2 ongoing	Phase B – efficient services and infrastructure delivery	• Capacity • Predictability • Safety • Cost-efficiency • Operational efficiency • Flexibility
PJ.01-05	Airborne Spacing Flight Deck Interval Management	V2	Phase B – efficient services and infrastructure delivery	• Capacity • Predictability • Safety • Cost-efficiency • Operational efficiency • Interoperability
PJ.01-06	Enhanced Rotorcraft and GA operations in the TMA	V3-S	Phase B – efficient services and infrastructure delivery	• Capacity • Predictability • Safety • Operational efficiency
PJ.01-07	Approach Improvement through Assisted Visual Separation	V2	Phase B – efficient services and infrastructure delivery	• Capacity • Predictability • Safety • Cost-efficiency • Operational efficiency
PJ.06-01	Optimised traffic management to enable Free Routing in high and very high complexity environments.	V3-S	Phase A – Address known critical network performance deficiencies	• Predictability • Cost-efficiency • Operational efficiency

Candidate SESAR Solution ref.	Candidate SESAR Solution Title	Maturity level in 2019	ATM system upgrade phase	ATM Master Plan KPAs contributed to
				• Interoperability
PJ.06-02	Management of Performance Based Free Routing in lower Airspace	V2	Phase C – Regional, trajectory-based, flight- and flow-centric operations	• Capacity • Predictability • Cost-efficiency • Human Performance • Operational efficiency • Access and Equity • Interoperability
PJ.10-01a	High Productivity Controller Team Organisation	V3	Phase B – efficient services and infrastructure delivery	• Safety • Operational efficiency • Cost-efficiency • Capacity • Predictability • Flexibility
PJ.10-01b	Flight Centred ATC	V2	Phase C – Regional, trajectory-based, flight- and flow-centric operations	• Capacity • Flexibility • Cost-efficiency • Human Performance • Operational efficiency • Predictability
PJ.10-01c	Collaborative Control	V2	Phase B – efficient services and infrastructure delivery	• Safety • Operational efficiency • Cost-efficiency • Capacity • Predictability

Candidate SESAR Solution ref.	Candidate SESAR Solution Title	Maturity level in 2019	ATM system upgrade phase	ATM Master Plan KPAs contributed to
				• Flexibility
PJ.10-02a	Improved Performance in the Provision of Separation	V3-S	Phase C – Regional, trajectory-based, flight- and flow-centric operations	• Capacity • Safety • Human Performance • Cost-efficiency
PJ.10-02b	Advanced Separation Management	V1	Phase C – Regional, trajectory-based, flight- and flow-centric operations	• Capacity • Operational efficiency • Predictability • Safety • Human Performance • Cost-efficiency
PJ.10-05	IFR RPAS Integration	V2	Phase B – efficient services and infrastructure delivery	• Safety • Interoperability
PJ.10-06	Generic (non-geographical) Controller Validations	V1	Phase C – Regional, trajectory-based, flight- and flow-centric operations	• Cost-efficiency
PJ.11-A1	Enhanced Airborne Collision Avoidance for Commercial Air Transport normal operations - ACAS Xa	V3-S	Phase B – efficient services and infrastructure delivery	• Safety • Human Performance
PJ.11-A2	Airborne Collision Avoidance for Remotely Piloted Aircraft Systems – ACAS Xu	V2	Phase B – efficient services and infrastructure delivery	• Safety • Human Performance
PJ.11-A3	ACAS for Commercial Air Transport specific operations – ACAS Xo	V2	Phase B – efficient services and infrastructure delivery	• Safety • Human Performance
PJ.11-A4	Airborne Collision Avoidance for General Aviation and Rotorcraft – ACAS Xp	V2	Phase B – efficient services and infrastructure delivery	• Safety • Human Performance

Candidate SESAR Solution ref.	Candidate SESAR Solution Title	Maturity level in 2019	ATM system upgrade phase	ATM Master Plan KPAs contributed to
PJ.11-G1	Enhanced Ground-based Safety Nets adapted to future operations	V2	Phase C – Regional, trajectory-based, flight- and flow-centric operations	• Safety • Human Performance

Table 9: Candidate SESAR Solutions delivery within the 'Advanced Air Traffic Services' Key Feature in 2019 or 2020

2.4.1.4 IR Projects delivering candidate SESAR Solutions within the 'Enabling Aviation Infrastructure' Key Feature

The 'Enabling Aviation Infrastructure' Industrial Research and Validation projects are expected to deliver the following results in 2019 or 2020. Enabling Aviation Infrastructure projects are not mapped with Performance Focus Areas as their role in the work programme is to support the achievement of performance targets through operational projects. Similarly, the maturity of the Enabling Aviation Infrastructure candidate Solutions is indicated according to the technology readiness level (TRL) criteria and not according to the E-OCVM as for other Key Features:

Candidate SESAR Solution ref.	Candidate SESAR Solution Title	Maturity level in 2019	ATM system upgrade phase
PJ.14-01-01	CNS environment evolution	TRL2	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.14-02-01	FCI Terrestrial Data Link	TRL4	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.14-02-02	Future Satellite Communications Data link	TRL4	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.14-02-04	FCI Network Technologies incl. voice solutions & military interfacing	TRL4	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.14-02-05	Development of new services similar to FIS-B to support ADS-B solutions for General Aviation	TRL4	Phase B – efficient services and infrastructure delivery
PJ.14-02-06	Completion of AeroMACS development	TRL6	Phase B – efficient services and infrastructure delivery
PJ.14-03-01	Advanced GBAS cat II-III operations (e.g. offset touchdown)	TRL4	Phase B – efficient services and infrastructure delivery

Candidate SESAR Solution ref.	Candidate SESAR Solution Title	Maturity level in 2019	ATM system upgrade phase
PJ.14-03-02	Multi Constellation / Multi Frequency (MC/MF) GNSS	TRL4	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.14-03-04	Alternative Position, Navigation & Timing – short term (A-PNT)	TRL6	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.14-04-01	Surveillance Performance Monitoring	TRL4	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.14-04-03	New use & evolution of Cooperative & Non-Cooperative Surveillance	TRL4	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.15-01	Sub-regional Demand Capacity Balancing Service	TRL6 ongoing	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.15-02	Delay Sharing Service	TRL6 ongoing	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.15-08	Trajectory Prediction Service	TRL4	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.15-09	Data Centre Service for Virtual Centres	TRL6	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.15-10	Static Aeronautical Data Service	TRL6 ongoing	Phase B – efficient services and infrastructure delivery
PJ.15-11	Aeronautical Digital Map Service	TRL6 ongoing	Phase B – efficient services and infrastructure delivery
PJ.16-03	Work Station, Service Interface Definition & Virtual Centre Concept	TRL6	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.16-04	Workstation, Controller productivity	TRL4	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.17-01	SWIM TI Purple Profile for Air/Ground Advisory Information Sharing	TRL6 (to be delivered in 2020 – grant extension duration)	Phase B – efficient services and infrastructure delivery
PJ.17.03	SWIM TI Green profile for G/G Civil Military Information Sharing	TRL4	Phase B – efficient services and infrastructure delivery

Candidate SESAR Solution ref.	Candidate SESAR Solution Title	Maturity level in 2019	ATM system upgrade phase
PJ17-07	SWIM TI Purple Profile for Air/Ground Safety-Critical Information Sharing	TRL1	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.17-08	SWIM TI Common runtime registry	TRL4	Phase B – efficient services and infrastructure delivery
PJ.18-01a	Addressed the technical part of 'Mission Trajectory Driven Processes' (will be removed because included in solution 07-03)		Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.18.01b	Mission Trajectories in TBO (will be removed because included in solution 18-02a)		Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.18-02a	Trajectory-based operations	V1	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.18-02b	Flight object interoperability		Phase B – efficient services and infrastructure delivery
PJ.18-02c	eFPL supporting SBT transition to RBT	TRL6	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.18-04a	Improved AIM Information	TRL6	Phase B – efficient services and infrastructure delivery
PJ.18-04b	Improved MET Information	TRL6	Phase B – efficient services and infrastructure delivery
PJ.18-04c	Improved use of MET and AIM in Cockpit	TRL4	Phase B – efficient services and infrastructure delivery
PJ.18-06a	ATC Planned Trajectory Performance Improvement	TRL6	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.18-06b	Tactical and NM Trajectory performance improvement	TRL4	Phase C – Regional, trajectory-based, flight- and flow-centric operations

Table 10: Candidate SESAR Solutions delivery within the 'Enabling Aviation Infrastructure' Key Feature in 2019 or 2020

Candidate SESAR Solution PJ.18-02b 'Flight Object Interoperability' has been extended to fully deliver the IOP Solution by 2020; while in 2018, significant progress has been made in the preparation of the two validation exercises with in particular a significant visibility demonstration run in April 2018. This is part of the actions required to mitigate risk CORP#03 'IOP solution supporting the PCP and developed in SESAR 2020 may not be delivered on time for deployment' (see Annex VIII for further details).

In 2019, the first exercise will be run in April securing the core scope of the PCP for En-route operations, while the second exercise will be run in April 2020 to complete the full scope in conjunction with operational expert validations.

2.4.2 IR Wave 2 (planned for the period from 2019 to 2022) – call for proposals with reference H2020-SESAR-2019-1

The IR Wave 2 call for proposals (within the restricted call with reference H2020-SESAR-2019-1 also covering VLD activities) will provide the flexibility needed to align future research with the results of Wave 1, re-assess relative priorities and ensure the best value-for-money for the EU and delivery against SES goals. This call will also allow for the completion of those candidate SESAR Solutions which were not planned to be delivered to V3 maturity level within Wave 1. It will also allow for strategic input to scope new projects from the Master Plan update and to build on results of the outcome of ER projects from the ER1 call for proposals to increase the maturity of research towards future SESAR Solutions.

This ecosystem will mainly be built upon ATM solutions characterised by:

- Higher levels of autonomy and connectivity of all air vehicles coupled with a more automated management of traffic;
- Digital and automated tools provided on board the aircraft itself or as part of the ground-based infrastructure;
- Virtual technologies to decouple the physical infrastructure such as sensors, communication or navigation devices from the services that are provided to manage the airspace;
- Big data analytics and open source data usage to encourage the creation of new services;
- System modularity to allow scalable and easier upgrades and greater interoperability.

For the definition of the candidate SESAR Solutions, the SESAR JU paid particular attention to ensuring a path towards achieving the SESAR Vision given in the ATM Master Plan 2015 edition and its performance ambition. This approach relied on the use of prioritisation criteria:

- ATM Performance Improvement Potential: demonstrating performance gains in Capacity (at Airport, en-route and in TMA), Cost-efficiency, Operational Efficiency, Safety, Security and Environment;
- ATM Digitalisation Potential: advancing automation, connectivity/sharing of information, Virtualisation, Integration of all vehicles, Flight- and flow-centric operations, Lean and modular systems.

The SESAR JU ran a prioritisation process including independent experts' assessment and stakeholders' consultation via the MPC and the PC according to the consultation process defined in the SPD 2018-2020.

The results expected from Wave 1 and Wave 2 will cover the objectives set for the Development phase of the SESAR programme in the Master Plan. Furthermore, the results from IR-VLD Wave 2 will provide the basis for setting up a changed ecosystem for aviation, and more specifically for modernising the underlying ATM infrastructure.

The total available funding for the Wave 2 call is EUR 151,5 million, covering both IR and VLD activities[28], with an indicative amount of EUR 131 million for IR. The exact allocation of funding appears in Section III, Paragraph 2.6.1.2.

[28] However, it should be noted that this call may be launched on the basis of the triggering the European Commission's implementing agreements, and without the availability of the related commitments in accordance with the budget profile available today

The objective is to launch the call in early 2019 and perform the evaluation of the proposals, the selection and grant of awards by the end of 2019. Subject to the successful completion of the grant award procedure and of the grant agreement signature procedure in 2019 and early 2020, this approach enables the launch into execution of the Wave 2 IR projects during Q4 2019-Q1 2020 and the delivery of Wave 2 candidate SESAR Solutions during 2020 and through to 2022.

The candidate SESAR Solutions will be developed (and, in some cases, delivered) by Wave 2 projects through the SESAR Release process. The list of Solutions developed under IR Wave 2 will be available following the completion of the Wave 2 grant award procedure. Section III, Paragraph 2.6.1.2.4 provides the conditions of the Wave 2 call, which includes the list of Topics and candidate Solutions to be developed in the context of Wave 2.

2.4.3 IR Wave 3 (currently planned for the period from 2020 to 2022) – Call with reference H2020-SESAR-2020-2

Considering that unspent budget could be made available at the end of Wave 1 and as a result of the evaluation of the Wave 2 proposals (e.g. proposals not accepted), the SESAR JU plans to launch the last restricted IR call (Wave 3 with reference H2020-SESAR-2020-2) in 2020. The objective of this activity is to optimise the coverage of the research and innovation topics of the SESAR 2020 programme, responding to the ATM Master Plan Phase C (see figure 5 in Chapter 1.4) and taking due account of the outcome of the Airspace Architecture Study. In preparation for this, during 2019 the SESAR JU will carry out activities required to define the content of the IR Wave 3 call if the need is confirmed. The SESAR JU will apply the same consultation process as described in the SPD 2018-2020 Section III, Paragraph 2.1.2, with an adapted timeline to secure the launch of the call and the completion of the award and grant agreement signature process before the end of 2020.

This approach will enable the launch into execution of the IR Wave 3 projects in Q4 2020 or in Q1 2021 at latest, with delivery of candidate SESAR Solutions in 2021 and 2022. IR Wave 3 is the last call for Industrial Research & Validation, consuming all remaining SESAR 2020 IR budget and securing the commitment of the SJU members until the end of the SESAR 2020 programme operations.

This third IR call would provide the flexibility needed to align future research with the results of Wave 1, re-assess relative priorities and ensure the best value-for-money for the EU and delivery against SES goals. This call would also allow to address Airspace Architecture Study and ATM Master Plan elements not already fully covered in the Wave 2 and to build on results of the outcome of Exploratory Research projects from the ER1, ER2-RPAS and ER3 calls for proposals (see paragraph 2.3) to increase the maturity of the research towards future SESAR Solutions.

The total available funding for the Wave 3 call is subject to the closure of Wave 1 and the final award of Wave 2. The exact allocation of funding is to be determined and will be defined in the SPD 2020-2022. The SESAR JU will aim to optimise the usage of available funds for this call. Finally, the Wave 3 call might be an opportunity to complete the scope of Wave 2 call to cover topics not awarded or solutions not covered (or only partially covered) by the awarded grants due to the limited budget devoted to IR in the Wave 2 call for proposals.

The candidate SESAR Solutions would be developed (and, in some cases, delivered) by Wave 3 projects through the SESAR Release process. The list of Solutions developed under IR Wave 3 will be available following the completion of the Wave 3 grant award procedure.

2.5 Strategic Area of Operation 4: Deliver Very Large-Scale Demonstration activities (VLD)

Very Large Scale Demonstrations are designed to help bridge the gap between the development and deployment phases of the SESAR programme, and not to replace either type of activity. VLDs use early versions of end-user systems and include the integration of new technology elements into existing systems when needed and possible. As such, VLDs will mostly derive from work matured through an earlier phase of Industrial Research & Validation.

Very Large-Scale Demonstrations are conducted either by the SESAR JU Members, and as such are subject to restricted calls for proposals, or by other entities through open calls for proposals. VLD activities are run under six calls for proposals and receive overall direct funding (Title III – Operational expenditure) of EUR 107,6 million, broken down as depicted in the figure below. The exact amount of each call is to be confirmed, especially to take into account the results of previous grant award procedures and of the grant amendment procedure for grants established under the restricted call for proposals with reference H2020-SESAR-2015-2 in 2018. In addition, a proportion of SESAR JU running costs (Title I – Staff expenditure and Title II – Infrastructure and operating expenditure) is used to carry out the Very Large-Scale Demonstration activities. The overall funding of Strategic Area of Operation #4 (Very Large-Scale Demonstration activities) for the period from 2015 to 2022 is indicated in Annex I.

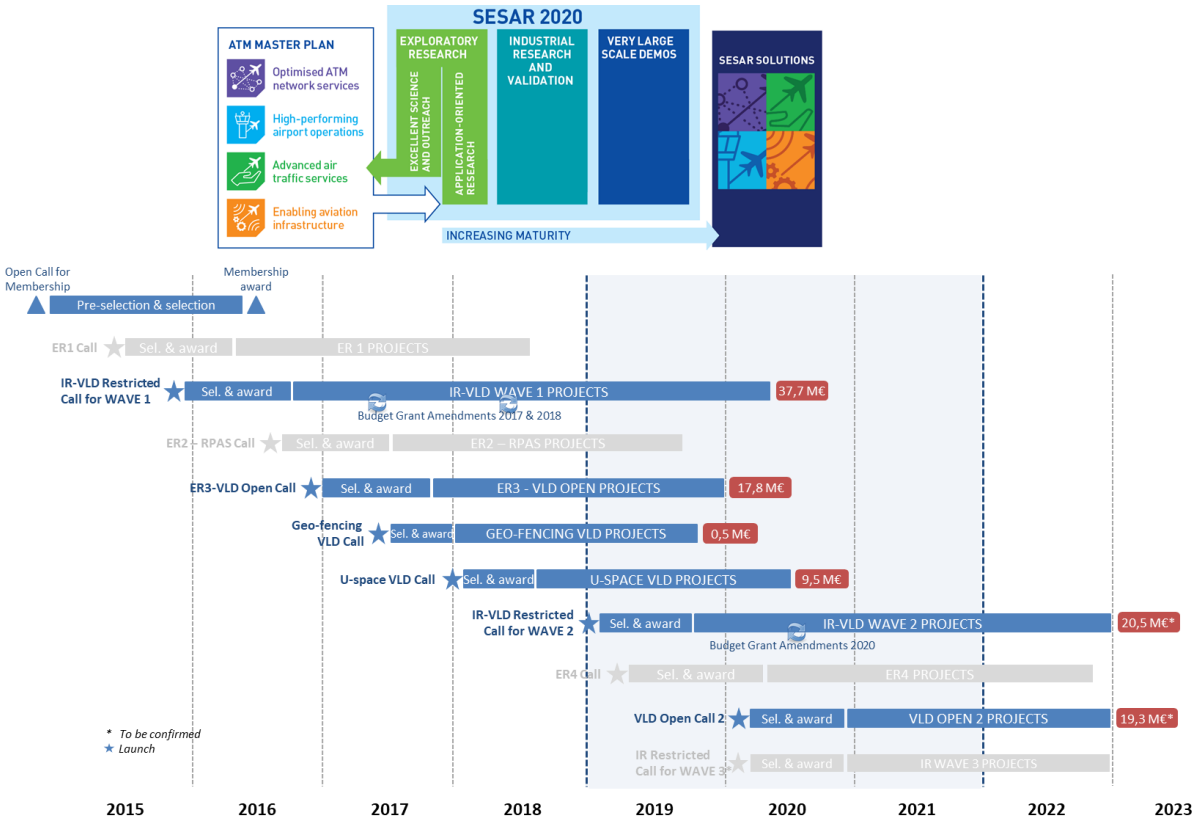

Figure 15: Sequence of VLD calls and related funding from 2015 to 2022

Therefore, during the 2019-2021 period, the SESAR JU will do the following, in the context of Very Large-Scale Demonstration activities:

- Supervise and ensure the delivery of VLD activities stemming from Wave 1 VLD and the VLD Open 1 calls for proposals (with reference H2020-SESAR-2015-2 and H2020-SESAR-2016-2 respectively), as well as the related grant agreements for Wave 1, then close these activities;
- Supervise and ensure the delivery of activities stemming from the Geo-fencing VLD call for proposals (with reference SESAR-2017-1);
- Supervise and ensure the delivery of the activity stemming from U-space ('U-space call' with reference CEF-SESAR-2018-1), then close this activity;
- Run the Wave 2 call procedure (within the call for proposals with reference H2020-SESAR-2019-1), evaluate the proposals received and subsequently award the grants, then sign the grant agreements and launch the projects; the VLD activities under the Wave 2 call are expected to close by the end of 2022; it is also envisaged that the same grant budget amendment procedure as for Wave 1 projects will be applied for Wave 2 projects in 2020;
- Execute (in 2019-2020) the transfer of the results of the Wave 1 IR projects to the Wave 2 VLD activities;
- Prepare and launch the VLD Open 2 call procedure (with reference H2020-SESAR-2020-1), with a view to conducting the evaluation of the proposals received and the award and signature of the grant agreements in 2020. The VLD activities under the VLD Open 2 call are expected to close by the end of Q3 2022.

As outlined in the SESAR 2020 Programme research topics presented in the introduction to Chapter 2, Very Large-Scale Demonstration activities cover the four Key Features of the ATM Master Plan, along with other high priority policy areas:

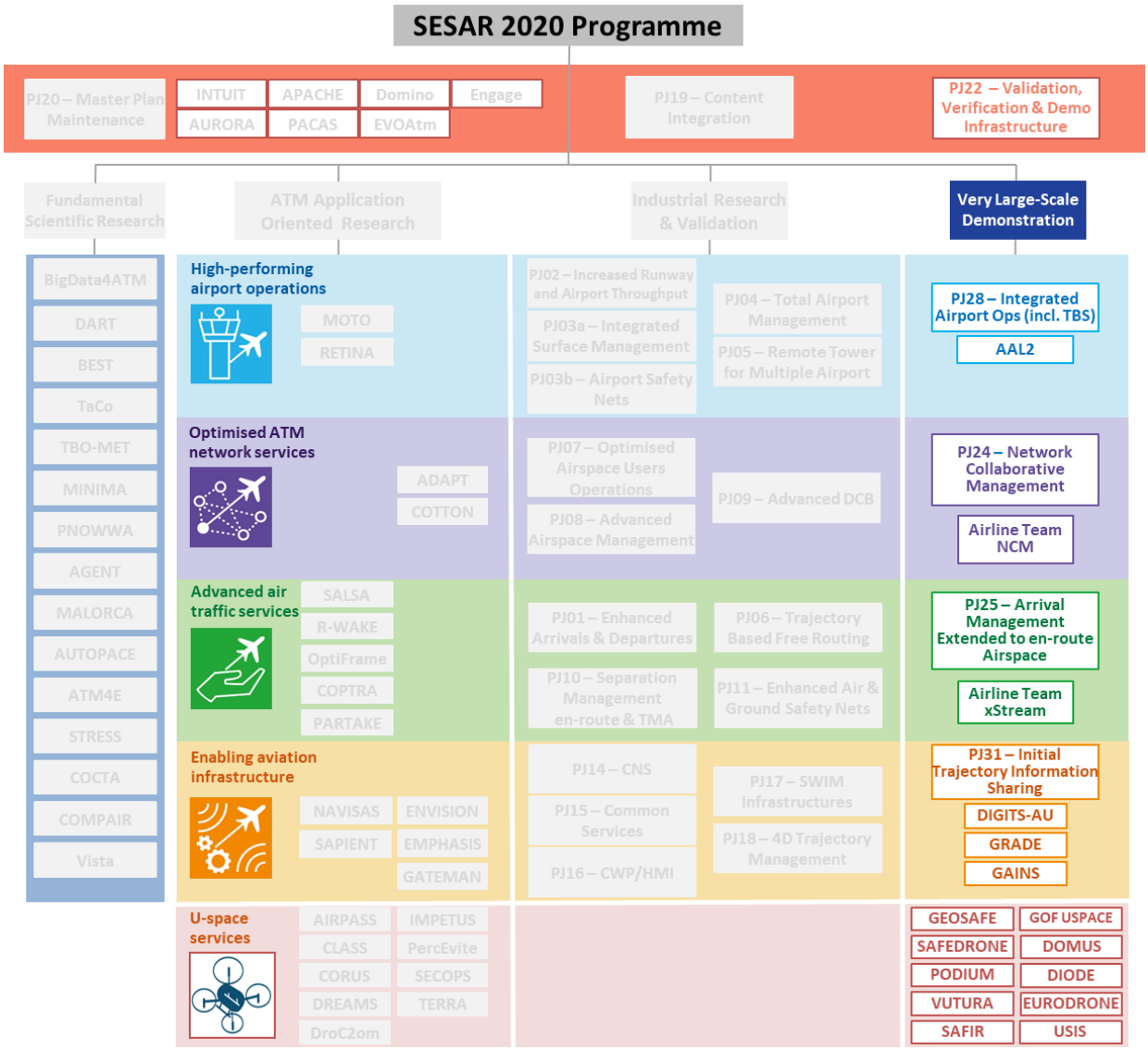

Figure 16: Very Large-Scale Demonstration portfolio of projects matching the research topics as at end 2018[29]

2.5.1 Management of calls for proposals within the H2020 set of rules

2.5.1.1 Calls already closed and projects already launched at the end of 2018

For grants relating to VLD Wave 1, the SESAR 2020 Programme will comply with all provisions of the H2020 Work Programme 2016-2017. It should be noted that the SESAR 2020 Programme will deliver results through the SESAR Solutions and not project by project. Therefore, it is not necessary for all VLD activities to provide open access for all data, therefore VLD activities will opt out of the provisions

[29] Compared to the figure presented in previous Single Programming Documents, VLD activity PJ.27 'Flight Information Exchange' is not appearing as it has been terminated in 2017 following recommendation of the Programme Committee

of Annex L 'Open access to research data' in Part 20. General Annexes[30]. This opt-out also aims to protect results that are expected to be commercially or industrially exploited

For grants relating to VLD Open 1, the SESAR JU will comply with all provisions of the H2020 Work Programme 2018-2020[31], including Annex L 'Open access to research data' within Part 19. General Annexes.

2.5.1.1.1 VLD Wave 1 (2016-2019) – Call with reference H2020-SESAR-2015-2

In 2019, and in continuation of the activities carried out in the period from 2016 to 2018, VLD activities will be conducted through four activities covering the four Key Features, taking into account that two projects (PJ.23 and PJ.26) were not awarded as a result of the call and that one project (PJ.27) has been terminated in 2018. These projects will deliver the following outcomes in 2019:

VLD activity ref.	Wave 1 VLD deliverables	2019
PJ.24	Demonstration Plan for Network Collaborative Management considering the Network Manager, Air Navigation Services, Airports and AU Flight Operation Centres	
	Demonstration Report for Network Collaborative Management considering the Network Manager, Air Navigation Services, Airports and AU Flight Operation Centres	X
PJ.25	Demonstration Plan for Arrival Management extended to En-Route Airspace	
	Demonstration Report for Arrival Management extended to En-Route Airspace	X
PJ.28	Demonstration Plan for Integrated Airport Operations	
	Demonstration Report for Integrated Airport Operations	X
PJ.31	Demonstration Plan for ATM Improvements Generated by Initial Trajectory Sharing (Extended Projected Profile)	
	Demonstration Report for ATM Improvements Generated by Initial Trajectory Sharing (Extended Projected Profile)	X

Table 11: Deliverables of Very Large-Scale Demonstration projects in 2019

[30] Part 20. General Annexes to the Horizon 2020 Work Programme 2016-2017 (European Commission Decision C(2016)4614 of 25 July 2016)

[31] European Commission Decision C(2017)7124 of 27 October 2017

2.5.1.1.2 VLD Open 1 within the call for proposals with reference H2020-SESAR-2016-2

To complement the previous call for proposals restricted to SESAR JU Members, an open call for proposals relating to Very Large-Scale Demonstration activities ('Open VLD call' within the call for proposals with reference H2020-SESAR-2016-2) was launched at the end of 2016. Out of the total maximum co-financing level of EUR 18 million for Very Large-Scale Demonstrations, the outcome of the call was an award of EUR 17,8 million and the selection of ten VLD activities[32]. The activities were launched into execution in the course of 2018, each delivering a Demonstration Plan and a Demonstration Report within the indicative project duration of 2 years. These are as follows:

Topic / Project acronym	Project Title	Short Project Description	Max. total co-financing value (in EUR)
Arrival management extended to En-route airspace			
Airline Team xStream	Airspace User Support to Arrival Management	The project will demonstrate the benefits for AUs in the operation of cross-border Arrival Management (AMAN systems) with an extended horizon in accordance with the Pilot Common Project first ATM Functionality (AF#1), as well as the demonstration of AU involvement in the operation of two AMAN-related advanced concepts: the Target Time management concept and the Arrival Flexibility (A-FLEX) concept, which connect the Extended AMAN concept to the PCP Fourth ATM Functionality (AF#4) The consortium will ensure the required operational capabilities of European AUs to contribute to the overall project objectives of SESAR 2020 PJ.25	1.800.963
Network Collaborative Management			
Airline Team NCM	Airspace User support to the development of Network Collaborative Management	The future ATM system concerns the entire ATM community. ATM is seen as a critical element in the air transport value chain and is the key to connecting Europe's regions while making it a global hub for mobility and prosperity. The focus of ATM modernisation needs therefore to reflect a greater focus towards increased efficiency and effectiveness while sustaining or even improving levels of safety and security. At the same time, it must also recognise the need to provide solutions to address critical capacity bottlenecks. ATM modernisation should continue to look at the flight as a whole, for instance end to end,	2.008.650

[32] A total of sixteen grant agreements were signed as a result of the call with reference H2020-SESAR-2016-2 comprising both ER and Open VLD, and two additional grant agreements are in the grand agreement preparation phase on VLD (therefore, the latter do not appear in the table above)

Topic / Project acronym	Project Title	Short Project Description	Max. total co-financing value (in EUR)
		within a flow and network context, and not in segmented portions of its trajectory, as is still the case today. With this in mind, the vision will be realised across the entire ATM system, offering improvements at every phase of a flight from early planning to complete execution. This vision is building on the notion of 'Trajectory Based Operations' (TBO) and relies on the provision of Air Navigation Services in support of the execution of the business or mission trajectory - meaning that AUs can fly their preferred trajectories without being constrained by airspace configurations. This vision is enabled by a progressive increase in the level of automation support, the implementation of virtualisation technologies and the use of standardised and interoperable systems	
Initial Trajectory Information Sharing			
DIGITS-AU	Demonstration of ATM Improvements Generated by Initial Trajectory Sharing - Airspace User Part	DIGITS-AU is the essential AU complement to the DIGITS project (Demonstration of ATM Improvements Generated by Initial Trajectory Sharing). DIGITS-AU brings together AUs - who operate (even partially) in the airspace of ANSPs participating in DIGITS - who will receive new onboard avionics capabilities, making it possible to downlink trajectory predictions, the so-called Extended Projected Profile (EPP), for sharing with ATC	4.527.147
Increase access to airports for low visibility mixed fleet operations			
AAL2	Augmented Approaches to Land 2	The proposed Augmented Approaches to Land 2 (AAL2) project addresses increased access to airports for low visibility mixed fleet operations. It builds upon the results from the former award winning SESAR project AAL, and will demonstrate augmented approach and landing operations based on the following candidate SESAR solutions: - Ground Based Augmentation System (GBAS) CAT II with CAT I airborne and ground equipment, enabling lower decision heights to CAT II minima (decision height 100ft) (addresses hubs and medium size airports);	2.110.729

Topic / Project acronym	Project Title	Short Project Description	Max. total co-financing value (in EUR)
		- Enhanced Flight Vision System (EFVS) to land using Head Up /or Mounted Display, with operational credit down to 300 m RVR in non- CAT II/III airports (addresses medium-sized and small airports).	
Solutions for General Aviation and Rotorcraft			
GRADE	GNSS Solutions for Increased GA and Rotorcraft Airport Accessibility Demonstration	The project main objective is the demonstration of General Aviation and Rotorcraft (GA/R) capability to benefit from the concepts developed in the SESAR programme, in order to facilitate their integration into airspace and airports where the SESAR concepts and technologies have been implemented. This objective will be achieved through live flight trials and preparatory Real-Time Simulation campaign, with hardware and humans in the loop, which will be focused on both procedural issues and technological aspects relating to GNSS technologies and simultaneous non-interfering (SNI) operations. Specifically, the GRADE project will demonstrate in flight, by using GA aircraft and rotorcraft equipped with non-certified or specific on-board equipment, the following existing candidate SESAR Solutions: Solution #51 – 'Enhanced terminal operations with LPV procedures', Solution #55 – 'Precision approaches using GBAS CAT II/III', Solution #103 – 'Approach Procedure with vertical guidance', Solution #113 – 'Optimised Low Level IFR routes for rotorcraft'. The project will also focus on technological aspects, testing in flight the following products, already available within the consortium and suitably customised to fit the above listed candidate SESAR Solutions: GNSS EGNOS and GBAS navigation algorithms able to guarantee the applicable RNP; Portable non certified Primary Flight Display to support pilot decisions and operations. The live flight trials will be conducted at two different sites and using three different aircrafts (two fixed-wing and one rotary aircraft). Flight tests data and information will be collected and analysed by taking into account relevant applicable SESAR Key Performance Areas and suitably performance indices.	1.156.015

Topic / Project acronym	Project Title	Short Project Description	Max. total co-financing value (in EUR)
		Performance evaluation and lessons learnt will represent the outcome of the project and will be made available to support regulation, standardisation and certification activities, as well as the integration of GA/R with commercial aviation	
GAINS	General Aviation Improved Navigation and Surveillance	The objective is to validate concepts on avionics and use of flight instrument procedures tailored to general aviation (GA) that enable the integration and inclusion of GA within high-density airspace or environments in which GA is constrained due to proximity of adjacent airports or airways for scheduled airlines or the military. The project builds on the concept demonstrated in the EVA project considering the suitability of ground monitoring from aerodromes with basic air traffic services (ATS) or ground services and testing viability for the use of PBN procedures more tailored to the capabilities of GA and the limitations of operations in dense airspace	1.453.690
Safe integration of drones			
PODIUM	Proving Operations of Drones with Initial UTM Management	Will perform four complementary large-scale demonstrations – with over 185 drone flights - at Odense in Denmark, Bretigny and Toulouse in France, and Eelde in the Netherlands. Unmanned aircraft system traffic management (UTM) solutions will be demonstrated for VLOS and BVLOS drone flights. The scope covers very low-level operations in rural and urban areas, in the vicinity of airports, in uncontrolled and controlled airspace, and in mixed environments with manned aviation.	1.395.649
SAFEDRONE	Activities on drone integration and demonstration in VLL operations	Aims to demonstrate how to integrate general aviation, state aviation, optionally piloted aircraft and drones into non-segregated airspace in a multi-aircraft and manned flight environment. The project will perform a large number of demonstrations in Spain the ATLAS flight test centre in Villacarrillo (Jaén, Spain) in order to accumulate evidence and experience about the required services and procedures necessary to operate drones in a safe, efficient and secure way within U-space.	1.169.074

Topic / Project acronym	Project Title	Short Project Description	Max. total co-financing value (in EUR)
		The demonstration is about U1 and U2 services, and a limited version of U3 advanced services including automated detect & avoid technologies.	

Table 12: Initial outline of VLD Open 1 projects (call for proposals with reference H2020-SESAR-2016-2)

2.5.1.2 Calls for proposals on Very Large-Scale Demonstration activities to be organised in the 2019-2021 period within the H2020 set of rules

In 2019, the SESAR JU will launch the restricted call for proposals with reference H2020-SESAR-2019-1 (to be launched in early 2019) and one open call for proposals in 2020 (with reference H2020-SESAR-2020-1). The VLD Wave 2 call (within the restricted call for proposals with reference H2020-SESAR-2019-1 also covering IR) will focus on the SESAR Solutions delivered in IR Wave 1. The total available funding for the Wave 2 call is EUR 151,5 million, covering both IR and VLD activities[33], with an indicative amount of EUR 20,5 million for VLD. The exact allocation of funding (see SPD 2018-2020 Section III, Chapter 2.1 for the Wave 2 definition process) appears in Section III, Paragraph 2.6.1.2 of the present document. The timeline for the call management and grant award procedures is the one defined for the Wave 2 call, introduced in Paragraph 2.4.2 above.

In 2020, the SESAR JU will launch the second open VLD call. Subject to the successful completion of the grant award procedure in Q3 2020 and the subsequent grant agreement signature procedure, this approach enables the launch into execution of the VLD Open 2 activities during 2020 and through to the end of 2022. This call is intended to be the last call for Very Large-Scale Demonstrations, when it is anticipated that all of the SESAR 2020 VLD budget will have been consumed.

In 2019 and 2020, taking account of the overall outcome of the VLD calls, the SESAR JU will analyse the gap between the expected VLD results and the objectives set out by the Master Plan for the SESAR 2020 Programme in relation to Very Large-Scale Demonstrations, and will plan for the necessary actions as required.

2.5.2 Management of calls for proposals falling within sets of rules other than H2020

2.5.2.1 Geo-fencing VLD call – Call with reference SESAR-2017-1

A specific call for proposals related to geo-fencing VLD activities was launched in 2017 through European Parliament's / European Commission's funds in accordance with the standard EU Financial Regulation[34]. It was managed in the SESAR JU accounts as assigned revenue. The scope of this call focused solely on Active Geo-fencing Service and fills the gap with activities conducted under the previous call for proposals (VLD Open call for proposals with reference H2020-SESAR-2016-2) in the topic on the 'Safe integration of drones' in relation to geo-fencing. It targets demonstrations of web-

[33] However, it should be noted that this call may be launched on the basis of the triggering the European Commission's implementing agreements, and without the availability of the related commitments in accordance with the budget profile available today

[34] Regulation (EU, Euratom) 2018/1046 of the European Parliament and of the Council of 18 July 2018 on the financial rules applicable to the general budget of the Union, amending Regulations (EU) No 1296/2013, (EU) No 1301/2013, (EU) No 1303/2013, (EU) No 1304/2013, (EU) No 1309/2013, (EU) No 1316/2013, (EU) No 223/2014, (EU) No 283/2014, and Decision No 541/2014/EU and repealing Regulation (EU, Euratom) No 966/2012 (OJ L 193, 30.7.2018, p. 1–222)

based Geo-fencing solutions that use location signals to prevent drones from flying in no-fly zones. The call procedure resulted in the signature of a grant agreement under which one project (GEOSAFE) will deliver its results within two years (2018-2019), complementing the work done in the context of the call for proposals H2020-SESAR-2016-2 on the topic 'Integrating Remotely Piloted Aircraft Systems (RPAS) in European airspace using an Active Geo-fencing Service (AGS)' – see previous paragraph. This will ensure that any gaps can be targeted and opportunities explored in order to make the most of the limited funding available.

The GEOSAFE project aims to establish state-of-the-art geo-fencing solutions regarding U-space regulation, to propose/evaluate improvements and recommendations for future geo-fencing system definition through an extensive flight-test campaign to be conducted at Pourrières, Bordeaux, Montmagny and Valence in France. The campaign will employ a number of commercially available geo-fencing solutions to address drone behaviour in different situations. The campaign will also perform a technical assessment of the navigation system's performance with regard to the efficiency of geo-fencing.

2.5.2.2 U-space call (2018-2019) – Call for proposals with reference CEF-SESAR-2018-1

In light of discussions held in June 2017 with the European Commission, and driven by the concept of U-space further developed in the U-space blueprint, the SESAR JU has been mandated to manage a call under the Connecting Europe Facility (CEF) programme for a value of EUR 9,5 million, relating to the performance of a number of large-scale demonstration activities to validate systems that support U-space services against the relevant requirements and standards: the U-space demonstration call for proposals with reference CEF-SESAR-2018-1. The SESAR JU launched this open call for proposals in early 2018 and signed six grant agreements. Subsequently, the related projects were launched in Q3 2018. These projects will deliver results in 2019, with demonstration activities taking place in Q3-Q4 2019, and are expected to close by mid-2020. These are as follows:

Ref.	Project Title	Short Project Description	Max. total co-financing value (in EUR)
VUTURA	Validation of U-Space by Tests in Urban and Rural Areas	Aims to show how a common U-space framework (based on SWIM) with U1 and U2 services can enable multiple U-space service providers and multiple operators to execute commercially feasible BVLOS operations. The demonstration will showcase these operations in a rural, urban and smart city environment. Each of the scenarios involves two service providers that have to coordinate their services and demonstrate many realistic elements: manned aviation, different levels of automation, off-the-shelf drones versus tailor-made drones, commercial and leisure drones. The flight demonstrations will be performed at different locations in The Netherlands (Delft, Enschede, Flevoland Province), in close cooperation with the civil aviation authorities	1.088.950
SAFIR	Safe And Flexible Integration of Initial U-	The demonstration will showcase an application for multiple drone operations that is viable, robust and ready-to-implement throughout Europe. A broad range of operations and services up to U3	1.328.441

Ref.	Project Title	Short Project Description	Max. total co-financing value (in EUR)
	space Services in a Real Environment	linking to smart mobility will be demonstrated, including flights in both controlled and uncontrolled very low level (VLL) airspace; flights in both VLOS and BVLOS; and flights interacting with both manned aircraft and other unmanned aircraft. The operations will take place in Belgium at three locations: City of Antwerp, Port of Antwerp and a DronePort Test Facility in Sint-Truiden	
GOF USPACE	Finnish-Estonian 'Gulf of Finland' Very Large U-Space Demonstration	Aims to establish a pre-operational flight information management system (FIMS) with an architecture capable of integrating existing commercial-off-the-shelf UTM components. The capabilities of the FIMS will be demonstrated in different live cases representing the most typical visual line of sight (VLOS) and beyond visual line of sight (BVLOS) missions: - International parcel delivery between Helsinki and Tallinn - Dense urban drone fleet operations in Helsinki with Police intervention - Dense urban drone fleet operations in Tallinn in controlled airspace - 100km+ BVLOS multisensory inspection flights in forestry and utility inspection - Co-operation with GA and recreational users at uncontrolled airport - Maritime traffic surveillance combined with search-and-rescue over Gulf of Finland - Drone Taxi flight from Helsinki-Vantaa airport to the centre of Helsinki	1.617.098
DOMUS	Demonstration Of Multiple U-Space Suppliers	Aims to illustrate the full set of core U2 services and the demonstration of specific U3 services, such as tactical de-confliction and collaboration with ATM. The demonstration will involve three U-space service providers interacting with an ecosystem manager and several drone operators that will fly drones from different manufacturers. The planned operations will take place in Andalusia in Spain.	1.989.400
DIODE	D-flight Internet of Drones Environment	Aims to demonstrate how the implementation of the full set of U-space services up to U3 ensures a safe flow of drones pursuing specific business or recreational intents, fully integrated with manned aviation, and in all types of environment. Live demonstrations will take place in Rieti, a small province, close to Rome, known as '*umbilicus Italiae*' with several different geographical	1.978.443

Ref.	Project Title	Short Project Description	Max. total co-financing value (in EUR)
		situations, including rural, mountain and remote territories, industrial, urban and semi¬urban. These demonstrations will cover a wide range of operations: parcel delivery; road traffic patrol; professional photography; railway and power-lines surveillance; search and rescue, airport operations; interaction with GA; and firefighting.	
EuroDRONE	A European UTM Testbed for U-Space	Aims to connect various stakeholders (operators, regulators, law enforcement agencies, product developers) and different systems in a unified environment. Specifically, the demonstration will test U-space functionalities up to U3 in Missolonghi, Greece. The EuroDRONE drone architecture is made up of cloud software (DroNav) and hardware (transponder) to be installed on drones. It is a sophisticated self-learning system based on software and hardware elements, operating in a distributed computing environment, and offering multiple levels of redundancy, fail-safe algorithms for conflict prevention/resolution and assets management.	1.400.000

Table 13: U-space demonstration activity outline (under the call for proposals with reference CEF-SESAR-2018-1)

2.6 Strategic Area of Operation 5: Deliver SESAR Outreach

As indicated in its Founding Regulation, the SESAR JU is responsible for securing the support and buy-in of all stakeholders in the ATM value chain for the definition (European ATM Master Plan) and development of SESAR technologies and procedures (SESAR Solutions).

This requires continued and extensive outreach (communications activities and external relations) targeting a wide range of organisations, including air navigation service providers, airspace users, airports, the manufacturing industry, national aviation authorities and EASA; standards-setting organisations; professional staff organisations; and the relevant scientific institutions or the relevant scientific community. It also calls for close engagement with the SESAR Deployment Manager to ensure the smooth delivery of SESAR Solutions where synchronised deployment is. These outreach activities are supported by the core SESAR membership, as well as cooperation agreements and contracts with specific stakeholder groups.

As the technological pillar of the SES and a key enabler for the EU Aviation Strategy, it is imperative to continue outreach activities in 2019 with the EU Institutions and Member States. This allows the SESAR JU to demonstrate that SESAR R & I meets the policy needs of the EU and brings real value to European citizens and businesses.

Looking further afield, the SESAR JU will continue to conduct outreach activities with international partners in support of global interoperability and harmonisation, recognising these as vital prerequisites for a safe, secure, efficient and sustainable global ATM system. In this respect, the SESAR JU will build on established cooperation arrangements with partners worldwide. This includes cooperation with the U.S. Federal Aviation Administration (FAA) / NextGen Programme under the EU/U.S. memorandum of cooperation (MoC); the MoC between the European Commission and Japan; and those between the SESAR JU and Qatar, Singapore and the United Arab Emirates. Collaboration with international partners under EU technical cooperation projects in the field of aviation will also continue. Conducted within the framework of the EU's external aviation policy, these arrangements cover sharing lessons learnt, knowledge and expertise, and cooperation activities related to ATM modernisation.

The SESAR JU will also continue to work closely with its EU partners in support of the International Civil Aviation Organization (ICAO) and the development of the Global Air Navigation Plan (GANP) with the Aviation System Block Upgrades (ASBUs). This ensures alignment of priorities in relation to SESAR, the European ATM Master Plan, industry standardisation and the evolution of ICAO provisions. These activities help secure SESAR´s position as a global leader in ATM modernisation, which also serves to promote the competitiveness of the European aviation and ATM industry.

In 2019, the need to communicate research results, SESAR Solutions and the SESAR innovation pipeline will continue to increase. This will be achieved through publications, online media and general events participation, as well as focussed SESAR JU-led events jointly organised with EU and global partners. These activities will also be critical for promoting SESAR Solutions and gathering the experiences, viewpoints and priorities of the global community together with the SESAR JU members and stakeholders.

As introduced in Section II, Chapter 3.2, in addition to direct funding (from Title II and Title III), the SESAR JU also dedicates a proportion of SESAR JU running costs (Title I – Staff expenditure and Title II – Infrastructure and operating expenditure) to carry out SESAR outreach activities. The overall funding of Strategic Area of Operation #5 is indicated in Annex I.

2.7 Strategic Area of Operation 6: Deliver effective financial, administrative and corporate management

Management and administrative services are brought together primarily under this area of operation to ensure that the core horizontal activities of the SESAR JU are planned, implemented, monitored and reported in a coherent and consistent way. The main objective of this strategic area of operation is to facilitate efficient and effective delivery of the SESAR JU's work programme and to ensure sound financial and resource management. The effectiveness of the organisation based on the mission, vision and values of the SESAR JU will continue, aligning the capabilities of the organisation, technology and the extensive competencies of its human capital in order to maximise its added value.

To that end, in the 2019-2021 period, the SESAR JU will continually align operational and strategic planning along with the capabilities of the organisation to best serve stakeholders' needs, ensuring full regulatory compliance with reporting obligations stemming from the various legal frameworks it operates under, namely Horizon 2020, CEF, general EU funds[35]. The SESAR JU's Internal Audit Capability function will continue to objectively examine, evaluate and report on the adequacy of the SESAR JU's internal controls as a contribution to the proper, economic and effective use of its resources.

Furthermore, in an effort to continually align resource allocation to strategic priorities through the introduction of industry best practices and standards, the SESAR JU will identify key business areas and processes that need improvement, diagnose and analyse the reasons behind poor performance, and plan and implement the changes necessary to improve performance in a quantifiable or measurable way.

In developing and maintaining a strong corporate culture and a positive image for its stakeholders and the EU institutions, the SESAR JU will promote a positive image of the SESAR JU through effective communication and leadership and through effective external communications (including through legal and statutory reporting obligations).

Finally, the SESAR JU will retain and continually develop its staff through robust knowledge and skills management.

As introduced in Section II, Chapter 3.2, the SESAR JU dedicates a proportion of its running costs (from Title I and Title II) to carrying out financial, administrative and corporate activities. The overall funding of Strategic Area of Operation #6 is indicated in Annex I.

[35] The SESAR JU receives funds from the EU that vary in origin in order to execute the SESAR 2020 Programme. These funds have been delegated to the SESAR JU under four different legal frameworks (see Paragraph 3.2.2 below), namely Horizon 2020, CEF (Connecting Europe Facility) and two types of assigned revenues, each referring to the execution of grants (following calls for proposals) or studies (following calls for tender). The diversity of the applicable legal frameworks under which the SESAR JU operates, with each its own templates and obligations, also comes with a high degree of complexity due to the number of derogations to the legal frameworks which have been defined in the corresponding delegation agreements

3 Human and financial resources outlook for the 2019-2021 period

3.1 Overview of the past and current situation

At the end of 2017 and during 2018, in line with the situation reported in 2017, the number of human resources in the Staff Establishment Plan is 39 temporary agent (TA) positions, plus 3 seconded national expert (SNE) positions where Member States' experience is requested (as authorised by the SESAR JU Administrative Board). For detailed data on the different staff categories, please refer to annex III table 1.

From 2017 to 2018, Title III – Operational expenditure has increased compared to previous years due to the launch of SESAR 2020 projects in execution and the ongoing signature of new grant agreements and grant budget amendments (see Chapters 2.1 to 2.4 relating to Strategic Areas of Operations 1 to 4 in the *Single Programming Document 2018-2020*). For 2018, Title III – Operational expenditure also includes unused appropriations of EUR 23.920.200 from 2017:

	Executed Budget for 2017 (in EUR)	Executed Budget for 2018 (in EUR)[36]
Title I	5.995.000	6.040.300
Title II	4.180.351	3.476.234
Title III	103.005.914	143.921.427
TOTAL	**113.181.265**	**153.437.961**

Table 14: SESAR JU financial resource (commitment appropriations) overview for 2017 and 2018

3.2 Resource programming for the years 2019-2021

Budgetary and staff figures laid out for 2019 in the following paragraphs are final while the figures laid out for 2020 and 2021 are indicative and subject to the outcome of future budgetary procedures.

3.2.1 Human resources

In the period from 2019 to 2021, the number of human resources in the Staff Establishment Plan will be in line with the figures for 2018, i.e. 39 TAs and 3 SNEs.

As explained in Chapter 2.7 above, the SESAR JU operates under four different legal frameworks, namely Horizon 2020, CEF (Connecting Europe Facility) and two types of assigned revenues, each referring to the execution of grants (following calls for proposals) or studies (following calls for tender). The diversity of the applicable legal frameworks, each with its own templates and obligations, also comes with a high degree of complexity due to the number of derogations to the legal frameworks which have been defined in the corresponding delegation agreements.

To cope with that complexity and despite the fact that the number of staff allowed in the Staff Establishment Plan has not been adapted accordingly, the SESAR JU will continue its efforts towards

[36] As per the *Single Programming Document 2018-2020* adopted by the Administrative Board on 14 December 2017, plus the inclusion of 2017 unused appropriations

further efficiency gains. These will contribute to the mitigation of major risk with reference CORP05 'The SESAR JU may not be able to take up new challenges due to limited HR capabilities' (see Annex VIII). Some examples are the reduced number of staff missions, enabled through the increased use of video conferences, especially for recurring monitoring activities such as project reviews. Typically, for meetings relating to ER, IR and VLD and except for critical meetings such as kick-off meetings and critical reviews, the SESAR JU prefers to coordinate with grant beneficiaries via web conference to coordinate with grant beneficiaries, which represents a significant benefit in terms of environmental footprint, efficiency and work-life balance. In addition, the SESAR JU undertakes regular process improvement initiatives in the context of the SESAR JU Quality Management System (QMS, see Section III, Paragraph 2.6.5) monitored by the Quality and ICT Committee (QICT Committee), in order to use the resources more efficiently and on value-added activities.

For detailed data on the different staff categories, please refer to annex III table 1.

3.2.2 Financial resources

3.2.2.1 Revenues

In accordance with Article 4 of the SESAR JU Regulation (constituent act) and the Statutes annexed to it, all revenue of the SESAR JU shall come from contributions from its Members and can be financial or in-kind. The Regulation extending the SESAR JU and implementing financing over the 2014-2020 period sets overall EU funding of EUR 585 million from the Horizon 2020 programme. In addition, the SESAR JU has been provided:

- under delegation agreement EC/SESAR JU ref. MOVE/E3/DA/2016-669/SI2.743803 signed on 06/12/2016[37], with EUR 500.000 in assigned revenue to organise a call for proposals for a geo-fencing demonstration;
- under delegation agreement EC/SESAR JU ref. MOVE/E3/DA/2017-477/SI2.766828 signed on 10/11/2017, with an additional EUR 800.000 in assigned revenue from the European Commission to procure a study to develop a proposal for the future architecture of European airspace;
- under delegation agreement EC/SESAR JU ref. MOVE/E3/DA/2017-564/si2.771010 signed on 13/12/2016, with an additional EUR 10 million in assigned revenue from the European Commission from the Connecting Europe Facility (CEF) funds to organise a call for proposals on U-space demonstrations.

Year 2020 will be the last year to request the remaining EU entitlements (EUR 585 million less the funds already requested). This EU contribution[38] planned for 2020 is aligned with the official EU draft budget for the same year. Therefore, it is indicative and subject to the outcome of future budgetary procedures. For detailed data on the structure of SESAR JU's revenue, please refer to annex II table 2.

All SESAR JU Members other than the European Commission contribute to the SESAR JU as follows:

- Financial contributions: at least 5% of each Member's contribution shall be in cash in order to finance the running costs of the Joint Undertaking (i.e. staff, infrastructure and operating expenditure);

[37] In accordance with Articles 54(2)(a) and 58(1)(c)(iv) of the EU Financial Regulation

[38] Includes the EFTA contribution for 2020 calculated on the basis of the 'proportionality factor' of 2,41%

- In-kind contributions, consisting of the operational activities carried out by the stakeholder Members and EUROCONTROL for developing jointly and under the SESAR JU's supervision the next generation of the ATM system in Europe.

Before the SESAR JU Administrative Board accepted the accession of 19 stakeholder Members, the value and the utility of the in-kind contributions offered by each Candidate Member for carrying out the tasks of the JU were assessed and contractually fixed in a unique Membership-Agreement signed by all Members and the SESAR JU. These are as follows:

Members	Total net Contribution (EUR)	*of which financial contribution*	*of which net in-kind contribution*
European Union	**585.000.000,00**	***585.000.000,00***	
EUROCONTROL *(1)*	**492.256.781,00**	***25.000.000,00***	***467.256.781,00***
Other Members in total	**325.838.461,65**	***18.466.058,00***	***307.372.403,65***
AIRBUS	26.761.006,00	*1.667.271,00*	*25.093.735,00*
AT-ONE Consortium	12.495.693,00	*627.887,00*	*11.867.806,00*
B4 Consortium	2.382.455,00	*397.076,00*	*1.985.379,00*
COOPANS Consortium	9.275.779,00	*599.718,00*	*8.676.061,00*
DASSAULT Aviation	5.247.567,00	*290.928,00*	*4.956.639,00*
DFS	8.483.712,00	*672.725,00*	*7.810.987,00*
DSNA	9.831.224,62	*641.023,00*	*9.190.201,62*
ENAIRE	16.452.269,00	*834.917,00*	*15.617.352,00*
ENAV	8.143.260,00	*643.950,00*	*7.499.310,00*
FREQUENTIS Consortium	6.885.998,00	*475.866,00*	*6.410.132,00*
HONEYWELL AEROSPACE	15.324.183,38	*777.926,00*	*14.546.257,38*
INDRA	21.534.500,00	*1.656.500,00*	*19.878.000,00*
LEONARDO-FINMECCANICA	48.127.619,53	*2.291.791,00*	*45.835.828,53*
NATMIG Consortium	10.472.227,00	*511.804,00*	*9.960.423,00*
NATS	9.363.535,00	*655.208,00*	*8.708.327,00*
SEAC2020 Consortium	3.485.625,00	*222.625,00*	*3.263.000,00*
SKYGUIDE	1.637.165,12	*263.860,00*	*1.373.305,12*
THALES AIR SYSTEMS	75.585.799,00	*3.599.324,00*	*71.986.475,00*
THALES AVIONICS	34.348.844,00	*1.635.659,00*	*32.713.185,00*
TOTAL	**1.403.095.242,65**	***628.466.058,00***	***774.629.184,65***

Table 15: SESAR JU financial resource overview revenues H2020 Programme

This overall budget was broken down into annual commitment and payment instalments over the lifetime of the SESAR 2020 Programme.

(1) The contribution of EUROCONTROL as a Founding Member of the SESAR JU is composed as follows:

- **In-kind contribution** (the target net amount of which referred to as 'net in-kind contribution' in the table above) through grants, the Programme Management Unit (see Annex IV 'Human Resources Policy'), ATM-related studies and the management of the ICT services provided to the SESAR JU (ICT management overhead),
- **Financial contribution to the SESAR JU running costs**, consisting in 'cash' (financial) contribution (EUR 15 million) and in the provision of ICT services and supplies (in accordance with Schedules 2 and 4 of the SESAR JU-EUROCONTROL agreement, the management of ICT services is considered as an in-kind contribution) (EUR 10 million – in the SESAR JU-EUROCONTROL agreement, ICT services and supplies are considered as 'cash contributions').

3.2.2.2 Expenditure

For the 2019-2021 period, once SESAR JU running costs are taken into account, the overall expenditure is EUR 283,4 million in commitment appropriations, broken down as follows:

	Budget for 2019 (in EUR)	Budget for 2020 (in EUR) (as amended, indicative)	Budget for 2021 (in EUR) (indicative)
Title I	6.044.372	6.157.360	6.280.507
Title II	3.612.935	3.417.079	3.465.671
Title III	140.901.014	112.035.660	1.467.500
TOTAL	**150.558.321**	**121.610.099**	**11.213.678**
Unused appropriations in current year[39]		13.383.404	

Table 16: SESAR JU financial resource overview (commitment appropriations) for the 2019-2021 period

Title I (Staff expenditure) and Title II (Infrastructure and operating expenditure) are maintained at comparable levels to previous years for 2019-2021 (see annexes I, II and III).

Title III (Operational expenditure) is as follows:

- For grants, subject to the successful conclusion of calls for proposals launched in 2019, it is maintained at a level comparable to previous years for 2019 and 2020, but will decrease significantly as from 2021 due to the end of H2020 commitments. Indeed, the financial plan for the calls for proposals launched in 2019 (see Paragraph 2.1.3 above and the 2019 work programme in Section III) is the following:
  - Level-1 commitments in 2019 at the launch of the two calls for proposals (Wave 2 and ER4),
  - Level-2 commitments in relation to the grant agreement signature
    - in the period from Q4 2019 to Q1 2020 for grant agreements under the 'Wave 2' call (IR and VLD restricted call, see Paragraphs 2.4.2 and 2.5.1.1.3 above),

[39] This budget line represents the amount of EUR 13.383.403 frontloaded in 2020 for the expenditure during the 2021-2024 period as C1 credits redistributed in the amounts of EUR 3.345.851 per year.

- in the period from Q1 to Q2 2020 for grant agreements under the ER4 call (open call, see Paragraph 2.3.2),
- in the period from Q3 to Q4 2020 for grant agreements under the 'VLD Open 2' call (open call, see Paragraph 2.5.1.1.3 above),

- New level-1 and level-2 commitments in relation to the grant budget amendment procedure in Q2 or Q3 2020 (to be specified in the SESAR JU Single Programming Document for the 2020-2022 period) for grant agreements under the 'Wave 2' restricted call,
- Level-1 commitments in 2020 at the launch of the VLD Open 2 and IR Wave 3 calls, then level-2 commitments, also by the end of 2020 or the beginning of 2021, in relation to the grant agreement signature following these call procedures,
- Unused commitment and payment appropriations for the level-2 commitments of 2020 will be carried over into 2021, 2022 and as required 2023, to cover operational expenditure.

- The global budgetary envelope for procurements appears in Annex IX (2019 only).

The overall expenditure budget of the SESAR JU for the period in commitment appropriations is broken down per Strategic Areas of Operation in the following table:

Strategic Area of Operations	Types of procedures	Call and support activity budget[40]	
		In EUR	In % of total
Strategic Area of Operation 1– Strategic Steering	Restricted H2020 calls for proposals Procurement of support services	14.204.067	5%
Strategic Area of Operation 2 – Exploratory Research	Open H2020 calls for proposals	44.237.721	16%
Strategic Area of Operation 3 – Industrial Research and Validation	Restricted H2020 calls for proposals Procurement of support services	147.435.663	52%
Strategic Area of Operation 4 – Very Large-Scale Demonstrations	Open and restricted H2020 calls for proposals Procurement of support services	65.709.891	23%
Strategic Area of Operation 5 – SESAR Outreach	Procurement of support services	5.585.202	2%
Strategic Area of Operation 6 – Financial, administrative and corporate management	Procurement of support services	6.209.555	2%
TOTAL		**283.382.100**	**100%**

Table 17: SESAR 2020 expenditure overview for the 2019-2021 period

[40] Budget figures include a proportion of running costs (Title I - Staff expenditure and Title II - Infrastructure and operating expenditure)

3.2.2.3 Budget outturn and cancellation of appropriations

The 2017 surplus that remains within the Joint Undertaking is EUR 17,737 million (of which EUR -2,755 million for the SESAR 1 Programme and EUR +20,492 million for the SESAR 2020 Programme).

The 2018 surplus that remains within the Joint Undertaking is EUR 76,088 million (of which EUR 30,929 million for SESAR 1 Programme and EUR 45,159 million for the SESAR 2020 Programme).

Given the multi-annual nature of SESAR I and SESAR 2020, and in line with the SESAR JU Financial Rules, cancelled appropriations may be entered in the estimates of revenue and expenditure up to the following three financial years. Therefore, the commitment appropriations unused by year-end 2018 will be cancelled in 2019. The payment appropriations unused by year end 2018 for Titles I and II were carried forward automatically (RAL) and any appropriations left after closure of the contractual obligations will be cancelled in 2019 (see annex II table 3).

Section III – Work Programme Year 2019[41]

1 Executive summary

In 2019, the SESAR JU will continue to steer and manage the innovation pipeline delivered through SESAR 2020 by the SESAR JU Members and other organisations involved in ATM-related research and demonstration activities. This includes:

- The conclusion of the update of the European ATM Master Plan and the release of the 2019 edition, as well as follow-on activities to address level 3 in particular (the 'Implementation view'),
- Exploratory Research projects resulting from the ER2-RPAS (H2020-SESAR-2016-1) and ER3 (2020-SESAR-2016-2) calls for proposals, and management of the related grant agreements,
- IR projects and VLD activities under Wave 1 (H2020-SESAR-2015-2), the VLD Open 1 call (H2020-SESAR-2016-2), the 2017 Geo-fencing call (SESAR-2017-1, GEOSAFE project) and the U-space call (CEF-SESAR-2018-1), and management of the related grant agreements,
- The execution of Release 9 in line with the Release Plan published in 2018, and start of the planning and preparation for Release 10 to be conducted in 2020,
- The closure of Exploratory Research projects resulting from the ER2-RPAS call for proposals (H2020-SESAR-2016-1, to be closed by the end of September) and ER3 call for proposals (2020-SESAR-2016-2, to be closed by the end of December), of a large part of the IR projects and VLD activities under Wave 1 (H2020-SESAR-2015-2), and of the 2017 Geo-fencing GEOSAFE project,
- The launch of the following calls for proposals, and the subsequent proposals evaluation, grant award and grant agreement signature for:
    - the restricted call for proposals for Wave 2 for IR and VLD, which will be opened in early 2019 (H2020-SESAR-2019-1),
    - the ER4 open call for proposals which will be opened in Q2 2019 (H2020-SESAR-2019-2),
- The preparation of the following calls for proposals to be launched in 2020:
    - the second VLD Open call for proposals (H2020-SESAR-2020-1),
    - the restricted call for proposals for Wave 3 for IR (H2020-SESAR-2020-2).

In addition, the SESAR JU will process payments in accordance with the financial circuit for the grant agreements where reporting periods become due and/or projects close their work and final payment is due.

Stakeholder engagement beyond the Members is critical to the successful delivery of SESAR JU's mandated goals. As such, there will be a continuing need to embed a strategic and systematic approach to civil and military stakeholder engagement and management across the SESAR JU in 2019. To do this, the SESAR JU will continue to engage in partnerships with relevant actors in order to foster operational

[41] The content of the SPD annual work programme section includes the required content of a Work Plan as referred to in Article 16(1)(b) of Council Regulation (EC) No 219/2007, as amended. This term corresponds to the term 'work plan' defined in Article 2(1)(22) of Regulation (EU) No 1290/2013 of the European Parliament and of the Council of 11 December 2013 laying down the rules for participation and dissemination in 'Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)' ('Rules for Participation Regulation No 1290/2013') (OJ L 347, 20.12.2013 p.81): 'the document similar to the Commission work programme adopted by funding bodies entrusted with part of the implementation of Horizon 2020 in accordance with Article 9(2) of Regulation (EU) No 1291/2013'

and policy coherence, and to have a positive benefit on the execution of the SESAR JU's mandate and that of its main stakeholders. Such partnerships will include, *inter alia*, EU institutions and decentralised bodies, the ICAO, other regional R&D programmes, standardisation bodies and other third-party organisations. SESAR JU will also continue to undertake effective outreach through the delivery of clear, targeted and effective communications on the SESAR JU's activities to all its external stakeholders, increasing the visibility, credibility and accurate understanding of the SESAR JU's work and mandate, leading to a significantly increased visibility of the SESAR JU as an important stakeholder in the modernisation of the European ATM system. Interaction with the European GNSS Agency (GSA) will also be strengthened in order to ensure coordination on activities relevant for EU GNSS (EGNOS/Galileo).

During the course of the year, the SESAR JU will also continue to align the capabilities of the corporate service elements of its organisation to support the delivery of the SESAR 2020 Programme. The objective for the SESAR JU in 2019 is the continued development and consolidation of SESAR JU support processes, with an emphasis on further developing their efficiency and effectiveness in line with best practices, standards and applicable regulatory frameworks.

Regarding the SESAR 1 programme, the last *ex-post* audit activities are expected to be finalised in early 2019.

2 Activities in 2019

In this chapter, each Strategic Area of Operation is described with a focus on activities to be conducted in 2019 that are associated with objectives, indicators and 2019 targets/metrics.

All SESAR JU activities will be supervised by the Administrative Board (see above in Section II, Paragraph 2.1.5) which is planning to hold three meetings in 2019. The key decisions and documents to be adopted during the course of 2019 are expected to be the following:

Q1	Adopt operating decisions required for 2019 and beyond Adopt decision on Internal Audit Capability Work Plan Adopt decision on Voting rights allocation
Q2	Appointment of Board vice-chairperson Adopt decision on the CAAR 2018 and its assessment by the ADB
Q4	Adopt decision on 2018 final accounts Adopt the Single Programming Document for 2020-2022

Table 18: Provisional timetable for key Administrative Board activities and decisions in 2019

2.1 Strategic Area of Operation 1 (operational activity): Provide strategic steering for the SESAR programme

In 2019, the SESAR JU will, in the context of strategic steering activities:

- Supervise, then close most of the transversal steering projects under Wave 1 and the related grant agreements;
- Launch the call procedure for the IR-VLD Wave 2 call including Transversal Activities, with a view to awarding the grants by the end of 2019 (see Paragraph 2.6.1 below for the call conditions);
- Plan the transition between ER1 and IR Wave 1 on one side, and IR-VLD Wave 2 on the other side, with regard to content, process and timing (see Paragraph 2.1.1 below for further details on that transition); the execution of the transition process should start at the end of 2019;
- Conclude the update of the European ATM Master Plan and the release of the 2019 edition, and carry out follow-on activities in particular to address level 3 (the 'Implementation view'), so as to start providing a yearly exhaustive view on the state of SESAR implementation;
- Continue the support activities towards the European Commission in the fields of U-space and the Airspace Architecture Study in order to strengthen the link between SESAR and the other pillars of the SES;
- Extend the mandate of the current membership of the Scientific Committee until February 2021.

2.1.1 Wave 1 – Wave 2 transition for Industrial Research and Validation and Very Large-Scale Demonstrations

The Release Strategy drives the definition of top-down validation activities per Release connecting the programme's Key Features – as defined in the ATM Master Plan with the SESAR Release process. The Release Strategy reflects the maturity level of all candidate SESAR Solutions and in particular identifies when they need to reach end of V3 maturity in order to meet stakeholders business needs. At the end of each Release, the maturity of the candidate SESAR Solutions is assessed. The results can lead to declaring the SESAR Solution mature enough for pre-industrialisation and inclusion in the Deployment Programme, or requiring further validation activities to be planned in the next Release.

Wave 1 will be concluded with Release 9 by the end of 2020. The maturity assessment of the candidate SESAR Solutions validated in Release 9 will also be performed and the resulting SESAR Solutions ready for pre-industrialisation will be published as part of the Wave 1 final outcomes. Candidate SESAR Solutions requiring further validation could be addressed as part of Wave 2.

The definition phase of Wave 2 (see 2018-2020 SPD, Section III, Paragraph 2.1.2) was carried out in parallel with the definition of the Release 9 content and was finalised when Release 9 was in its final definition phase. This parallel approach enabled the SESAR JU and its Members to keep an accurate view of the evolution of the maturity of the candidate SESAR solutions and to reflect it in regular updates of the Release Strategy. Therefore, candidate SESAR Solutions assessed as not being ready at the end of Wave 1 were considered in the Wave 2 content definition in order to further ensure their validation.

In a similar way, the outcomes of the ER1 projects were considered as potential input for further validation into Industrial Research.

Simultaneously, the European ATM Master Plan update campaign and the work performed at the MPC made it possible to identify top-down priorities taken into consideration as input for Wave 2 definition. In particular, the Master Plan level 1 in its Operational View identifies and describes the candidate SESAR Solutions defined in the scope of Wave 2.

Therefore, the SESAR JU has ensured consistent transition between both Waves and adequate consideration of the ER1 results by guaranteeing the consistency between the main drivers such as the Release Strategy, the Wave 2 content and the ATM Master Plan.

In addition to this consistency, clear reference to Wave 1 Solutions and to ER1 outcomes have been made in the description of the Wave 2 Solutions. The aim is to ensure that Wave 2 will start building on the foundation resulting from Wave 1 validation activities and on ER1 results, when needed.

2.1.2 Follow-on activities to be conducted in 2019 in relation with the 2018 update of the European ATM Master Plan

The maintenance and execution of the European ATM Master Plan, as defined in the SESAR JU Regulation, is central to the SESAR JU as the agreed roadmap driving the modernisation of the ATM system and connecting SESAR R&I with deployment. It is the key tool for SESAR providing the basis for timely, coordinated and efficient research and deployment of new technologies and procedures.

In 2019, the SESAR JU will conclude the update of the Master Plan and will monitor the adaptation of level 3 (the 'Implementation view'), with the support of the MPC. In line with the Internal Audit Services (IAS) recommendations, levels 2 and 3 of the European ATM Master Plan shall be updated so as to be fully aligned with Level 1 and will be submitted so as to allow simultaneous approval of all three levels.

2.1.3 Transition Plan for implementing the recommendations of the Airspace Architecture Study

In 2018, the SESAR JU developed the *'proposal for the future architecture of the European airspace*' in close coordination with the Network Manager. The study contains proposals to address the airspace capacity challenge by combining airspace configuration and management changes with technologies to decouple the service provision from the local infrastructure, and by increasing progressively the level of automation support. Handed over to the European Commission on 5 February 2019, it was publicly presented on 5 March 2019 at the European Parliament by the Sky and Space Intergroup of the European Parliament (SSI) and the European Commission. The SSI and the European Commission both asked for a fast implementation of the recommendations.

In such context, the European Commission requested the SESAR JU in April 2019 to develop *'a transition plan regarding the operational and technical dimensions of the target architecture defined in the Airspace Architecture Study*' in close cooperation with the Network Manager and EUROCONTROL.

In view of the recent but fast-growing flight delays affecting the European airspace, generating unnecessary costs to the airspace users, negative environmental impact and degradation of passenger experience, the European Commission has added a sense of urgency to the work on the transition plan and asked the SESAR JU to focus on the actions and programmes that aim at bringing short-term solutions to this 'capacity crunch'.

In addition, as it is already foreseen that the capacity relief from these implementation measures will most likely be outpaced by traffic growth over the next couple of years, the plan will also contain a description of the measures that will enable the timely transition towards a Single European Airspace System that fully implements the recommendations of the Airspace Architecture Study and leverages modern technologies by accelerating SESAR delivery.

The transition plan is expected to be delivered on time for presentation at a Commission high-level event on 12 September 2019.

2.1.4 Indicators and measurements applicable to Strategic Area of Operation 1

Objectives	Indicators	Target for 2019
Call reference H2020-SESAR-2015-2 (IR –VLD Wave 1 call for proposals): Wave 1 Transversal Activities projects delivery of results	Percentage of Wave 1 Transversal Activities (PJ.19, PJ.20, PJ.22) having delivered their Final Project Report and performed a project and grant agreement closure	100%
	Key results delivered by Transversal Activities projects: 2019 performance report, Concept of Operations, Architecture	100%
Call with reference H2020-SESAR-2019-1 (IR-VLD Wave 2 call for proposals): launch, evaluation and award of the Transversal Activities	Percentage of the targeted number of grant agreements signed for Transversal Activities (see call conditions in Paragraph 2.6.1) at the end of the year	100%
Strengthen coordination with relevant Master Plan stakeholders	European ATM Master Plan update delivered to the ADB for formal consultation and adoption	100%

Objectives	Indicators	Target for 2019
Continued coherence between all three levels of the Master Plan	Adaptation of the Master Plan levels 2 and 3 following the 2018-2019 Master Plan update campaign	100%
Development of a transition plan for implementing the recommendations of the Airspace Architecture Study	A transition plan for the operational and technical aspects of the Airspace Architecture Study presented at a European Commission's high-level event on 12 September 2019	100%
Provide support to the European Commission on other areas linked to the technological pillar of the SES	Continuous support to the European Commission in relation to U-space and the network of demonstrators	
Ensure effective and efficient SESAR 2020 Programme governance meetings	Four meetings of the PC and its sub-committees (DMSC and OTSC)	100%
	At least two MPC meetings held	100%
	Three meetings of the SC	100%
	Membership of the Scientific Committee extended until February 2021	100%

Table 19: Objectives, indicators and 2019 targets for Strategic Steering activities

2.2 Strategic Area of Operation 2 (operational activity): Deliver Exploratory Research

In 2019, the SESAR JU will, in the context of Exploratory Research activities:

- Supervise, and then close projects under the ER2-RPAS and ER3 calls for proposals, and manage the related grant agreements;
- Launch the call procedure for the ER4 call for proposals (with reference H2020-SESAR-2019-2), with a view to awarding the grants in the beginning of 2020 (see Paragraph 2.6.1 for the call conditions);
- Start performing a gap analysis for Exploratory Research with the expectations set out for the SESAR 2020 Programme in the European ATM Master Plan, the needs identified from Industrial Research and maintain a healthy body of research and researchers in ATM;
- Explore through the SESAR Academy initiative how to link existing SESAR output with the development of new educational and continuing professional development services using existing contractual arrangements and communications channels;
- Organise the SESAR Innovation Days (see Paragraph 2.5.1 and Section II, Paragraph 2.3.3);
- In continuation of activities conducted in the previous years, organise the Young Scientist Award: the annual prize of EUR 5 000 to be awarded to the successful young scientist applicant resulting from an open call.

Accordingly, in addition to those specific ER deliverables outlined within the multi-annual section of the SPD, the SESAR JU has identified a number of other objectives to be delivered in 2019, which are outlined in the table below:

Objectives	Indicators	Target for 2019
Call reference H2020-SESAR-2016-1 (ER2 – RPAS call for proposal) projects execution: delivery of results	Percentage of ER2-RPAS projects having delivered their Final Project Report and performed a project and grant agreement closure	90%
Call reference H2020-SESAR-2016-2 (ER 3 call for proposal) projects execution: delivery of results	Percentage of ER3 projects having delivered their Final Project Report and performed a project and grant agreement closure	75%
Call with reference H2020-SESAR-2019-2 (ER4 call for proposal): launch of the call and evaluation of proposals	Evaluation report prepared in view of its submission to the Executive Director in the beginning of 2020	90%
Ensure commitment of the scientific community around the SESAR topics	Organisation of Young Scientist Awards by the end of 2019	100%
Establish the SESAR Academy into operation	Portal publicly available and at least four organisations signed up across Academia, Industry, Standards and Regulation	100%

Table 20: Objectives, indicators and 2019 targets for Exploratory Research

2.3 Strategic Area of Operation 3 (operational activity): Deliver Industrial Research and Validation

In 2019, the SESAR JU will, in the context of Industrial Research and Validation activities:

- Supervise those projects launched under the Wave 1 call for proposals, as well as the related grant agreements, in particular through the finalisation of Release 8, the execution of Release 9 and the preparation of Release 10, then close those projects (the current plan is that most Wave 1 projects should close by the end of 2019, with some exceptions granted based on recommendations from the PC – see Section II, Chapter 2.4);
- Launch the call procedure for the IR-VLD Wave 2 call for proposals, with a view to awarding the grants by the end of 2019 (see Paragraph 2.6.1 for the call conditions);
- Execute the transition between ER1 and IR Wave 1 on one side, and IR-VLD Wave 2 on the other side, with regard to content, process and timing (see Paragraph 2.1.1 above for further details on that transition);
- Perform a gap analysis for Industrial Research & Validation with the expectations set for the SESAR 2020 Programme in the European ATM Master Plan, and define the IR Wave 3 call for proposals (with reference H2020-SESAR-2020-2) to be launched in 2020 if confirmed.

In addition to those specific deliverables outlined within the corresponding multi-annual section, the SESAR JU has identified a number of other objectives to be delivered in 2019, which are outlined in the table below:

Objectives	Indicators	Target for 2019
Finalise validation exercises of Release 8 and draft final report	Percentage of Release 8 completed in 2019	100%
	Release 8 Final Report available before year end	Yes
Execute validation exercises of Release 9	Percentage of Release 9 Solution validation exercises completed in 2019	90%
Call reference H2020-SESAR-2015-2 (IR –VLD Wave 1 call for proposal): Wave 1 projects delivery of results	Percentage of Wave 1 projects having delivered their Final Project Report and performed a project and grant agreement closure	70%
Call with reference H2020-SESAR-2019-1 (IR-VLD Wave 2 call for proposal): launch, evaluation and award of the IR projects	Percentage of the targeted number of grant agreements signed for IR projects (see call conditions in Paragraph 2.6.1) at the end of the year	100%
Gap analysis for Industrial Research and Validation against the ATM Master Plan	Preparation of the IR Wave 3 call for proposal (H2020-SESAR-2020-2): call material readiness by 31/12/2019 for possible publication in Q1 2020 if confirmed	80%

Table 21: Objectives, indicators and 2019 targets for Industrial Research and Validation

2.4 Strategic Area of Operation 4 (operational activity): Deliver Very Large-Scale Demonstration Activities

In 2019, the SESAR JU will, in the context of Very Large-Scale Demonstrations activities:

- Supervise those projects launched under the Wave 1 and 2017 Geo-fencing calls for proposals, as well as the related grant agreements, then launch the closing procedure of those projects;
- Supervise those projects launched under the 2016 VLD Open 1 and the 2018 U-space calls for proposals, as well as the related grant agreements;
- Ensure high level of finalisation of preparation of the call procedure for the second VLD Open call for proposal (with reference H2020-SESAR-2020-1): see Paragraph 2.6.1.

In addition to those specific deliverables outlined within the corresponding multi-annual section, the SESAR JU has identified a number of other objectives to be delivered in 2019, which are outlined in the table below:

Objectives	Indicators	Target for 2019
Call reference H2020-SESAR-2015-2 (IR –VLD Wave 1 call for proposal): Wave 1 VLD activities delivery of results	Percentage of Wave 1 VLD activities having delivered their Final Project Report and performed a project and grant agreement closure	75%
Call reference SESAR-2017-1 (VLD Geo-fencing call for proposal): delivery of results	Geo-fencing project having performed a project and grant agreement closure	Yes
Call reference H2020-SESAR-2016-2 (VLD Open 1 call for proposal): delivery of results	Percentage of VLD Open 1 activities closed	40%
Call reference CEF-SESAR-2018-1 (U-space call for proposal): delivery of results	Percentage of U-space demonstration activities having conducted their main demonstration activity at the end of 2019	90%
Call reference H2020-SESAR-2019-1 (VLD Wave 2 call for proposal): launch, evaluation and award of the VLD activities	Percentage of the targeted number of grant agreements signed for VLD activities (see call conditions in Paragraph 2.6.1) at the end of the year	100%
Call reference H2020-SESAR-2020-1 (VLD Open 2 call for proposal): call material preparation	Preparation of the VLD Open 2 call for proposal (H2020-SESAR-2020-1): call material readiness by 31/12/2019 for possible publication in Q1 2020 if confirmed	80%

Table 22: Objectives, indicators and 2019 targets for Very Large-Scale Demonstrations

2.5 Strategic Area of Operation 5 (operational activity): Deliver SESAR Outreach

SESAR Outreach plays an integral role in engaging with and informing the wider air transport community about the SESAR JU's work and results while encouraging wider international commitment to the SES approach to ATM modernisation, as well as contributing to maintaining the momentum around the SESAR project.

For 2019, the following key messages will be the focus of the SESAR JU's outreach activities:

1. The unique SESAR JU public-private partnership is delivering solutions that drive aviation performance, in support of EU transport and mobility policy objectives,
2. The SESAR JU model pools resources and expertise from Europe's aviation community and beyond to deliver efficient and value-for-money R&D,
3. Embracing new trends and opportunities through cutting-edge R&D is a prerequisite for maintaining Europe's global leadership and competitiveness in aviation.

2.5.1 Communication and promotion activities

In 2019, SESAR JU communication activities will support the activities of SESAR 2020 through the application of the following targeted objectives, in accordance with the SESAR JU 2015-2020 Communications Strategy:

- Continue to regularly illustrate and showcase SESAR solutions that are mature and ready for industrialisation and deployment, showing tangible benefits for the air transport industry and society as a whole;
- Continue the awareness and outreach activities on SESAR directly with stakeholders and at European and Global events/conferences to promote SESAR results, raising awareness and securing European and global stakeholders' commitment;
- Promote SESAR as an integral part of the 'day-to-day' air transport and ATM domain, both in Europe and globally;
- Enhance the arrangements of the SESAR JU with its Members.

To meet these objectives, the SESAR JU will carry out the following activities:

- Promote and market the SESAR brand, the benefits that can be realised through SESAR Solutions and the availability of industrial products to deliver results in international forums, both in Europe and in other regions, including the ICAO;
- Create and disseminate appropriately targeted printed materials and digital communications in general and as needed based on SESAR 2020 project results and specifically in relation to the events listed below;
- Provide effective press and media outreach.

The following table provides an overview of the major events and conferences in which SESAR invests significant resources. However, please note that various other conferences and events organised by the EU, European and international stakeholders will require SESAR JU participation in the form of speakers, workshops or exhibition stands.

EVENT NAME	LOCATION	DATE	ORGANISER	COMMENTS
SESAR JU internal meeting	Madrid	11 March	SESAR JU	Update to members on state of play of SESAR JU
World ATM Congress	Madrid	12-14 March	CANSO/ATCA	Exhibition stand + workshops
Aerodays	Bucharest	27 – 31 May	DG Research and Innovation (DG RTD)	Exhibition stand + workshops and presentation by the Executive Director of the SESAR JU
Paris Air Show	Paris	17-21 June	GIFAS	Exhibition stand + workshops (TBC)
SESAR Innovation Days	Athens	2-5 December	SESAR JU	3 day conference with exhibition and networking

Table 23: Major events and conferences foreseen by the SESAR JU in 2019

The following represents the publications/digital communications/on-line communications and communications coordination currently planned for 2019:

Publications	**When**
Application of SESAR 2020 visual identity (print material: posters, visual graphics, printed material)	Q1-Q4 2019
SESAR innovation pipeline: Research and innovation highlights of 2018	Q1 2019
SESAR Solutions Catalogue 3rd Edition	Q1 2019
2018 SESAR Innovation Days scientific papers	Q1-2 2019
European ATM Master Plan 4th Edition	Q3 2019
U-space brochure	Q4 2019
Ad hoc factsheets and promotional material	Q1-Q4 2019
Digital communication	**When**
2019 Highlights	Q4 2019
SESAR Solutions virtual experience	Q1-2 2019
Online communication	**When**
SESAR e-news (Interviews and project news)	10 SESAR e-news per annum
Contributions to external magazines	12-16 articles per annum
Press relations	Q1-Q4 2019
Social media campaigns	Q1-Q4 2019
Communications coordination	**When**

Review SESAR 2020 project plans and activities	Q1-Q4 2019
Organise WebEx and face-to-face meetings with Coordination Group	Q1-Q4 2019

Table 24: Main publications and communication activities in 2019

2.5.2 Dissemination and information about project results

The SESAR JU will systematically collate and disseminate data from completed and ongoing projects with the aim of obtaining a comprehensive view of the progress achieved in each financed project against targets outlined in the SESAR JU's annual and multi-annual work plans. Such data collection will enable a holistic view of SESAR 2020 activities and their impact. Output from projects, such as standardisation material, publications and patents, will be made available on the SESAR JU website (either through uploaded documents or links to relevant websites), as well as the direct dissemination of material to the appropriate bodies in support of preparation for deployment. Information on H2020 calls for proposals and projects will continue to be made available through the H2020 portal and other H2020 reporting mechanisms. In addition, the SESAR JU will continue to publish and promulgate SESAR Solutions once they are available and have been validated through the Release process.

The SESAR 2020 Programme will comply with all provisions of the H2020 programme. However, while ER projects will comply with all provisions of the H2020 Work Programme set out in Annex L relating to open access to research data, as explained in Section II, Chapters 2.4 and 2.5, IR projects and VLD activities may opt out of these provisions in order to protect results that are expected to be commercially or industrially exploited. In addition, the justification for project-by-project opt-out by IR and VLD projects can be further reinforced due to the nature of Complementary Grants awarded; meaning that collective results (SESAR Solutions) shall be published and accessible rather than individual project-by-project results. This process is coordinated and put in place by the SESAR JU.

2.5.3 Stakeholder engagement

A fundamental principle of the SESAR JU is to broaden and deepen collaboration with a range of different stakeholders in order to benefit from their expertise and gain their assurance that candidate SESAR Solutions meet the needs of the entire European and global ATM and air transport community and that they deliver the performance benefit required under the SES policy. The fact that such a wide range of stakeholders contribute to the SESAR JU, the Master Plan and the work programme projects and validation activities, secures to a large extent the operational inputs necessary and is in line with users' expectations on the expected deliveries of SESAR solutions. As such, the SESAR JU will in 2019 maintain and enhance the secured participation and active input into the SESAR JU tasks of the SESAR project Definition phase (the *European ATM Master Plan*) and Development phase (SESAR 2020). Over the course of 2019, the SESAR JU will continue to foster strong ties with all European and global key stakeholder groups, the details of which are included below:

- European Airports - under the established specific framework contract the SESAR JU will secure support from all airport categories to the SESAR JU. This includes the provision of expertise for specific airport-related activities. Likewise, the SESAR JU will support airport activities such as roadshows and conferences etc. with SESAR specific inputs for securing awareness, buy-in and commitment;
- Civil Airspace Users - under the specific framework contract the SESAR JU will secure support from the different airspace user categories and for the SESAR JU to support airspace user categories in their respective activities that are agreed to relevant and necessary to secure, awareness, buy-in and commitment to the SESAR solutions. This can be done through dedicated workshops, conferences and presentations;

- New innovative airspace user entrants in the field of Unmanned Aviation Systems (UAS) and high-level operations will be approached on a case-by-case basis to find the most efficient mechanism of cooperation for the benefit of SESAR JU tasks and activities;
- Professional Staff Organisations - under the MoC the SESAR JU will secure support from the different professional staff associations in the provision of operational expertise across the tasks of the SESAR JU. Moreover, this cooperative arrangement serves to enhance the buy-in of front-end users to the new ATM developments. Furthermore, the SESAR JU will support the professional staff associations in their respective activities which are agreed, to be relevant and necessary to secure inclusion in developments and commitment to the SESAR solutions;
- National Aviation Authorities (NAAs) - the SESAR JU will work under the established memorandums of cooperation with the European national authorities (NAA´s) to secure support to the SESAR JU from the different national authorities in securing the early involvement and inputs to de-risk SESAR solutions readiness for industrialisation and subsequent deployments;
- European Aviation Safety Agency (EASA) – The SESAR JU will collaborate under the established memorandum of cooperation with the EASA to secure early involvement and inputs to the SESAR JU to de-risk SESAR Solution development in readiness for industrialisation and subsequent deployments. The MoC will, at the same time, cater for the direct support of the SESAR JU to EASA in activities relating to securing the necessary safety, security and regulatory arrangements;
- Clean Sky JU – the established memorandum of cooperation caters for sharing of best practices, to identify gaps and secure synergies in areas where a joint approach would be needed in respective development, validation and demonstration activities. The cooperation will also enhance the definition of the performance targets, in particular for environmental targets;
- EUROCAE - the participation of the SESAR JU in the Council and Technical Advisory Committee (TAC) will continue in 2018 with collaboration with EUROCAE to continue the involvement of SESAR members and the availability of SESAR material in support of standardisation to ensure alignment of priorities in relation to SESAR 2020 Programme, the ATM Master Plan and the ICAO GANP;
- Advisory Council for Aviation Research and Innovation in Europe (ACARE) — the SESAR JU participates in the Advisory Council for Aviation Research and Innovation in Europe framework to ensure the appropriate representation of ATM in the European strategic innovation and research agenda and to secure the link with Flightpath 2050;
- European ATM Standardisation Coordination Group — the SESAR JU will further strengthen its involvement in the European ATM Standardisation Coordination Group to ensure that a consistent and credible plan for the development of ATM standards is maintained, aligned with the priorities of SESAR 2020, the ATM master plan and the ICAO GANP;
- ESCP – The SESAR JU will actively participate in the activities under the EASA-led European Strategic Coordination Platform for the coordination of the definition and implementation of the European Strategy for Cybersecurity in Aviation;
- European Defence Agency (EDA) – the established memorandum of cooperation with the EDA will secure support from the military community (in their roles as ANSP, Airport operator, AUs and regulators) for the SESAR JU and also for the SESAR JU to support the military community through the EDA with SESAR specific inputs for securing awareness, buy-in and commitment to the ATM Master Plan and the SESAR 2020 Programme. In particular, the areas of common interest include the Master Plan, regulations, space-based systems,

RPAS integration, cyber-security threats and vulnerabilities to ATM and aviation/ATM standards development;

- European Space Agency (ESA) – the established memorandum of cooperation will make it possible to focus on strategic cooperation to coordinate roadmaps specifically in relation to the integrated CNS strategy and the ATM Master Plan, defining the role of satellite communication as part of the future enabling infrastructure of ATM;
- European GNSS Agency (GSA) – the current informal cooperation framework will be reinforced, by ensuring that all R&D projects with a satellite navigation, positioning and timing component will be cross-reviewed, to ensure the maximisation of synergies and coherent messages to the industry.

2.5.4 International Affairs

The SESAR JU will continue to engage actively with key international partners in support of global interoperability and harmonisation. At global level in relation to the ICAO, the SESAR JU will maintain its active participation and collaboration under the European Commission's chairmanship and with the SESAR JU 2020 members in order to prepare for the 2019 update of the ICAO Global Air Navigation Plan (GANP) and the Aviation System Block Upgrades (ASBUs), following up on the outcome of the ICAO Thirteenth Air Navigation Conference in 2018. The alignment between the ICAO GANP, the SESAR ATM Master Plan and SESAR 2020 Programme is crucial to de-risk development towards deployment. The SESAR JU will in this respect continue to coordinate in the European ICAO ATM Coordination Group under the European Commission's chairmanship.

The close collaboration with the FAA and its NextGen programme will continue with a focus on the SESAR full life cycle of definition, development and deployment, securing the collaboration of not only the FAA but also entities like NASA for exploratory research coordination and RPAS. International harmonisation and global interoperability risks will be further identified and mitigations further refined in order to agree standards and positions on ICAO provisions.

The existing cooperative agreements with other international partners either directly with the SESAR JU or indirectly under the European Union agreements covering the ATM domain, will be further enhanced in 2019 as the SESAR Solutions evolve and are being deployed. This involves arrangements with Japan, Qatar and Singapore. The SESAR JU will also work closely with the European Commission and other SESAR Members to identify and leverage opportunities to extend and deepen international collaboration, including under EU technical cooperation projects with China, South East Asia, South Asia and Latin America. In doing so, the SESAR JU will closely follow the policies of the EU and the needs of the EU Aviation Strategy and of the SES framework.

2.5.5 Indicators and measurements applicable to the Strategic Area of Operation 5

The outcome of these activities will be measured according to the metrics indicated in the 2015-2020 Communications Strategy (e.g. level of participation of stakeholders, website analytics, social media analytics, etc.).

Objectives	Indicators	Target for 2019
Strengthen the Global Interoperability activities aligned with expectations of the European Commission, especially towards the ICAO in close collaboration with the	Coverage of GANP ASBU modules aligned and agreed with NextGen. Transparent progress steps towards agreed interoperable and harmonised timelines between SESAR and Next Gen on air/ground	Active participation in GANP working group

FAA/NextGen and other global modernisation initiatives	data communication protocols, network and applications	
Strengthen links towards Standard Making Organisations like EUROCAE, RTCA etc. with the involvement of SESAR members and the availability of SESAR material in support of standardisation.	Alignment of priorities in standards developments with the ATM Master Plan and SESAR 2020 needs	Well aligned and supporting roadmaps relevant for standards among SESAR, SMO's, international bodies and the ICAO
		SESAR JU active participation in the European ATM Standardisation Coordination Group, EUROCAE Council and TAC to ensure alignment of the work programmes
		SESAR Member/Project contribution to standard development groups
Strengthen dissemination of SESAR Solutions/demonstrations/ER activities and results through SESAR publications, workshops and communications events	SESAR dissemination and demonstration events	See above in table 23
	SESAR participation to relevant ATM events	
	SESAR publications	See above in table 24
Active cooperative arrangement with all European (Member States and Regions) actors, international actors and other modernisation initiatives in aviation relating to SESAR Definition and Development phases	Active cooperative arrangements or agreements with European (Member States and Regions) actors	Actors and initiatives to be addressed as a priority: - NAAs - Airports Council International Europe (ACI Europe) - Clean Sky JU - EASA - EDA - ESA - European GNSS Agency (GSA) - EUROCAE
	Active cooperative arrangements or agreements with international actors and other ATM modernisation initiatives	Actors and initiatives to be addressed as a priority: - ICAO - FAA - Japan (2019 Steering Board, tbc) - Singapore (2019 Steering Committee, tbc) - Qatar (2019 workshop, tbc)
Prepare new cooperative arrangement with European (Member States and Regions) actors, international actors and other modernisation initiatives in aviation relating to SESAR Definition and Development phases	Set up of new cooperative arrangements or agreements with European (Member States and Regions) actors, International actors and other ATM modernisation initiatives	Actors and initiatives to be addressed as a priority: - China - South East Asia - South Asia - Latin America

Table 25: Objectives, indicators and 2019 targets for SESAR Outreach

2.6 Strategic Area of Operation 6 (transversal activity): Deliver effective financial, administrative and corporate management

This chapter outlines the activities that will be carried out to deliver the objectives of the SESAR JU relating to financial, administrative and corporate management. These objectives are summarised in Paragraph 2.6.10 and associated with relevant indicators and 2019 targets.

2.6.1 Calls for proposals and Grants Management

Article 189 of Regulation (EU, Euratom) No 2018/1046 provides that: 'Grants shall be awarded following a publication of calls for proposals, except in the cases referred to in Article 195.'

The following activities are scheduled to take place in 2019 in relation to the calls for proposals mentioned earlier in this document[42]:

- The management of grant agreements, monitoring project implementation and execution of payments in accordance with the financial circuit for the grant agreements within the H2020 set of rules where reporting periods become due and/or projects close their work and final payment is due, namely:
  - The ER2 and ER3 calls for proposals (with reference H2020-SESAR-2016-1 and H2020-SESAR-2016-2),
  - The Wave 1 call for proposals for IR and VLD (with reference H2020-SESAR-2015-2) – it should be noted that no grant budget amendment will take place in 2019 for these grants,
  - The 2016 VLD Open call for proposals (with reference H2020-SESAR-2016-2);
- The management of grant agreements, monitoring project implementation and execution of payments in accordance with the financial circuit for the grant agreements with sets of rules other than H2020 where reporting periods become due and/or projects close their work and final payment is due, namely:
  - The 2017 Geo-fencing call for proposals (with reference SESAR-2017-1),
  - The U-space call for proposals (with reference CEF-SESAR-2018-1);
- The launch, evaluation, award and grant agreement preparation of two calls for proposals within the H2020 set of rules, the conditions of which are defined in Paragraphs 2.6.1.2 and 2.6.1.3 below:
  - The restricted call for proposals for Wave 2 for IR and VLD (with reference H2020-SESAR-2019-1): launch, evaluation, award, grant agreement preparation and signature, and launch of projects in execution with the related management of grant agreements,
  - The open ER4 call for proposals (with reference H2020-SESAR-2019-2): launch and evaluation,
- The finalisation of the preparation of the VLD Open 2 call for proposals within the H2020 set of rules (with reference H2020-SESAR-2020-1),

[42] Regulation (EU) No 1290/2013 of the European Parliament and of the Council of 11 December 2013 laying down the rules for participation and dissemination in "Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)" (OJ L 347, 20.12.2013) only applies to Horizon 2020 funding

- The definition of the content and preparation of the call material for the last call for proposals under the H2020 set of rules: the IR Wave 3 call for proposals (with reference H2020-SESAR-2020-2), as identified above in Chapter 2.3.

2.6.1.1 General conditions for the two H2020 calls for proposals to be launched in 2019

The provisions of this paragraph have been established in accordance with Council Regulation (EU) No 721/2014 of 16 June 2014[43], recital 16, and Article 5(m), Article 9 (Paragraph 1) and Article 10 of the Statutes of the JU, and with Article 25 of the Horizon 2020 Framework Regulation[44]. In line with these legal texts, 'public-private partnerships shall make public funds accessible through transparent processes and mainly through competitive calls, governed by rules for participation in compliance with those of Horizon 2020' (Horizon 2020 regulation Article 25). Exceptions to the use of competitive calls should be duly justified. The SESAR JU shall financially support R&I actions through grants awarded as a result of calls for proposals in accordance with the Horizon 2020 Rules for Participation[45].

In light of this, and considering that by the end of the duration of the H2020 financial framework, the entire financial contribution to the SESAR JU shall be allocated by the EU, the SESAR JU will publish two calls for proposals in 2019 (with references H2020-SESAR-2019-1 and H2020-SESAR-2019-2). For these H2020 calls for proposals, the SESAR JU will comply with all provisions of the H2020 Work Programme 2018-2020[46] part 19. General Annexes, under the conditions defined in the following paragraphs. These General Annexes are complemented by conditions specific to the two aforementioned calls for proposals which are set out in Paragraphs 2.6.1.2 and 2.6.1.3 respectively.

2.6.1.1.1 List of countries, and applicable rules for funding

Part A of the General Annexes to the European Commission's Horizon 2020 Work Programme 2018-2020 applies with specific additional provision for cases in which the SESAR JU deems participation of the entity essential for carrying out the action funded through Horizon 2020. This means in particular for SESAR when the following apply:

- The non-EU country concerned has signed at least one aviation agreement with the European Union;
- The participation of the entity concerned adds value to SESAR 2020 and to the European Union actions. Such added value shall be assessed on the basis of the following elements:
    - Operational and technical continuity of European airspace (in particular in, but not limited to, the context of Functional Airspace Blocks – FABs): this concerns in particular countries which have signed the European Common Aviation Area (ECAA) Agreement and Iceland, Morocco, Norway and Switzerland. These countries are part of the SES and therefore they should be fully part of SESAR;

[43] Council Regulation (EU) No 721/2014 amending Council Regulation (EC) No 219/2007 of 27 February 2007 on the establishment of a Joint Undertaking to develop the new generation European air traffic management system, modified by Council Regulation (EC) No 1361/2008 (SESAR JU Regulation)

[44] Regulation (EU) No 1291/2013 of the European Parliament and of the Council of 11 December 2013 establishing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020) and repealing Decision No 1982/2006/EC

[45] Regulation (EU) No 1290/2013 of the European Parliament and the Council of 11 December 2013 laying down the rules for participation and dissemination in 'Horizon 2020 – the Framework Programme for Research and Innovation (2014-2020) and repealing Regulation (EC) No 1906/2006

[46] The H2020 Work Programme 2018-2020 was adopted on 27 October 2017 and published on the Funding and Tenders Portal (European Commission Decision C(2017)7124 of 27 October 2017)

  - Technological partnerships: this concerns in particular countries that participate in Research Framework Programmes, and that are natural technological partners of Europe; Organisations or undertakings around the world which have a technological partnership with European industry should also be considered in this category, in order to promote global interoperability;
  - Market access: For emerging countries which will need to invest in new technologies; These countries represent considerable market opportunities for the European aviation industry;
  - Competence/expertise of the non-EU country entity;
  - Access to research infrastructure, to particular geographical environments and to data.
- A programme equivalent to SESAR exists in the non-EU country; reciprocity in terms of access for the European industry to equivalent funding possibilities is an absolute necessity.
- The transfer of technological know-how should benefit European society in terms of building European technological competence and creating jobs in Europe. Transfers of know- how to non-EU country members should be managed by the European members.

As noticed in the General Introduction of Horizon 2020 Work Programme 2018-2020, it should be noted that until the UK leaves the EU, EU law continues to apply to and within the UK, when it comes to rights and obligations; this includes the eligibility of UK legal entities to fully participate and receive funding in Horizon 2020 actions such as those called for in this work programme. Please be aware however that the eligibility criteria must be complied with for the entire duration of the grant. If the UK withdraws from the EU during the grant period without concluding an agreement with the EU ensuring in particular that British applicants continue to be eligible, they will no longer be eligible to receive EU funding and their participation may be terminated on the basis of Article 50 of the grant agreement.

2.6.1.1.2 Standard admissibility conditions

All proposals must conform to the conditions set out in the Rules of Participation and to the provisions of the H2020 Work Programme 2018-2020 Part 19. General Annexes section B. 'Standard admissibility conditions, page limits and supporting documents'.

The topic description used as reference is provided in the paragraph entitled 'Activities covered by this call for proposals' of the respective call below.

2.6.1.1.3 Eligibility conditions for grant proposals and related requirements, specific provisions and funding rates

Please refer to the H2020 Work Programme 2018-2020 Part 19. General Annexes sections C. 'Standard eligibility conditions' and D. 'Types of action: specific provisions and funding rates'.

Types of actions considered under the aforementioned calls for proposals are:

- Research & innovation actions (RIA),
- Innovation actions (IA),
- Coordination & support actions (CSA).

Funding rates depend on the type of action and, for Innovation Actions, on the type of entity applying.

Furthermore, the SESAR JU will distinguish between two types of calls for proposals (open and restricted) and will grant agreements with specific eligibility conditions:

- Open, competitive calls for proposals that, pursuant to Article 9.5 of the H2020 Rules for participation (Regulation (EU) No 1290/2013), will be addressed to any eligible entity;
- Restricted calls for proposals, which will limit the type of beneficiary to SESAR JU Members (defined in Annex XI).

The type of procedure for each of the 2019 calls for proposals is indicated under the 'Eligibility criteria' of each call specific conditions paragraph below.

2.6.1.1.4 Evaluation rules

Please refer to the H2020 Work Programme 2018-2020 Part 19. General Annexes section H. 'Evaluation rules'. The full evaluation procedure is described in the relevant guide published on the Funding and Tenders Portal.

Use of internal experts for the evaluation

Moreover, the SESAR JU will make use of internal experts for the evaluation. Indeed, the SESAR JU was established by its Founding Regulation as a body that has its own technical expertise and competence in the domain of ATM, and that is responsible for coordination with regard to content and across a wide programme of grants awarded to both members and other beneficiaries, enabling a 'pipeline of innovation' and securing the delivery of operational procedures and technologies leading to performance improvements for SES. The skills needed to undertake this specificity are formalised in the Organisation Chart included as Annex X to this SPD and the staffing that includes ATM and programme experts is in accordance with the Human Resources Policy (Annex IV). Then, these uniquely skilled and accountable SESAR JU expert staff and secondees (collectively *intramuros* staff) are used to complement external independent experts and independently assess proposals and/or deliverables and reports, always subject to the confirmation of no conflict of interest. To ensure appropriate external scrutiny for calls for proposals, the SESAR JU will ensure that all proposals are evaluated by a minimum of three external independent experts selected from the H2020 database (i.e. following the H2020 call for experts, published in the Official Journal of the EU on 22 November 2013), and secured using the appropriate IT tools and may decide to complement this number with additional internal experts.

The SESAR JU shall ensure that independent external experts are involved in all stages of the evaluation procedure and will also appoint an independent external observer to ensure that due process is respected and lessons learnt are captured to continuously improve the procedures.

Independently of the internal or external nature of experts, the SESAR JU shall always ensure absence of conflict of interest for all experts involved in the process.

Evaluation in light of selection criteria

Provisions set in section H. of the Work Programme 2018-2020 on financial capacity and operational capacity apply.

Evaluation in light of award criteria

Award criteria are defined for each call for proposals specifically and therefore are indicated in the paragraph 'Award criteria' within each call specific conditions. Provisions set in these paragraphs comply with the general conditions set in the aforementioned section of the Work Programme 2018-2020 Annex.

2.6.1.1.5 Budget flexibility

Please refer to the H2020 Work Programme 2018-2020 Part 19. General Annexes section I. 'Budget flexibility'.

2.6.1.1.6 Actions involving financial support to third parties

Please refer to the H2020 Work Programme 2018-2020 Part 19. General Annexes section K. 'Actions involving financial support to third parties'.

2.6.1.1.7 Conditions related to open access to Research Data

Please refer to the H2020 Work Programme 2018-2020 Part 19. General Annexes section L. 'Conditions related to open access to Research Data'.

However, for the same reasons as explained in Paragraph 2.5.2, IR projects and VLD activities under the call for proposals with reference H2020-SESAR-2019-1 will opt out of the provisions of the said Annex. This opt-out also aims to protect results that are expected to be commercially or industrially exploited.

2.6.1.1.8 Complementarity of grants

In addition, and as already used in the call for proposals H2020-SESAR-2015-2 restricted to Members, for the call for proposals H2020-SESAR-2019-1 and for the Application-oriented research part of the open call for proposals H2020-SESAR-2019-2, the grants awarded may include the possibility of enabling the options regarding 'complementary grants' of the SESAR JU Model Grant Agreement for Members (MGAM) and SESAR JU Model Grant Agreement (MGA) in force at the time of the call and the associated provisions therein. This includes additional access rights to background and results for the purposes of the complementary grant(s) and will ensure the complementarity of the activities performed in the calls are coordinated in the wider interest of the SESAR JU in its role in coordinating research and the SESAR 2020 Programme, being independent from the direct interests of the beneficiaries. This approach is consistent with the partnership established under the SESAR JU Membership Agreement. In this respect, the SESAR JU may implement the 'complementary' concept between calls launched in different years, if deemed necessary for the overall achievement of the objectives of the IPs and/or CCAs.

2.6.1.1.9 Consortium agreement

The legal entities wishing to participate in a project may form a consortium and appoint one of its consortium members to act as its coordinator depending upon whether other partnering arrangements exist at the SESAR JU Membership level and are deemed suitable by the applicant. Consequently, applications from SESAR JU Members shall submit a coordinated proposal but are not required to conclude a Consortium Agreement, in accordance with Article 24 (2) of the Rules of Participation. In other cases, entities wishing to participate in a project shall conclude a Consortium agreement among themselves prior to the signature of a Grant agreement.

2.6.1.2 Specific conditions for the IR-VLD Wave 2 call for proposals (with reference H2020-SESAR-2019-1)

2.6.1.2.1 Call identifier

This restricted call for proposals has the reference H2020-SESAR-2019-1.

2.6.1.2.2 Indicative call timetable

Publication date	January 2019
Opening date	January 2019
Final date for submission	April 2019
Information on the outcome of the evaluation	Maximum 5 months from the final date for submission
Signing of grant agreements	Not later than the end of Q1 2020

Table 26: Indicative timetable for the IR-VLD Wave 2 call for proposals with reference H2020-SESAR-2019-1

2.6.1.2.3 Indicative call budget

The indicative budget for this call is EUR 151.481.975.

Budget	Commitment (first estimate)	Payment (first estimate)
	In 2019: EUR 67.247.427 In 2020: EUR 84.234.548	In 2019: EUR 53.797.941 In 2020: EUR 58.964.185 In 2021: EUR 22.838.693 In 2022: EUR 7.686.160 In 2023: EUR 8.194.996

Table 27: Indicative budget for the IR-VLD Wave 2 call for proposals with reference H2020-SESAR-2019-1

This restricted call for proposals relies on the arrangements co-financed by contributions from both the Industry Members and EUROCONTROL through in-kind contributions as per the SESAR JU Membership Agreement, and in accordance with the H2020 regulation and the SESAR JU financial rules. In operating the PPP it is extremely important for the success of the PPP in meeting its mission to have an appropriate allocation of funding across the Key Features (allocated per project) and the complementary allocation per major ATM skills and competencies, specifically Airborne Systems, Ground ATM Systems and Service Provision. While not mandatory, this distribution provides the basis for the Wave 2 call for proposals and is fully described in Paragraph 2.6.1.2.5 (budget-to-scope allocation).

2.6.1.2.4 Activities covered by this call for proposals

The SESAR JU proposed a list of initial candidate solutions derived from its Single Programming Document (SPD) concept elements and also incorporating the results of a wide consultation process e.g. innovation workshops, SESAR innovation pipeline, etc. Independent experts assessed these candidate solutions, in particular, their potential to achieve the SESAR performance ambitions (i.e.

capacity) as well as their digitalisation potential. Based on a set of criteria (described in Section II, Paragraph 2.4.2) the independent experts assessment delivered a selection of candidate SESAR Solutions that aligned best with the SESAR strategy/needs/priorities.

The independent experts list was further considered with the views of the SESAR JU governance (PC/DMSC) and the Master Planning Committee evaluating the alignment with the SESAR priorities. During this process, the stakeholders/members were given the opportunity to provide additional information related to the potential of the candidate solutions. Once the consultation process finished, the SESAR JU started the elaboration of the Technical Specifications for the IR VLD Wave 2 call for proposals describing the final set of candidate solutions.

Given that it may not be possible to cover all candidate SESAR Solutions within the budget envelope stemming from the SPD, the proposals will cover a selection of the candidate Solutions to address the topics listed in the paragraphs below. In line with the ATM Master Plan update campaign and the recommendations from the European Court of Auditors, the selection of the candidate SESAR Solutions covered by the proposal shall be justified according to the following set of principles:

- Demonstrating contribution to increasing network capacity and/or access to airports including regional/secondary airports;
- Demonstrating added value for the ATM network in particular about:
    - Defragmentation of service provision: promoting a common service architecture across the European ATM system;
    - Interoperability: enabling the seamless exchange of information between systems;
    - sharing of infrastructure: promoting the efficient and shared use of infrastructure such as CNS;
    - Scalability: delivering Solutions that enable the ATM System to be enlarged, to easily adapt operational capacity to meet demand.
- Demonstrating that the solution development will ensure a deployment oriented outcome.

WORK AREA I. INDUSTRIAL RESEARCH

Maximising the potential of digitalisation is key to the future success of aviation throughout Europe and will be the overall theme of the next ATM Master Plan update campaign. The aviation industry is being transformed by digitalisation with increasing automation, and exchange of data amongst all parts of the aviation value chain. But this is only the start and digitalisation will play an increasingly important role in the capacity delivery and future safety and efficiency of the aviation industry. SESAR 2020 Wave 2 has to mark a first significant step for the key European aviation stakeholders who must work together to ensure that the digital transformation of aviation does not become fragmented and pursue game changing ideas to meet the objectives of the EU's SES and the EU Aviation Strategy, in particular providing the required network capacity to accommodate with the expected traffic growth.

During the reporting period, SESAR 2020 Industrial Research and Validation (IR) activities will continue to facilitate the migration of ideas from Exploratory Research and have them further extended in the Applied Research phase and finally to pre-industrial development, validation, large scale demonstration and then final preparation for deployment. In addition, the industrial research programme will include lower maturity topics in order to allow the injection of innovative concepts to embrace the ATM Master Plan digitalisation challenge.

Therefore, the main objective of this strategic area is to deliver SESAR Solutions derived from the ATM Master Plan and identified in the SESAR JU's multi-annual work programme.

During the period 2018-2019, the IR Wave 2 call for proposals will be in preparation, with execution taking place during the period 2019-2022. This second IR call for proposals will enable the flexibility needed to align future research with the results of Wave 1, re-assess relative priorities and ensure the best value-for-money for the EU and delivery against SES goals, thus contributing to the mitigation of major risk with reference CORP01 'R&D activities do not deliver solutions allowing to reach expected ATM performance' (see annex VIII).

This call for proposals will also allow for strategic input to scope new projects from the Master Plan update, allow to build on results of the outcome of Exploratory Research projects under the ER1 call for proposals to increase the maturity of the research towards future solutions. It will also allow for the completion of some solutions which have not reached V3 within Wave 1.

In preparation for this, during the year 2018, the SESAR JU has carried out activities required to define the content of the IR Wave 2 call for proposals.

The objective is to launch the call for proposals in early 2019 and perform the evaluation of the proposals, and the selection and the grant awards by the end 2019. This approach enables the launch into execution of the Wave 2 IR projects during Q4 2019 and the development and delivery of Wave 2 candidate SESAR Solutions during the year 2020 and through to the year 2022.

The following sections describe, per Work Area, the list of topics and candidate SESAR Solutions that should be covered by the call for proposals.

In order to provide for coordination and guidance to the whole programme, receive proposals from Exploratory Research results and provide an integration role across maturity phases and Work Areas, two Topics (as Coordination and Support Actions (CSA)) will cover transversal areas.

- **Topic PJ.19 W2 'Content Integration, Performance management and Business case Development'**: to support Programme execution and solution projects developments for delivering the SESAR Solutions in line with the ATM Master Plan:
  - Organising and executing Content Configuration Change process
  - Organising on a continuous basis the activities needed at programme level aiming to coordinate, consolidate and integrate SESAR ATM and Technological Solutions, and as such to support and guide the processes to ensure their completeness, consistency and coherency from a holistic perspective
  - Contributing to the Solution maturity assessment
  - Ensuring the translation of the MP performance ambition into validation targets
  - Support Solution projects in their performance evaluation and aggregate performance results into business cases.
  - Ensuring the evolution of future envisaged concept of operations (CONOPS) aligned with the SESAR Vision and Performance Ambition as set at the Master Plan level 1;
  - Enabling and supporting system engineering data management framework allowing to capture SE data (requirements and validation/demonstrations objectives and results) in a structured way and ensuring consistency, coherence and coverage analysis at Programme level
- **Topic PJ.20 W2 'Master Planning'**: to apply top-down approach to facilitate the strategic steering of the SESAR project as a whole in line with Policy priorities :

- Organising the Master Plan update campaign (one update campaign is tentatively planned to take place in 2022, precise year to be confirmed by the SESAR JU and its Governance Bodies) and publication of the ATM MP Level 1;
- Publication of the ATM MP Level 2 and monitoring of its alignment and consistency with the Level 1
- Yearly Deployment Planning & Reporting of ATM MP Level 3

In addition, in this Work Area, there are 11 topics (Research and Innovation Actions (RIA)) that will actually develop the candidate SESAR Solutions in Wave 2. They are described below structured per Key Feature.

2.6.1.2.4.1 SESAR Key Feature High-Performing Airport Operations

Topic PJ.02 W2 'Airport airside and runway throughput'.

Problem statement and R&D needs

At capacity constrained airports, traffic demand for runway operations can exceed the runway capacity. With the expected rapid growth in air traffic, there will be an increasing number of capacity-constrained airports for significant periods of each day, and this situation will become even more critical under adverse weather conditions. Airport will have to improve the efficiency of runway operations and their resilience in visually and/or meteorological challenging conditions. This would be achieved in fully integrating surface management tools with other systems including runway occupancy time prediction, wake separation and arrival and departure management (AMAN/DMAN) systems. In turn it will further reduce the number of incidents / accidents at the airport e.g. collisions on the apron and taxiway with traffic and/or fixed obstacles.

Airports and airlines need to enhance their capability to deliver, plan and improve the use of airport resources so that costs, emissions and fuel consumption can be reduced, whilst improving passenger satisfaction.

Performance expectations

The delivered solutions are expected to have a positive impact on:

- Airport and Airspace TMA Capacity - Increase runway and airspace throughput (e.g. reducing runway occupancy time, or arrivals and departures wake turbulence separation) and resilience;
- Safety: maintain or increase runway, taxiway and apron safety levels, increase situational awareness, ATC Workload maintained or reduced;
- Improved access to secondary airports, with expected benefits in resilience, cost-efficiency and increased flexibility under non-nominal conditions at the airport;
- Predictability - increased predictability and airport efficiency (e.g. runway occupancy time, runway exit and departure rotation);
- Environmental Sustainability - reduced fuel consumption and noise near the airports

Candidate SESAR Solutions space

- Solution PJ.02-W2-14 Evolution of separation minima for increased runway throughput.

The solution addresses the refinement and consolidation of static pairwise separation matrixes and weather dependent separation minima for successive arrivals, the development of static pairwise separation matrixes for successive departures and between arrivals and departures. It includes the development and validation of ATCO tools and also covers the potential use of flight-specific aircraft characteristics taken from the eFPL, or from an evolution of the eFPL (e.g. aircraft weight), downlinked from the aircraft.

- Solution PJ.02-W2-21 Digital evolution of integrated surface management.
  The solution covers the development (e.g. using new algorithms, artificial intelligence/expert systems) of procedures and required system support for an improved surface traffic management, including extension of the A-SMGCS routing functions and the integration of inputs from airport DCB processes. The solution covers as well the guidance assistance to both pilots and vehicle drivers using Airfield Ground Lighting (AGL), the consolidation of the 'Follow-The-Greens' procedures, the exchange of information between ATC and vehicles/aircrafts using airport data link and other guidance means, and the development of enhanced airport safety nets for controllers beyond those delivered in SESAR 1.
- Solution PJ.02-W2-04 Advanced geometric GNSS based procedures in the TMA.
  This solution addresses the use of GNSS geometric guidance from the initial approach fix or earlier, in order to make the transition easier in certain MET conditions (e.g. high temperatures). The research will address the potential impact of MET conditions on the safe conduct of advanced curved operations and the required separation minima. The research may also address curved departures, potentially combined with precise geometric altimetry, in order to further develop curved departure routes that turn shortly after take-off.
- Solution PJ.02-W2-17 Improved access to secondary airports.
  The solution aims at increasing access to secondary airports in all conditions, including in particular low visibility conditions by developing systems and operational procedures that allow operational credits as considered by the Performance Based Aerodrome Operational Minima (PBAOM). The validation will focus on business aviation, general aviation, rotorcraft and military aircraft.
- Solution PJ.02-W2-25 Safety support tools for avoiding runway excursions.
  The solution aims at improving runway condition awareness to increase safety in order to prevent runway excursions (take-off and landing), including the enhancement of runway status information on secondary airports, the on board runway friction coefficient elaboration and the airport runway status model update. The objective is to provide the flight crews with objective and synthetic information elements for them to make the right decisions during take-off, approach, and landing phases.

Topic PJ.04 W2 'Total airport management'

Problem statement and R&D needs

The full integration between Airport and Network Operations has still to be achieved. In particular, the management of predicted airport performance deterioration needs to be aligned with the Network. Collaborative recovery procedures and support tools in coordination with all the relevant ATM stakeholders are required to facilitate the pro-active management of predicted performance deteriorations such as airport capacity reduction. Total airport demand and capacity balancing processes and tools require further integration with the execution tools (arrivals and departure management systems and advanced surface movement guidance & control systems) and resource allocation planning tools (e.g. stand/gate allocation) with the objective of optimising the airport

capacity to better comply with the traffic demand. Airport landside/airside performance monitoring and management processes need to be further integrated while the turnaround monitoring within the Airport Operations Centre (APOC) requires refinement in coordination with the Airspace Users. Impact assessment tools available to the APOC need to better integrate information about MET forecast uncertainty. Post-operations analysis processes, support tools and reporting capabilities need to be as well developed.

Performance expectations

The delivered solutions are expected to have a positive impact on :

- Better use of existing airport capacity and its optimisation to comply with traffic demand;
- A better situational awareness through SWIM information sharing, enabling provision and reception of Airport CDM data including MET and AIM.
- A significant increase in the predictability, efficiency, environmental sustainability and flexibility of airport operations thanks to a performance-driven airport through KPIs monitoring and early detection of deviations, collaborative decision making using support tools and what-if functions, post-operations analysis used as learning process, etc.;
- Proactive management of predicted impacts to normal operations, quicker reactions on deviations;
- Increased resilience through shorter and effective recovery to normal operations and collaboration with the Network, from predicted or unpredicted adverse operating conditions;
- Increased safety in the airport environment due to reduced uncertainty of operations and reduced congestion through better planning.

Candidate SESAR Solutions space

- Solution PJ.04-W2-28 Enhanced Collaborative Airport Performance Planning and Monitoring.
  The solution aims at enhancing the collaborative airport performance planning and monitoring processes, in particular, through the inclusion in the airside processes of the relevant landside (passenger and baggage flow) process outputs, the consideration of connectivity and multi-modality aspects and the extension of turn-round monitoring within the APOC. The solution goal is to achieve a full and seamless interoperability with the AU operational systems and to improve the connectivity between regional airports and the NMOC.
- Solution PJ.04-W2-29 Digital Collaborative Airport Performance Management.
  The solution addresses the digital data management of airport performance thanks to the development and validation of rationalised predictive data driven dash boards fed with all landside and airside leading key performance airport indicators covering the TAM processes. The SESAR Solution will enable stakeholders to pro-actively identify demand and capacity imbalances, their timeframe, location and impacted trajectories and solve them supported by what-if capabilities. The solution explores data and video analytics, big data and machine learning techniques.

Topic PJ.05 W2 'Digital technologies for Tower'

Problem statement and R&D needs

Some small and remote European cities are highly dependent of local and regional airports for connection purposes, maintaining local business and cargo. Remote Tower Services (RTS) provide an opportunity for continued operation of airports and rural development. The costs for performing Air Traffic Service (ATS) are high and could be reduced, particularly at low to medium density airports, by provision of Air Traffic Services (ATS) from a remote tower specifically through a highly efficient multi remote tower solution. The focus on maintaining situation awareness becomes an increasingly important factor with multiple remote tower operations, therefore additional automation functionalities e.g. voice recognition, conflict detection, and conflict resolution advisories should be developed in order to gradually increase the operating range of the concept. There is a need for effective planning tools in both short term and long term all managed by a supervisor role.

The efficiency of using the CWP HMIs for the airport tower requires improvements by exploiting the latest mature technologies and new interaction modes e.g. touch, gesture, voice, etc..

Performance expectations

This project will develop solutions that are expected to provide:

- Improved cost-efficiency with the optimisation of the use of available resources;
- Increased safety with an increased awareness of the traffic situation thanks to the use of digital display information available to the tower controller;
- Increased ATCO efficiency with the use of technologies allowing ATCOs to focus on key tasks.

Candidate SESAR Solutions space

- Solution PJ.05-W2-35 Multiple Remote Tower and Remote Tower centre.
  The solution addresses the remotely provision of Air Traffic Services (ATS) from a Remote Tower Centre (RTC) to a large number of airports. It includes the development of RTC supervisor and support systems and advanced automation functions for a more cost efficient solution. The solution also covers the integration of approach for airports connected to the remote centre and connections between RTCs with systems for flow management and the development of tools and features for a flexible planning of all aerodromes connected to remote tower services.
- Solution PJ.05-W2-97 HMI Interaction modes for Airport Tower.
  The solution addresses the development of new human machine interface (HMI) interaction modes and technologies in order to minimise the load and mental strain on the Tower controllers. The SESAR solution shall consider modern design and development approaches and methodologies such as modularity, SoA, adaptive automation, etc. The new HMI interaction modes include the use of in-air gestures, attention control, user profile management systems, tracking labels, virtual and augmented reality, etc.

2.6.1.2.4.2 SESAR Key Feature Optimised ATM Network Services

Topic PJ.07 W2 'Optimised airspace users operations'

Problem statement and R&D needs

The current ATM environment based on static flight plans is evolving towards a trajectory based environment in order to improve airports and ATM network performance. Airspace users' (AU) decision processes and resulting business priorities differ from AU to AU and from flight to flight within one AU. The trajectory development and management processes in ATM currently do not allow each individual user to incorporate specific aircraft/flight priorities into the requested trajectory, and respect any constraint in a way that best meets the business priorities. Similarly, OAT flight plans are not harmonised at European level and information is not disseminated into the network, this induces a lack of awareness about military traffic intentions that can impact ATM network performance (including safety), a lack of flexibility in the definition of cross-borders exercises and limitations in terms of interoperability. Irregular operations impose unplanned/additional cost on airlines and have a huge impact on airlines' annual costs and revenue. Today the ATM system allows little flexibility to airspace users (e.g. ATFM slot swapping process). Airspace users' full participation through their flight operations centres (FOC/WOC) into ATM collaborative processes, including flights' prioritisation with the full user driven prioritisation process (UDPP), is essential to minimise impacts of deteriorated operations for all stakeholders including airspace users. A better recovery process that should offer more flexibility to accommodate AUs' changing business priorities and equity in the ATM system. The collaborative planning and flight execution processes shall be performed at 'level playing field', i.e. performance of all actors is taken into consideration. Rules must be implemented in case no collaborative planning is possible.

Performance expectations

This project will develop solutions that are expected to have a positive impact on the Network improving:

- Increased capacity based on a better integration of the AUs trajectory definition and the network demand and capacity function
- Increased flexibility by allowing the airspace users to recommend to the network management function a priority order for flights;
- Environmental sustainability - fuel efficiency thanks to the use of the preferred trajectory taking into consideration the Airspace users needs;
- Increased punctuality and predictability of individual flights thanks to the collaborative framework of the trajectory management.

Candidate SESAR Solutions space:

The topic 'Optimised airspace users operations' covers the following candidate SESAR Solutions:

- Solution PJ.07-W2-38 Enhanced integration of AU trajectory definition and network management processes.
  The objective of this solution is to reduce the impact of ATM planning on Airspace Users' costs of operations, by providing them a better access to ATM resource management and

allowing them to better cope with ATM constraints. The solution shall improve Airspace Users flight planning and network management through improved FOC participation into the ATM network collaborative processes in the context of FF-ICE and its potential evolutions.

- Solution PJ.07-W2-40 Mission trajectories management with integrated Dynamic Mobile Areas Type 1 and Type 2.
  The objective of the solution is to improve the use of airspace capacity for both civil and military users and the efficiency of airspace management by introducing more automation and increased flexibility in the civil-military coordination. The solution delivers improvements to the planning phase of the mission trajectory, including the connection of MT management with the booking of ARES (in the context of this solution DMA Type 1 and Type 2), for which the WOC will be the key actor. The coordination between WOC and regional NM is a key element for this solution.
- Solution PJ.07-W2-39 Collaborative framework managing delay constraints on arrivals.
  The solution develops a collaborative framework that will enable the integration and necessary coordination of 4D constraints from various stakeholders (airports, ANSPs, AUs and NM). This will ensure the continued stability and performance of the network and will give the opportunity to the Airspace Users to prioritize their most important flights hence reducing the impact of ATM planning constraints on the costs of their operations. The solution will streamline all prioritisation processes occurring in the planning phase from all stakeholders concerned on arrivals.

Topic PJ.09 W2 'Digital Network Management Services'

Problem statement and R&D needs

Today, air traffic flow and capacity management (ATFCM), airspace management (ASM) and air traffic control (ATC) are still separated processes and the interfaces between ATFCM, ASM and ATC processes and systems require further integration, as well as full collaboration between ATM actors and airspace users. Also, the sharing of airspace information is not optimally adapted to Aircraft Operators (AO) and other Airspace User (AU) processes, which is leading to limited usage of available dynamic configurable airspace. Similarly, the current ATM environment provides neither an accurate prediction of traffic and relevant measurements of its uncertainty nor the sector predicted workload with a confidence index, with which to determine efficient airspace organisation.

The organisation of resources across Area Control Centres need to be improved as well as the scoping of measures from local level to full network impact assessment, and the promotion of opportunity measures over those with implication on airspace users costs. The operational data shared in the network operations plan (NOP) has to be expanded in scope and time horizon to integrate more tactical (real-time) dynamic airspace configuration and Airports data. The relevant information should be accessible to everyone and distributed in a transparent but cohesive way with the aim of ensuring sufficient flexibility in the short term DCB phase and the efficient ATC involvement in the DCB process execution. Accurate traffic prediction has to be made available to all actors concerned (e.g. NM, AUs, ATC) from medium-term planning till execution of the trajectories for managing traffic complexity, solving traffic constraint issues and optimising the performance of the network. Relevant indicators to assess DCB measures and monitor execution against the predicted impact on network performance need to be defined and provided through automated tools enabling what-if and what-else analysis.

Performance expectations

This project will develop solutions that are expected to have a positive impact on the Network improving:

- Capacity through a dynamic configuration of airspace responding with flexibility to the Airspace users flight trajectory needs
- Safety: Improved safety in better anticipating and managing potential overloads;
- Efficiency thanks to the monitoring of the DCB measures against network performance and the implementation of corrective actions
- Cost-efficiency: DCB allows improved ATM resource planning and better use of existing capacities leading to reduced ATC and Airport Capacity costs;
- Predictability: the NOP will provide the planned network situation considering all known constraints and time deviation will be managed by anticipating demand/capacity imbalance detection and improving the implementation of DCB solutions;
- Flexibility: common awareness to all stakeholders through the NOP and access to opportunities in case of late changes in capacity or demand.

Candidate SESAR Solutions space:

The project 'Digital Network Management Services' covers the following candidate SESAR Solutions:

- Solution PJ.09-W2-44 Dynamic Airspace Configurations (DAC):
  The objective of the solution is to improve the use of airspace capacity for both civil and military users by increasing the granularity and the flexibility in the airspace configuration and management within and across ANSPs' areas of responsibilities. This solution will address the integration of concepts and procedures to allow flexible sectorisation boundaries to be dynamically modified based on demand. This includes potential implications for ATCO licences, international boundaries and potentially IOP and A/G multi-datalink communication capabilities.
- Solution PJ.09-W2-45 Enhanced Network Traffic Prediction and shared complexity representation.
  The solution aims at improving the accuracy of the network manager traffic prediction from medium-term planning phase (D-2) to execution (included), relying in particular on new trajectory management features such as the preliminary FPL. It shall adapt existing methodologies and algorithms for demand prediction and regional complexity assessment.
- Solution PJ.09-W2-47 Network optimisation of multiple ATFCM time based measures.
  The solution aims at improving the efficiency and reducing the adverse impact of multiple regulations affecting the same flight or flows. It explores the relationships between the DCB regulations and their interactions trough the flights to quantify the network effect of those interactions. Key to this solution is to identify and avoid regulations with negative impact on network performance.
- Solution PJ.09-W2-48 Digital Integrated Network Management and ATC Planning (INAP).
  The SESAR solution 'digital INAP' aims at filling the gap between the management of traffic flows at network level (dDCB) and the control of flights in individual sectors. The solution develops and integrates local functions and associated tools, roles and responsibilities providing an automated interface between local NM and ATC planning to assist controllers in alleviating traffic complexity, traffic density, and traffic flow problems.

- Solution PJ.09-W2-49 Collaborative Network Performance Management.
  The solution aims at providing a common framework and toolbox to the other solutions and actors, allowing them to assess the Network Performance in the pre-tactical and tactical phases of the Network Management. The solution shall develop transparent and shareable network performance indicators, network state monitoring and prediction to support NMOC supervision and awareness, network performance what-if and what-else capabilities.

2.6.1.2.4.3 SESAR Key Feature Advanced Air Traffic Services

Topic PJ.01 W2 'Enhanced Arrival and Departures'

Problem statement and R&D needs

With the extension of Arrival Management (AMAN) systems horizons, En-Route sectors are affected by concurrent arrival management strategies due to the overlapping AMAN horizons of several independent Terminal Manoeuvre Areas (TMAs). The interaction between traffic synchronisation and demand-capacity balancing (DCB) within the extended horizon needs to be addressed, and potential information integration needs and balancing mechanisms need to be investigated and developed to ensure delivering the optimal capacity. Complex interacting traffic flows in the TMA (including from/to multiple airports) need to be more actively managed to increase safety and improve fuel efficiency whilst capacity is increased. Continuous climb and continuous descent operations (CCO/CDO) at near idle thrust are environmentally friendly, because they are more fuel efficient and also minimize the time that aircraft have to be at low altitude, thereby reducing their noise impact. However, controllers often need to use intermediate level-offs in order to ensure separation. Use of stepped climbs and descents should be reduced at the same time as optimising flights laterally and with appropriate speed management, and optimising the overall Air Traffic Control (ATC) task. Multiple arrival management systems need to ensure a more regular flow of arriving aircraft managed for TMA optimisation as well as runway optimisation. Multiple departure management systems are required to enable a more consistent delivery of departures into the TMA and ultimately to En Route sectors. Improved flows will help to facilitate optimised profiles for aircraft, with dynamic route structures able to provide additional solutions integrated with the management of queues. IFR Rotorcraft operations are constrained to use same approach/departure procedures as fixed wing aircraft and due to their lower speed profiles, runway throughput is very often negatively impacted at busy airports. Specific rotorcraft procedures need to be defined in particular in adverse weather conditions to assist rotorcraft pilots by extending landing to degraded visual conditions.

Performance expectations

This project will develop solutions that are expected to have a positive impact on the Network improving:

- Airspace capacity (improved throughput / airspace volume & time) and airport capacity (improved runway throughput flights/hour) thanks to the synchronisation of the arrival and departure sequences to and from airports using extended AMAN overlapping operations;
- Environmental sustainability and fuel Efficiency thanks to the implementation of continuous descent and climb profiles ;

- Predictability with the increased accuracy of the AMAN data);
- Cost-efficiency (reduced direct ANS cost per flight);
- Safety with in particular assisting rotorcraft pilot for landing in bad weather conditions.

Candidate SESAR Solutions space:

The project 'Enhanced Arrival and Departures' covers the following candidate SESAR Solutions:

- Solution PJ.01-W2-08 Dynamic E-TMA for advanced continuous climb and descent operations and improved arrival and departure operations.
  The objective of this solution is to improve descent and climb profiles in busy airspace, as well as the horizontal flight efficiency of arrivals and departures, while at the same time ensuring traffic synchronisation, short-term DCB and separation. This requires a very broad scope, which includes advances in airspace design, development of ground tools, and development of ATC and airborne procedures.
- Solution PJ.01-W2-01 Next generation AMAN for 4D environment.
  This solution will provide enhancements to the arrival management systems and procedures in the context of digitalisation in ATM: uplink of AMAN constraints, uplink of a STAR or custom arrival route to the aircraft via ATN B2 from the ATSU, potential use of maximum descent speeds, etc. It investigates strategies to increase the use of managed/automatic mode for flights handled by TTL/TTG during sequencing, improved consideration of downlinked aircraft data by AMAN algorithms, use of machine learning for the refinement of AMAN algorithms, etc.
- Solution PJ.01-W2-06 Advanced rotorcraft operations in the TMA.
  The solution addresses the development of a number of advanced procedures and technologies for rotorcraft (e.g. Head up Display (HUD), Helmet Mounted Display (HMD)) to assist rotorcraft pilots by extending landing to degraded visual conditions. The solution covers as well the development of new cost efficient traffic surveillance systems enhancing the pilots' situation awareness as well as rotorcraft interoperability with GA, drones and RPAS.

Topic PJ.18 W2 '4D skyways'

Problem statement and R&D needs

The SESAR concept is based upon the fundamental element of trajectory sharing. The ultimate goal is a trajectory based ATM system where actors optimise business and mission trajectories through common trajectory information taking into account users priorities and ATC constraints. The objective is the sharing of the trajectories between the ATM actors including airspace users through an iterative process to take into account more accurate data once available (e.g. intentions, MET forecast, current traffic, airspace management). This will allow the Airspace User to choose the preferred way of integrating ATM constraints when required. There is a need to agree in more details on the elements that will constitute the reference business trajectory (RBT) in trajectory based operations (TBO) and better understand how these will be used operationally. The new ATM Solutions will need better trajectory predictions and additional data exchanges between systems.

A generic principle of the SES and the SESAR programme is that, where services can be delivered in a harmonised manner, they should be done so. The future high level architecture should offer an option for the de-fragmentation of the ATM system through the provision of harmonised or Common Services

(a service to consumers that provides a capability in the same form that they would otherwise provide themselves). Introducing a Common Service will change how a solution is delivered and this is likely to change organisational relationships between the stakeholders due to the provision and consumption of the new service.

Performance expectations

The project will contribute to increase:

- Safety by generating and proposing conflict free clearance that considers aircraft performance
- Interoperability by sharing the same trajectory view between air and all ground actors;
- Predictability by improved trajectory accuracy and sharing information updates throughout the flight;
- Flexibility by matching the trajectory with the Airspace User needs;
- Flight efficiency: flight is managed closer to its optimal profile;

Candidate SESAR Solutions space:

The project '4D skyways' covers the following candidate SESAR Solutions:

- Solution PJ.18-W2-53 Improved Ground Trajectory Predictions enabling future automation tools.
  The solution focuses on the operational validation of improved CD&R tools. The main goal is to increase the quality of separation management services reducing controller workload and separation buffers and facilitating new controller team organisations. The foundation is the improvement of the ground TP(EPP data beyond weight and CAS, known MET data or new MET data and capabilities, etc.).
- Solution PJ.18-W2-56 Improved vertical profiles through enhanced vertical clearances.
  The objective of this solution is to develop an automation support for ATCOs to issue vertical constraints that support more efficient flight profiles while ensuring separation provision. First step, for flight still in climb, enhanced prediction of vertical profile data are presented to ATCOs to facilitate decision making. In a second more advanced step, the ATC system would generate proposals for conflict-free clearances that take anticipated aircraft performance into account, which can be uplinked to the flight crew by ATCO..
- Solution PJ.18-W2-57 RBT revision supported by datalink and increased automation.
  The solution aims at supporting a continuous increase in the amount and the usefulness of information shared between air and ground and of the level of automation support to controllers and pilots, e.g. towards the automatic uplink of clearances with or without previous controller validation and towards increased use of the auto-load to FMS of uplinked clearances and of managed/automatic mode by the flight crew.
- Solution PJ.18-W2-88 Trajectory Prediction Service.
  This solution is a technical service conceived as being provided to Europeans ANSPs, AUs, AO, Military and the Network Manager (NM) in support of trajectory operations. The solution is intended to provide a single point of truth for a specific trajectory in the time frame from creation in long term pre-flight planning through to the flight execution phase. The solution is not intended to replace today's flight data processing systems and consequently the service can be used as an input to ATC systems but not used directly for control purposes.

Topic PJ.10 W2 'Separation Management and Controller Tools'

Problem statement and R&D needs

Current operations within continental En-route and TMA airspace are based on sectorisation structures that intend to handle the traffic demand according to the capacity of the controllers to handle it. It results in the tactical use of multiple radar vectors and stepped climbs and descents to maintain separation between aircraft in high traffic situations. This leads to less efficient flight profiles and high levels of workload for both ATC and the flight crews. It makes it also very difficult to balance the operators' requirements in terms of flight efficiency (notably user-preferred trajectories) with the need for overall capacity, safety of the operations and ATC workload. Occasionally, where no further splitting of sectors is possible due to limited controller resources, the sector demand exceeds the available controller capacity resulting in flow restrictions, level-capping and other measures that ensure safety at the expense of flight efficiency and timeliness. Future En-Route and TMA environment is anticipated to be even more loaded and complex than todays.

New system functionalities and further steps of automation provide the chance to achieve significant operational benefits. New ATC tools and the development of new concepts will allow for sectorless environment (where appropriate) to suit various airspace structures like free route, various traffic levels and complexities. Controller productivity needs to be addressed with new team organisations to cope with the collaborative planning and control based on the unplanned boundaries concept.

In today's situation Air Navigation Service Providers (ANSPs) usually host a monolithic ATM system in each Air Traffic System Unit (ATSU) with very few information services and infrastructure elements being shared between the different centres. In the virtual centre approach, the controller working positions are decoupled and may even be geographically separated from the ATM information services that they consume, and these ATM information services may be shared between different ATSUs or even between ANSPs. The main benefits expected from the virtual centre approach are cost reduction and more flexibility to support load-balancing between the participating ATSUs, delegation of airspace or manage contingency situations. The development of technical services and common interfaces resulting from new technologies, working methods, service oriented architectures (SOA) and procedures would also need to address human factors considerations.

There is a need to increase the efficiency of using the CWP HMIs for the En-Route and APP ATC centre by exploiting the latest mature technologies and new interaction modes e.g. touch, gesture, voice, etc.

Performance expectations

This project will develop solutions that are expected to have a positive impact on the Network improving:

- Safety by being flight centric focused in particular in Free route environment and a reduction of the potential conflict that are laterally far better distributed over the airspace;
- Capacity thanks to the reduction of the partitioning of the airspace (sectors), the airspace capacity is not longer restricted by sector capacity and thanks to the reduction of the controller workload (reduction of sectors handovers) that would lead to increase the amount of flights per ATCO
- Efficiency with a reduction of coordination and handover the pilot has to comply with and the set up

- Flexibility thanks to the load-balancing or the management of the contingency situations between ACCs and controllers when applying virtual centre concept ;
- Cost-efficiency thanks to the interoperability between system and the decoupling of the ATM data provision from the ATC service provision enabling data to be shared between different ATSUs.

Candidate SESAR Solutions space:

The project 'Separation Management and Controller Tools' covers the following candidate SESAR Solutions:

- Solution PJ.10-W2-73 Flight-centric ATC and Improved Distribution of Separation Responsibility in ATC.
  The solution covers a concept that consists of assigning aircraft to ATCOs without references to geographical sectors, and have the aircraft controlled by that same ATCO across two or more geographical sectors. The solution requires flight-centric specific allocation, visualisation (traffic filtering), coordination tools (e.g. in the event of a conflict, establish which controller is responsible for its resolution) and, for high traffic densities advanced CD&R tools (that are not flight-centric specific). The solution also covers the concept of collaborative control with planned boundaries in which sectors are retained as they are today, with aircraft being assigned to a sector according to its geographic location. The boundaries between sectors have planned coordination conditions like in current operations, but with some additional flexibility by allowing controllers to issue clearances without prior coordination to aircraft in a different sector.
- Solution PJ.10-W2-93 Delegation of airspace amongst ATSUs.
  The objective of this solution is to explore the different possible delegation of airspace amongst ATSUs based on traffic / organisation needs (either static on fix-time transfer schedule (Day/Night) or dynamic e.g. when the traffic density is below/over certain level) or on contingency needs. The solution covers an operational thread, which aims at defining and validating the different types of delegation of airspace and a technical thread, which aims at specifying the impacts of the operational thread on the services defined in the Virtual centre concept.
- Solution PJ.10-W2-96 HMI Interaction modes for ATC centre.
  The solution addresses the development of new human machine interface (HMI) interaction modes and technologies in order to minimise the load and mental strain on controllers in the ATC centre. The SESAR solution shall consider modern design and development approaches and methodologies such as modularity, SoA, adaptive automation, etc. The new HMI interaction modes include the use of in-air gestures, attention control, user profile management systems, tracking labels, virtual and augmented reality, etc.
- Solution PJ.10-W2-70 Collaborative control and Multi sector planner (MSP) in en-route.
  The solution addresses the collaborative control with unplanned boundaries concept, in which the traditional requirement to coordinate traffic at all sector boundaries is waived for an area covering two or more sectors. In case it is not completed in wave 1, the solution scope covers as well the development, for the en-route environment, of the concept of operation and the required system support e.g. coordination tools for operating in a team structure where a Planner has responsibility for the airspace under the executive control of two or more independent Executive Controllers (multi-sector planner or MSP). The MSP is able to adjust the internal (executive) sector boundaries so that workload is balanced between the Executive controllers.

Topic PJ.13 W2 'IFR RPAS'

Problem statement and R&D needs

The number of remotely piloted aircraft systems (RPAS) is continuously increasing and this will imply higher interactions with the wider ATM system. IFR RPAS operation characteristics e.g. speed, manoeuvrability, etc., together with their avionic system equipage may differ substantially from conventional aircraft.

One basic principle underpinning the integration of IFR RPAS in ATM, in alignment with ICAO principles, is that RPAS have to be treated in a similar manner to manned aircraft while duly considering the specific character of remotely-manned operations. IFR RPAS must be transparent (alike) to ATC and other airspace users.

Performance expectations

This project will develop solutions that are expected to have a positive impact on the Network improving:

- Safety thanks to the development of detect and avoid system for preventing collision with other traffic;
- Efficiency with the definition of adequate procedure and systems enabling the introduction of IFR RPAS in a controlled environment
- Access and equity in enabling airspace access to new users

Candidate SESAR Solutions space:

The project 'IFR RPAS' covers the following candidate SESAR Solutions:

- Solution PJ.13-W2-111 'Collision avoidance for IFR RPAS'.
  The solution will develop and operationally validate a detect and avoid (DAA) system for IFR RPAS, which consists of two functions: collision avoidance (CA) and remain well clear (RWC), in order to allow the remote pilot to contribute to safety by preventing collisions, should normal separation provision fail. The RWC function is designed to provide the remote pilot with greater situational awareness.
- Solution PJ.13-W2-115 IFR RPAS accommodation in Airspace Class A to C.
  The solution is aimed at accommodating IFR RPAS in non-segregated airspace in the short-term, in accordance with the drone roadmap in the ATM Masterplan. The objective is to enable IFR RPAS operating from dedicated airfields to routinely operate in airspace classes A-C as GAT without a chase plane escort. The development of ATC procedures, adaptations to the flight planning processes, contingency etc. are included in the solution.
- Solution PJ.13-W2-117 IFR RPAS integration in Airspace Class A to C.
  The SESAR solution aims at providing the technical capabilities and procedural means to allow IFR RPAS to comply with ATC instructions and the development of new procedures and tools to allow ATC to handle IFR RPAS in a cooperative environment in full integration with manned aviation.

2.6.1.2.4.4 SESAR Key Feature: Enabling Aviation Infrastructure

Topic PJ.14 W2 'Integrated CNSS'

Problem statement and R&D needs

Communication, Navigation and Surveillance, except for few cases, are actually significantly relying on national infrastructure deployed and operated by Air Navigation Services Providers. This leads to a deployment of technologies based on local/national choices and priorities resulting in un-synchronised, un-homogeneous and fragmented deployments. Some of these technologies have been in operation since decades and are not capable to support the automation of the ATM and the future need of airspace users including new entrants (e.g. RPAS). New technologies are being introduced. However, optimisation of the infrastructure has not largely been undertaken resulting in accumulation of legacy and new technologies having negative impacts of cost of operation and maintenance, spectrum usage, number of embarked systems.

Performance requirements for Communication, Navigation and Surveillance (CNS) systems are becoming increasingly complex and demanding considering convergence towards a common infrastructure, and a unified concept of operations (CONOPS) across the different (COM, NAV and SUR) domains. The new technical capabilities must be developed to fully meet the requirements derived from operational needs, taking into account the new emerging CNS technologies.

Performance expectations

While the technological solutions developed under this topic do not have direct impact on operational key performance areas, they are in the critical path to deliver the ATM Master Plan performance ambition in areas as efficiency, capacity, safety, security and cost-efficiency.

Candidate SESAR Solutions space:

The project 'Integrated CNSS' covers the following candidate SESAR Solutions:

- Solution PJ.14-W2-76 Integrated CNS and Spectrum.
  The solution addresses the CNS cross-domains consistency in terms of robustness, spectrum use and interoperability including the civil-military aspects through the provision of a global view of the future communications, navigation and surveillance services and the definition of the future integrated CNS architecture (and the CNS spectrum strategy).
- Solution PJ.14-W2-77 FCI Services.
  The Solution will allow the real-time sharing of trajectories, timely access to ATM data and information services and the support to SWIM. The 'Communication Services' will support ATN-B1, ATN-B2 ATS services, and be expandable to support advanced ATM applications such as ATN-B3 ATS services. It will support AOC services and digital voice (VoIP) services. The Communication Services will be delivered using ATN/IPS and will allow interoperability with ATN/OSI protocols.
- Solution PJ.14-W2-107 Future Satellite Communications Data link.
  The solution addresses the development of the future satellite data link technologies Iris Long term Class A SatCom for both the continental and remote/oceanic regions needed for supporting the future concepts beyond 2020.

- Solution PJ.14-W2-60 FCI Terrestrial Data Link and A-PNT enabler (L-DACS).
  The solution constitutes the future terrestrial A/G and A/A data link solution, which is one of the 'ICAO technologies', and supports the increasing ATM performance requirements (due to the growth of air traffic and its complexity). L-DACS constitutes a potential component of the A-PNT to support positioning and navigation requirements in PBN/RNP operations in case of a GNSS degradation or outage.
- Solution PJ.14-W2-81 Long-term alternative Position, Navigation and Timing (A-PNT).
  The solution aims at developing A-PNT systems capable to provide better performances in comparison to the short-term solution (based on DME-DME) and support PBN/RNP operations in case of a GNSS degradation or outage. Long term A-PNT airborne solution is expected to support: RNP 1 for the Standard Instrument Departure Route (SID) or Standard Terminal Arrival Route (STAR) developed upon RNP 1 navigation specification, the airways defined with RNP 0.3 or RNP 1 constraints, and preferably RNP-APCH operations down to LNAV/VNAV minima supposing appropriate ground infrastructure. The solution also address the standalone mid-term aircraft technological enhancement (researched in Wave 1) that supports RNP-based Operations in the TMA e.g. RNP1 SIDs and STARs (mid-term A-PNT).
- Solution PJ.14-W2-79 Dual Frequency / Multi Constellation DFMC GNSS/SBAS and GBAS.
  The solution addresses the progress in development of GBAS approach service type F (GAST-F) and its degraded modes, which is the final goal to achieve the target ambition of SESAR. The solution also addresses DFMC GNSS/SBAS/GBAS receivers architectural consideration and the completion of wave 1 activities related to ABAS / SBAS DFMC GNSS developments for multi-constellation GNSS receivers and GBAS approach service type D (GAST-D) (e.g. extended scope including: Expanded Service Volume (ESV), extreme latitudes, complex airports).
- Solution PJ.14-W2-61 Hyper Connected ATM.
  The solution aims at identifying and specifying the high level operational requirements for a fast and exponentially capable broadband air/ground and air/air datalink for supporting future ATM and U-space operations, air/ground data exchanges, etc.
- Solution PJ.14-W2-110 Aircraft as an AIM/MET sensor and consumer.
  The SESAR solution addresses the application of information made available by the aircraft such as Aircraft Meteorological DAta Relay (AMDAR) or any other avionics source (information derived from ADS-C application can be used), and future evolutions, or CNS status information, in Air Traffic Management, and the representation and the improved usage of MET and AIM information to airspace users in order to enhance their situational awareness and to improve strategic trajectory management and collaborative decision making.
- Solution PJ.14-W2-83 Surveillance Performance Monitoring.
  The solution aims at enabling an improved performance monitoring of surveillance systems e.g. 'quasi real-time' functionality and ensuring the correct functioning of the ATM surveillance function. This applies both at the individual sensor level and at ATC end-to-end level (input to the controller working position) e.g. spotting degradation trends early in the process. The solution shall consider both current and emergent surveillance techniques: WAM, ground-based and space-based ADS-B, independent non-cooperative surveillance sensors (INCS, including MSPSR), MLAT, SMR, etc.
- Solution PJ.14-W2-84 New use and evolution of Cooperative and Non-Cooperative Surveillance.
  The solution covers major improvements of cooperative and non-cooperative surveillance systems in areas such as composite surveillance, multi-sensor data fusion, new non-

cooperative surveillance systems, secured surveillance systems and future ADS-B communications link.

Topic PJ.17 W2 'SWIM infrastructure'

Problem statement and R&D needs

System Wide Information Management (SWIM) Technical Infrastructure (TI) Air-Ground (A/G) Solutions are required for supporting Information Exchange Services and SWIM-enabled Applications for the future ATM System. Further work is required to mature and validate SWIM A/G solutions (SWIM Technical Infrastructure purple profile) for safety critical services, and SWIM solutions supporting civil-military interoperability.

Performance expectations

While the technological solutions developed under this topic do not have direct impact on operational key performance areas, they are in the critical path to deliver the ATM Master Plan performance ambition in areas as efficiency, capacity, safety and security. Cost-efficiency of operating air/ground communication systems is expected to be greatly improved.

Candidate SESAR Solutions space:

The project 'SWIM infrastructure' covers the following candidate SESAR Solutions:

- Solution PJ.17-W2-100 SWIM TI Purple Profile for Air/Ground Safety-Critical Information Sharing.
  The solution allows the distribution of safety-critical information through A/G SWIM infrastructure and aeronautical telecommunications network/Internet protocol suite (ATN/IPS) networking, rather than legacy point-to-point contracted services. Technical specifications will have to be defined to support safety and security requirements allowing exchange of safety critical information.
- Solution PJ.17-W2-101 SWIM TI Green profile for G/G Civil Military Information Sharing.
  The solution aims at enabling Ground/Ground civil – military SWIM based coordination at SWIM technical infrastructure level through SWIM profiles with an adequate quality of service, including (cyber) security/ resilience, needed by military stakeholders and agreed by civil stakeholders.

WORK AREA II. VERY LARGE SCALE DEMONSTRATIONS

The role of Very Large Scale Demonstrations (VLDs) is to bridge the research & innovation with deployment, and not to replace either type of activity. VLDs use early versions of end-user systems and include the integration of new technology elements into existing systems when needed and possible.

As Very Large Scale Demonstrations are designed to help bridge the gap between development and deployment phases, they are at the boundary in terms of maturity transition from the Industrial Research & Validation and the industrialisation and subsequent deployment and will mostly derive from work matured through earlier phase of Industrial Research & Validation.

Some of the proposed VLDs may require the contribution from Airspace Users (AUs) who are not members of the SESAR JU. Unlike in the Wave 1 IR-VLD call for proposals, it is expected that the SESAR JU members will subcontract the required AU contribution for the VLDs described in this section.

The following sections describe, per Topic, the areas that might be covered by the call for proposals.

Topic VLD.01 W2 'GBAS/SBAS precision approaches including variable approach paths'

Problem statement and R&D needs

GBAS based procedures can help mitigating the negative effects of weather and especially low visibility conditions as key contributors to airport and network delays.

GBAS helps as well overcoming the limitations inherent to ILS operations, in particular the need to protect the ILS critical and sensitive areas, which results in restricted ground movements and extra spacing margins between aircraft in order to accommodate the longer runway occupancy times (ROT). Since GBAS has limited (GBAS Local Object Consideration Areas) or no protection areas, usually located outside aircraft movement areas, this allows for reducing the ROT in low visibility conditions, resulting in reduced spacing between arrival aircraft, although the amount of runway throughput that can be gained depends on wake turbulence separation and any other additional spacing needs due to the airport layout. GBAS supports CNS infrastructure rationalisation since, whilst ILS operations require one ground station per runway, one GBAS ground station only can be used for multiple runways operations.

Performance expectations

This demonstration is expected to show benefits in the following areas:

- Airport and Airspace TMA Capacity - Increase runway and airspace throughput and resilience;
- Predictability - Increasing predictability and airport efficiency (e.g. of the landing rate, of Runway Occupancy Time, runway exit and departure rotation);
- Environmental Sustainability - Reducing fuel consumption and noise near the airports.

Candidate SESAR Solutions space:

The VLD aims at demonstrating a number of GBAS/SBAS-enabled advanced approach procedures developed and validated in wave 1 using: dual thresholds (DT), second runway aiming point (SRAP), increased glide slope (IGS), adaptive increased glide slope (A-IGS) and increased glide slope to a second runway aiming point (IGS-to-SRAP). The scope may include the demonstration of similar concepts (when possible) based on RNAV (Baro LNAV/VNAV) rather than GBAS/SBAS. The VLD shall consider different airport layouts, setting-up various airport platforms at the level of pre-operational or operational status to support the Proof of Concept. This topic may include activities aiming at completing TRL-6 maturity for the following aspects: the extended scope (beyond the outcome of SESAR 1) of GBAS GAST-D under candidate solution 79 'Dual Frequency / Multi Constellation DFMC GNSS/SBAS and GBAS' and the mid-term alternative Position, Navigation and Timing (A-PNT) under candidate solution 81.

Topic VLD.02 W2 'Airport Surface Management, Airport Safety Nets and ATSAW'

Problem statement and R&D needs

The importance of moving aircraft on the airport surface from stand to runway and vice versa in a safe, controlled and organised manner is paramount for airports and even more when capacity restrictions resulting from weather or other circumstances affect operations.

Performance expectations

Improve airport safety levels and efficiency in the platform management operations.

Candidate SESAR Solutions space:

The VLD aims at demonstrating candidate SESAR Solutions that improve airport surface management and safety at the airport. In particular it may cover the following candidate SESAR Solutions:

- 'Traffic alerts for pilots for airport operations' aims at warning pilots in case a traffic conflict is detected on airport surface. The solution is applicable to both mainline and business aircraft and the demonstration shall cover exercises for both. Note that the performance and quality reception of broadcast aircraft data (ADS-B) is a key enabler for the solution;
- 'Guidance assistance through airfield ground lighting' is a ground-based service, intended for controllers, flight crews and vehicle drivers, and supported by the Advanced Surface Management Guidance and Control Systems (A-SMGCS) Guidance function;
- 'CAVS' consists of a concept for delegation of separation from ATC to the flight crew on final approach (CDTI-assisted visual separation (CAVS)). The concept is based on the flight crew using the CAVS application on the CDTI, which requires ADS-B-in information;
- 'On-board Braking Action Computation System' (OBACS) considers the aircraft as a measuring device, a 'sensor in itself' and collects in real-time all relevant raw on-board data (engine settings, aircraft weight, aerodynamic braking, speed, deceleration, directional control etc.) to compute an on-board braking action. This on-board computed braking action is transmitted to the ground system to be considered and integrated in the RWYCC assessment algorithm.
- The topic may include activities aiming at progressing the maturity of candidate solution 61 'Hyper Connected ATM' given that it is expected that airport operations are the first scenario where hyper-connectivity will be deployed and the number of stakeholders participating in the demonstration activities represent a good opportunity to start capturing requirements for this solution.

Topic VLD.03 W2 'Improving runway throughput in one airport'

Problem statement and R&D needs

At capacity constrained airports traffic demand for runway operations exceeds the runway capacity. With the growth in air traffic there is an increasing number of airports that are becoming capacity constrained for significant periods of each day.

Performance expectations

- Safety: Maintain or increase runway, taxiway and apron safety levels, increase situational awareness. ATC Workload maintained or reduced;
- Airport and Airspace TMA Capacity - Increase runway and airspace throughput (e.g. reducing runway occupancy time, or landing and departure wake turbulence separation) and resilience;

Candidate SESAR Solutions space:

The VLD aims at demonstrating the following candidate SESAR Solutions that improve runway throughput while keeping safety levels:

- Arrival concept Static-Pairwise (S-PWS or PWS-A) provides a more precise definition of the minimum safe wake separation required for a pair of ICAO aircraft types through an optimisation of the ICAO wake turbulence separation classes;
- Wake Turbulence Separations (for Departures) based on Static Aircraft Characteristics aims at optimizing the ICAO wake turbulence separation classes by use of longitudinal wake turbulence static pair-wise separation (S-PWS) minima on departures for the initial common departure path from the runway, applicable in all operating conditions;
- Weather-dependent reductions of separation may also be demonstrated;
- Optimised Runway Delivery (ORD) for arrival and departures that have been also developed in the solution shall be used. These tools make use of Target Distance Indicators (TDIs) to enable consistent and efficient delivery of the required separation or spacing between arrival pairs on final approach up to the runway landing threshold;
- Wake decay enhancing concepts a technical design of the so-called plate lines shall be elaborated that is compatible with airport structural requirements (e.g. stability, frangibility) and approval of authorities for the installation of the plate line shall be obtained;
- Reduction of radar separation to 2NM for in-trail pairs on final approach Solution #02-03 (researched in Wave 1) refers to the concept of Minimum Pair Separation Based on Required Surveillance Performance (RSP) in support of a reduction of the in-trail Minimum Radar Separation from 2.5 NM to 2 NM on final approach at Large and Medium Airports and TMA High Complexity and TMA Medium Complexity sub-operational environments so as to provide a direct positive impact on runway throughput during periods of capacity constrained operations;
- Integrated AMAN-DMAN SESAR considers a number of concepts that aim at optimizing runway operations by providing dynamic assistance to controllers and supervisors in TWR and TMA. Their objectives are to increase runway throughput through the optimisation of arrival/departure spacing. The improvements include the use of a Runway Manager (RMAN) to optimise the planning of the runway use, and the sequence-based coupling of AMAN and DMAN including a sequence update a few minutes before touchdown and the use of TDIs between arrivals to support ATCOs to create the right gap between arrivals. This VLD will demonstrate the application of these concepts in order to optimise the use of the runway capacity for single or multiple runway airports;
- The VLD may include activities to complete the TRL-6 maturity for candidate solutions 83 ‘Surveillance Performance Monitoring’ and 84 ‘New use and evolution of Cooperative and Non-Cooperative Surveillance’.

Topic VLD.04 W2 'Advanced Rotorcraft and Business Aviation (BA) Operations'

Problem statement and R&D needs

IFR Rotorcraft operations are constrained to use same approach/departure procedures as fixed wing aircraft and due to their lower speed profiles, runway throughput is very often negatively impacted at busy airports. Low visibility conditions impact negatively flight crews as well, with reducing their situational awareness in the aerodrome overall picture overall picture. A unique advantage of the solution is that it is mainly supported by the aircraft system instead of airport systems and there is no need of complex and costly ground infrastructures.

Performance expectations

Access and equity to airport thanks to dedicated procedure and system enabling rotorcraft and business aviation to perform approach and departure procedures in low visibility conditions.

Candidate SESAR Solutions space:

Solutions #01-06 and #02-05 addressed in Wave 1 enhanced Rotorcraft operations in the TMA. The VLD shall cover the following aspects:

- GNSS- based (e.g. APV SBAS/Baro) approach/departure procedures with vertical guidance procedures at busy airports by using Rotorcraft specific independent IFR procedures to/from FATO (Final Approach & Take- Off area) located at airports in order to remove IFR rotorcraft from active runways and allow fixed wing aircraft and rotorcraft to perform simultaneous non-interfering (SNI) operations. These rotorcraft-specific independent IFR operations will be enabled by Point-in-Space (PinS) procedures to allow approach to/departure from a VFR FATO. When reaching the PinS, the pilot shall decide either to proceed to a landing or to abort the approach. The PinS is also the MAPT (Missed Approach Point). Dedicated IFR SNI concepts can provide an alternative IFR capability to small airports where the installation of traditional navigation aids is not financially viable or unfeasible due to other specific constraints.
- Advanced (e.g. curved) SBAS/GBAS guided PinS RNP approaches towards landing locations and PinS departures from landing locations are created with connections to/from Low Level IFR route network. The curved segment of the advanced PinS can be placed in the initial, intermediate or missed approach segment. The procedures can contribute to a reduced noise footprint and improved access to VFR FATOs. There is also a contribution to safety (fewer VFR approaches in marginal VMC, IFR approaches with vertical guidance). Use of a Head-Mounted Display (HMD) facilitates both the execution of curves in approach segments and departure procedures, and the transition from instrument flying and navigating via external visual cues. In this case, a three-dimensional path that the pilot has to follow (or to be more precise, a corridor in which the pilot has to stay) is displayed in the HMD; such a three-dimensional path has to give both lateral and vertical guidance. The HMD provides, with 'eyes-out' of the cockpit, the information that can be used to facilitate safe flying along the PinS procedure (take-off and approach), facilitating the transition from IFR instrument phase to visual phase (for 'proceed visually' PinS) or from IFR to VFR (for 'proceed VFR' PinS) and vice-versa, and reduces pilot workload;
- 'Enhanced visual operations' consists of taking credit of emerging visual based technologies such as EFVS and SVS combined through CVS and displayed in coloured HMD in order to

increase the operational efficiency in both taxi and landing while significantly improving situational awareness.

Topic VLD.05 W2 'Virtual Centre'

Problem statement and R&D needs

In today's situation Air Navigation Service Providers (ANSPs) usually host a monolithic ATM system in each Air Traffic System Unit (ATSU) with very few information services and infrastructure elements being shared between the different centres. In the Virtual Centre approach, the Controller Working Positions are decoupled and may even be geographically separated from the ATM information services that they consume, and these ATM information services may be shared between different ATSUs or even between ANSPs. The main benefits expected from the Virtual Centre approach are cost reduction and more flexibility to support load-balancing between the participating ATSUs or manage contingency situations. The development of technical services and common interfaces resulting from new technologies, working methods, Service Oriented Architectures (SOA) and procedures would also need to address human factors considerations. The proliferation of proprietary systems with proprietary interfaces shall be avoided as well as the use of non-user friendly interfaces.

Performance expectations

The demonstration shall provide evidences on the technical feasibility of the solution and benefits in terms of cost-efficiency.

Candidate SESAR Solutions space:

This VLD aims at demonstrating solution #16-03, which is expected to reach TRL6 in Wave 1. The solution allows an innovative Virtual Centre architecture between a Virtual Centre ATSU and ATM Data Service Provider (ADSP). The demonstration shall provide added value with respect to the technical validation performed by 16-03 e.g. increased number of validated services for the SOA architecture including cross validation of the services

The technical use cases may include demonstration validation of the required quality of service is met, in particular for the transfer of data between geographically separated locations, remote installation of HMI, remote supervision, transversal technical features as recording. Although demonstrations are normally aiming at live trials, in this case it is acceptable to achieve the objectives through other techniques such as shadow mode. In any case, connection to real data is expected.

2.6.1.2.5 Budget-to-Scope allocation

The SESAR 2020 Programme is performance-driven. Therefore, the SESAR JU established the allocation of budget per topic by considering the contribution of each topic and the related candidate SESAR Solutions to key performance areas set in the European ATM Master Plan (see Section II, Chapter 1.3), especially: contribution to Capacity improvements (at Airports, in TMA and En-route), environmental and cost-efficiency, predictability and punctuality. This approach aims to ensure the best value-for-money for Wave 2. Hence, under this call for proposals, the allocation per topic is as follows:

Wave 2 View Planned							
Work Areas	**Key Feature**	**Name of topic (Wave 2)**		**Indicative budget distributed across Topics**	**Indicative breakdown across Stakeholder groups**		
					AIRBORNE SYSTEMS CONTRIBUTION	**GROUND ATM SYSTEMS CONTRIBUTION**	**SERVICE PROVISION CONTRIBUTION**
Transversal		PJ.19 W2	Content Integration	**€ 5.366.033**	€ 880.000	€ 1.243.118	€ 3.242.915
		PJ.20 W2	Master Plan Maintenance	**€ 2.013.519**	€ 480.000	€ 621.697	€ 911.822
	TOTAL SESAR 2020 TRANSVERSAL WAVE 2			**€ 7.379.552**	**€ 1.360.000**	**€ 1.864.815**	**€ 4.154.737**
Industrial Research and Validation	High-Performing Airport Operations	PJ.02 W2	Airport Airside & Runway Throughput	**€ 17.369.077**	€ 4.816.687	€ 5.883.131	€ 6.669.259
		PJ.04 W2	Total Airport Management	**€ 7.881.644**	€ 0	€ 4.077.696	€ 3.803.948
		PJ.05 W2	Digital Technology for Tower	**€ 10.021.206**	€ 0	€ 7.019.262	€ 3.001.944
	Optimised ATM Network Services	PJ.07 W2	Optimised Airspace users Operations	**€ 4.674.164**	€ 2.126.426	€ 1.287.989	€ 1.259.749
		PJ.09 W2	Digital Network Management Services	**€ 8.376.490**	€ 0	€ 2.930.317	€ 5.446.173
	Advanced Air Traffic Services	PJ.01 W2	Enhanced Arrivals & Departures	**€ 8.928.771**	€ 2.651.996	€ 3.250.908	€ 3.025.867
		PJ.10 W2	Separation Management En-Route & TMA	**€ 18.440.502**	€ 200.000	€ 10.545.765	€ 7.694.737
		PJ.13 W2	IFR RPAS	**€ 10.958.708**	€ 4.252.852	€ 4.544.522	€ 2.161.334
		PJ.18 W2	4D Skyways	**€ 15.971.495**	€ 4.173.205	€ 5.315.066	€ 6.483.224
	Enabling Aviation Infrastructure	PJ.14 W2	Integrated BNSS	**€ 16.270.038**	€ 5.581.869	€ 8.650.340	€ 2.037.829
		PJ.17 W2	SWIM Infrastructure	**€ 4.710.328**	€ 1.329.016	€ 2.739.087	€ 642.225
	TOTAL SESAR 2020 IR PROJECTS WAVE 2			**€ 123.602.423**	**€ 25.132.051**	**€ 56.244.083**	**€ 42.226.289**
	TOTAL SESAR 2020 TRANSVERSAL & IR PROJECTS WAVE 2 (MAXIMUM)			**€ 130.981.975**	**€ 26.492.051**	**€ 58.108.898**	**€ 46.381.026**
					20,2%	*44,4%*	*35,4%*
VLD	**TOTAL SESAR 2020 VLD Wave 2 (MAXIMUM)**			**€ 20.500.000**			
	TOTAL SESAR 2020 PPP (Transversal, IR and VLD) for Wave 2 (MAXIMUM)			***€ 151 481.975***			

Table 28: Budget-to-scope allocation for the IR-VLD Wave 2 call for proposals (H2020-SESAR-2019-1)

The table above establishes the indicative budget per Topic for this call. For both the VLD Wave 2 and the total SESAR 2020 PPP budget, there is no flexibility beyond the maximum figure stated, as these figures are determined by the maximum funding and distribution contained in the SESAR JU Founding Regulation.

The indicative budget distribution per Topic is subject to the budget flexibility conditions referenced in the general conditions of the call (Para 2.6.1.1.5). In the reference document, budget flexibility in

the call budget per topic is limited to a maximum of 20%.Regarding the VLDs, the EUR 20,5 million EUR envelope for co-financing is not further broken down per Key Feature. However, a maximum co-financing value of EUR 8 million per proposal will be allowed to ensure the possibility to award multiple VLDs and avoid getting a single VLD proposal asking for a substantial part or total of the EUR 20,5 million budget.

During the evaluation process, and taking into account the award criteria (see below in Paragraph 2.6.1.2.13), the SESAR JU will assess the best value-for-money of proposals submitted by the Members.

2.6.1.2.6 Expected results

The results from the IR-VLD Wave 2 will provide the basis to set up a changed ecosystem for aviation and more specifically modernising the underlying air traffic management infrastructure.

This ecosystem will be mainly built upon ATM solutions characterised by:

- Higher levels of autonomy and connectivity of all air vehicles coupled with a more automated management of the traffic;
- Digital and automated tools provided on board of the air vehicle itself or as part of the ground-based infrastructure
- Virtual technologies to decouple the physical infrastructure such as sensors, communication or navigation devices from the services that are provided to manage the airspace;
- Big data analytics and open source data usage to encourage the creation of new services;
- System modularity to allow scalable and easier upgrades and greater interoperability.

2.6.1.2.7 Duration and key milestones

The awarded projects should be starting preparing and executing the validation and demonstration activities by end of 2019 and shall deliver full result no later than end of December 2022.

2.6.1.2.8 Funding rate, number of contracts and location

Types of action: specific provisions and funding rates

a. Research and Innovation Actions (RIAs): in accordance with preamble (24) and Article 28 (3) of the H2020 Rules for Participation, eligible costs of Research and Innovation (RIAs) will be reimbursed according to a single reimbursement rate of 70%.
    - This single co-financing rate will also apply to non-profit entities.
b. Innovation Actions (IAs): in accordance with preamble (24) and Article 28 (3) of the H2020 Rules for Participation, eligible costs of Innovation (IAs) will be reimbursed according to a single reimbursement rate of 70%.
    - This single co-financing rate will also apply to non-profit entities.
c. Coordination and Support Actions (CSAs): in accordance with preamble (24) and Article 28 (3) of the H2020 Rules for Participation, eligible costs of Coordination and Support Actions (CSAs) will be reimbursed according to a single reimbursement rate of 70%.
    - This single co-financing rate will also apply to non-profit entities.

The expected number of projects that will be funded through this call for proposals is 18.

Eligibility conditions for participation are set out in the Rules of Participation and to the provisions of H2020 Work Programme 2018-2020 Part 19. General Annexes section C. 'Standard admissibility conditions, page limits and supporting documents'.

A) For CSAs - at least one applicant established in a Member State or associated

Country shall participate in the activity;

B) For RIAs and IAs - at least three applicants shall participate in the activity. Each of the three shall be established in a different Member State or associated country. All three legal entities shall be independent of each other.

The list of associated country can be found in General Annexes section A of Horizon 2020 Work Programme 2018-2020.

2.6.1.2.9 Grant conditions

General conditions for the eligibility of costs are set in accordance with Article 26 of the H2020 Rules for Participation and Article 6 of the Model Grant Agreement.

The costs for avionics update are not eligible under this call for proposals.

2.6.1.2.10 Complementary grants

Complementarity between particular topics will be specified within their scope, in the topics description. The SESAR JU shall receive in particular access rights for:

1. technical specifications (documents approved by the SESAR JU upon recommendation of the Programme Committee which provides the necessary details about a specific operational and technical requirement for repeated or continuous application, with which compliance is not compulsory),
2. validation reports (i.e. deliverables which contributes to the validation of operational threads ensuring overall consistency with the Programme) as well as on
3. standards and norms proposals: i.e. documents which define, amongst other, uniform technical and/or operational Specifications for engineering or technical criteria, configurations, materials, equipment, methods, procedures and practices, and aim ultimately at ensuring interoperability of air traffic management systems in Europe and at enhancing Air Traffic Management capabilities in Europe, such as safety, capacity, security, environment, which may become compulsory upon approval and adoption of the duly empowered authority.

The SESAR JU Members and beneficiaries of grants awarded by the SESAR JU shall give each other access on a royalty free basis the declared background and results needed to implement their own tasks under an SESAR JU Action for the full duration of the SESAR Project. The SESAR JU shall also anticipate and allow for coordination with the Deployment phase activities taking into account the role of the Deployment Manager. The required elements of this arrangement will be explicitly included within the appropriate Grant Agreement.

2.6.1.2.11 Evaluation rules

The SESAR JU will make use of internal experts for the evaluation of proposals received in response to this call for proposals, as described in Paragraph 2.6.1 above.

2.6.1.2.12 Eligibility criteria

As a result of Administrative Board decisions ref. ADB(D)13-2014 dated 04/11/2014 and ADB(D)02-2016 dated 17 February 2016, the SESAR JU Members only are eligible under this call for proposals. The list of SESAR JU Members appears in Annex XI.

2.6.1.2.13 Award criteria

Transversal Activities

Type of Actions	**Excellence** *The following aspects will be taken into account in order to assess the extent to which the proposed work corresponds to the topic description*	**Impact** *The following aspects will be taken into account in order to assess the extent to which the outputs of the project should impact at European and/or International level*	**Implementation** *The following aspects will be taken into account in order to assess the quality and efficiency of the implementation*
Coordination and Support Actions (CSAs)	1. Clarity and pertinence of the proposal: degree to which the objectives, scope and requirements defined in the Technical Specifications are well understood and fully addressed. 2. Feasibility and adequacy of the proposed methodology: degree to which the proposed methodology is feasible and adequate to address the required coordination and support action. 3. Quality of the proposed coordination and support actions: degree to which the proposal demonstrates knowledge of previous coordination and support action work and explains how their action will address previous results and possible shortcomings.	1. Impact on SESAR Programme : clear description on how the described activities are appropriate to achieve the expected impact in terms of coordination and support 2. Quality of the proposed measures to: - Exploit and disseminate the project results (including management of IPR), and to manage research data where relevant. - Communicate the project activities to different target audiences	1. Quality and effectiveness of the Project Management Plan : degree to which the proposed plan is adequate considering its integration within the overall Programme lifecycle (Compliance with SESAR 2020 PMP and Programme Execution Guidance is required) including extent to which the resources assigned to work packages are in line with their objectives and deliverables. 2. Appropriateness of the management structure and procedures: degree to which the proposed management structure are appropriate, including complementarity of the participants within the Project. 3. Appropriateness of the technical expertise: degree to which the technical expertise is appropriate for undertaking the proposed tasks (including quality of the CV of the proposed Grant Coordinator and Transversal Activity Coordinators) and for ensuring that all participants have a valid role and adequate resources in the project to fulfil that role.

Industrial Research & Validation Activities

Type of Actions	**Excellence** *The following aspects will be taken into account in order to assess the extent to which the proposed work corresponds to the topic description*	**Impact** *The following aspects will be taken into account in order to assess the extent to which the outputs of the project should impact at European and/or International level*	**Implementation** *The following aspects will be taken into account in order to assess the quality and efficiency of the implementation*
Research Innovation Actions (RIAs)	1. Clarity and pertinence of the proposal: degree to which the objectives, scope and requirements defined in the Technical Specifications are well understood and fully addressed. 2. Feasibility and adequacy of the proposed methodology: degree to which the proposed methodology is feasible and adequate to mature the candidate SESAR solutions from their initial to their target maturity level. 3. Level of awareness of the state-of-the-art: degree to which the proposal demonstrates knowledge of current operations and relevant previous R&D work (both in and outside of SESAR) and explains how their proposed work is beyond the state of the art, and demonstrates innovation potential.	1. Impact on performance: degree to which the proposal demonstrates that the research will contribute to achieve the performance benefits outlined in the European ATM Master, according to the justification principles. 2. Appropriateness of the contribution to standardisation and regulation: the proposal demonstrates that the project will adequately contribute to the relevant standardisation and regulatory activities (when relevant). 3. Quality of the proposed measures to: - Exploit and disseminate the project results (including management of IPR), and to manage research data where relevant. - Communicate the project activities to different target audiences	1. Quality and effectiveness of the Project Management Plan: degree to which the proposed plan is adequate considering its integration within the overall Programme lifecycle (Compliance with SESAR 2020 PMP and Programme Execution Guidance is required) including extent to which the resources assigned to work packages are in line with their objectives and deliverables. 2. Appropriateness of the management structure and procedures: degree to which the proposed management structure are appropriate, including complementarity of the participants within the Project. 3. Appropriateness of the technical expertise: degree to which the technical expertise is appropriate for undertaking the proposed tasks (including quality of the CV of the proposed project manager and solution managers) and for ensuring that all participants have a valid role and adequate resources in the project to fulfil that role.

Very Large Scale Demonstration activities

Type of Actions	**Excellence** *The following aspects will be taken into account in order to assess the extent to which the proposed work corresponds to the topic description*	**Impact** *The following aspects will be taken into account in order to assess the extent to which the outputs of the project should impact at European and/or International level*	**Implementation** *The following aspects will be taken into account in order to assess the quality and efficiency of the implementation*
Innovation Actions (IAs)	1. Clarity and pertinence of the proposal: degree to which the objectives, scope and requirements defined in the Technical Specifications are well understood and fully addressed. 2. Feasibility and adequacy of the proposed methodology: degree to which the proposed methodology is feasible and adequate to undertake the action. 3. Level of awareness of the state-of-the-art: degree to which the proposal demonstrates knowledge of current operations and relevant previous R&D work (both in and outside of SESAR) and explains how their proposed work is beyond the state of the art, and demonstrates innovation potential	1. Impact on performance: degree to which the proposal is appropriate for bridging from R&I (i.e. identified Solutions) to deployment in generating buy-in and contributing to achieve the performance benefits outlined in the European ATM Master 2. Appropriateness of the contribution to standardisation and regulation: the proposal demonstrates that the project will adequately contribute to the relevant standardisation and regulatory activities (when relevant). 3. Quality of the proposed measures to: - Exploit and disseminate the project results (including management of IPR), and to manage research data where relevant. - Communicate the project activities to different target audiences	1. Quality and effectiveness of the Project Management Plan: degree to which the proposed plan is adequate considering its integration within the overall Programme lifecycle (Compliance with SESAR 2020 PMP and Programme Execution Guidance is required) including extent to which the resources assigned to work packages are in line with their objectives and deliverables. 2. Appropriateness of the management structure and procedures: degree to which the proposed management structure are appropriate, including complementarity of the participants within the Project. 3. Appropriateness of the technical expertise: degree to which the technical expertise is appropriate for undertaking the proposed tasks (including quality of the CV of the proposed project manager) and for ensuring that all participants have a valid role and adequate resources in the project to fulfil that role. 4. Adequacy of the budget : Consistency between the proposed activities, the expected results and the estimated budget

Table 29: Award criteria for the IR-VLD Wave 2 call for proposals with reference H2020-SESAR-2019-1

The scoring scheme used in evaluation for each criterion will be on a scale ranging from 0-5 with decimal points being valid. Pass thresholds per criterion and overall are established in the table below:

	Excellence	Impact	Implementation
Weight (%)	40	30	30
Threshold per criteria (n/5)	3	3	3
Overall Pass Threshold (%)	70		

Table 30: Scoring scheme and thresholds for the IR-VLD Wave 2 call for proposals with reference H2020-SESAR-2019-1

2.6.1.3 Specific conditions for the ER4 call for proposals (with reference H2020-SESAR-2019-2)

The objective of the SESAR 2020 Exploratory Research Programme is to address, where possible, the known yet unsolved problems across the ATM Research domain, taking on board these new or continuous challenges using traditional methods or new techniques, or transferring the results of past research and applying it to new applications and/or novel technologies in search of innovative and ground breaking results.

In preparation for the ER4 call for proposals, the SESAR JU used its Scientific Committee to help identify high-potential topics as well as existing research applications into ATM. In 2019, the SESAR JU will launch the fourth calls for proposals on Exploratory Research (also referred to as 'ER4') with reference H2020-SESAR-2019-2, fully funded under Horizon 2020 for an amount of EUR 38,6 million, to enable continued work on conducting and consolidating innovate activities striving to achieve tangible results under the scope of:

- ATM Excellent Science & Outreach aims at bridging ATM research with the wider research community and will provide the necessary scientific support to ATM change either directly or through connection research areas in other disciplines or sectors,
- ATM application-oriented research will help mature new concepts for ATM beyond those identified in the European ATM Master Plan as well as help mature emerging technologies and methods to the level of maturity required to feed the applied research conducted in the SESAR JU.

The research activities under ATM Operations, Architecture, Performance & Validation will directly contribute to the SESAR 2020 transversal activities of ATM Design & Integration Performance Management, Validation, Verification & Demo infrastructure and European ATM Master Plan maintenance.

The final content of the call for proposals will be detailed in the call specifications.

2.6.1.3.1 Call identifier

This open call for proposals has the reference H2020-SESAR-2019-2.

2.6.1.3.2 Indicative call timetable

Publication date	End April 2019
Opening date	End April 2019
Final date for submission	End August 2019
Information on the outcome of the evaluation	Maximum 5 months from the final date for submission
Signing of grant agreements	By end Q1 2020

Table 31: Indicative timetable for the ER4 call with reference H2020-SESAR-2019-2

2.6.1.3.3 Indicative call budget

The indicative budget for this call for proposals is EUR 38.564.361.

Budget	Commitment	Payment
	In 2019: EUR 38.564.361	In 2019: EUR 875.000 In 2020: EUR 10.000.000 In 2021: EUR 17.400.000 In 2022: EUR 10.289.361

Table 32: Indicative budget for the ER4 call for proposals with reference H2020- SESAR-2019-2

2.6.1.3.4 Activities covered by this call for proposals

The ER4 call for proposals covers topics related to two Work Areas:

- Work Area 1 - ATM Excellent Science & Outreach,
- Work Area 2 - ATM Application-Oriented Research.

Research activities across these two Work Areas are described in the paragraphs below.

WORK AREA 1 - ATM EXCELLENT SCIENCE & OUTREACH

ATM Excellent Science & Outreach aims at bridging ATM research with the wider research community and will provide the science necessary to support ATM change. The work will be performed not only within an existing ATM community but also through outreach to related research activities in other sectors and industries with the objective to look for potential applications into ATM.

The research performed under ATM Excellent Science & Outreach is typically curiosity-driven and explores new and innovative research areas for ATM. This type of scientific research not only brings new knowledge, but also encourages young scientists to develop innovative ideas, concepts and theories for the future ATM evolution. This will bring mutual benefits to SESAR research activities and to the section 11 (Smart, green and integrated transport) of the Horizon 2020 Work Programme 2018-2020. Consequently, the purpose of this research area is to investigate through research and innovation actions which new technologies, methodologies, concepts, or validation methods developed in non-ATM sector could be introduced in the context of ATM and in particular serve the identified SESAR business needs and Flightpath 2050 vision, or identify new ATM business opportunities.

Sub Work Area 1.1 – Automation & Autonomy

Automation could provide the key to significant performance improvements across many aspects of ATM. On the other hand, human cognitive abilities, especially in safety-critical situations, can have positive benefits and provide strong arguments against full autonomy in certain situations. The challenge is therefore to propose solutions with automation levels or autonomy that have the capability to provide substantial and verifiable performance benefits whilst fully addressing safety concerns.

Therefore, research activities under this theme should also address the application of new approaches to allow automation to cope also with non-nominal and unexpected situations and should explore new concepts for supporting the human operator under all conditions.

Under this sub work area, there is substantial scope for learning from aircraft automation, other industries and research sectors.

Sub Work Area 1.2 – Complexity, Data Science & Information Management

The research activities under this theme will address complexity science, data science and information management and their potential for applications in ATM. Complexity science will deal with the application of complexity theory in the ATM domain and will therefore contribute to a better understanding of how the ATM system works, in particular the interaction of its subsystems, capabilities and components.

Data science is an emerging field of research in ATM concerned with managing and exploiting large data sets through mining, big-data techniques, novel algorithms or artificial intelligence and their application to air traffic management. This will enable further exploitation of information management, knowledge creation and improved insight into optimizing planning and execution of ATM.

Effective application of information management into ATM must also address the need for Safety and Security, in particular cyber-security. Research activities in this theme are expected to address this need in some way but proposals can also be made on the application of state of the art trust frameworks into ATM, such as blockchain.

Sub Work Area 1.3 – Environment & Meteorology for ATM

The research activities will aim at better understanding the impact of aviation on the environment and the ways in which ATM can reduce these effects. Research activities should take into account CO2 but also other aspects like for example NOx, contrails, air quality (NOx, particle matter) and noise. Research activities may address research aimed at developing 4D trajectories that are optimised to take account of environmental considerations.

Further, research activates will study the vulnerability of the ATM system to local and global weather phenomena and how enhanced meteorological capabilities and their integration into ATM planning processes can be utilised for improving ATM efficiency and safety. This requires understanding of the potential of different types of weather-related information that could be used in ATM operations taking into account the inherent uncertainty of meteorological information.

Research activities will also investigate the impact of global and/or long-term phenomena such as changes in the frequency and severity of extreme weather resulting from climate change, or ash-cloud formation on ATM operations and ways to increase ATM robustness.

Sub Work Area 1.4 – Performance, Economics, Legal & Regulation

In recent years, the importance of understanding the evolution of the ATM service market structure, the need to minimize airborne costs, use of cost-effective new business and pricing models has become evident. The research performed under this area will contribute to the wider innovation and competitiveness of the European ATM industry, therefore contributing to Challenge 2 of Flightpath 2050.

The links between economics, the legal and the regulatory frameworks and the research performed in each subject are close; this means that the implications of change in one area have to be integrated across the whole, otherwise change in ATM can be unnecessarily blocked.

Sub Work Area 1.5 – ATM role in Intermodal Transport

The research activities under this theme will address the connection and dependence between ATM/aviation and other transport modes, from the perspective of ATM. Consequently, it is envisaged that complementary research will be performed linking to activities launched by the European Commission and potentially other transport areas (i.e. rail, road, water) to ensure interoperability and delivery of complementary services to realise cross-modal performance as described by the EU transport policy documents.

Sub Work Area 1.6 – CNS for ATM

As Communication, Navigation and Surveillance (CNS) are subjects not exclusive to ATM, activities proposed under this theme must show clear relevance for ATM.

Therefore the study and use, or adaptation, of new CNS technologies or techniques developed outside ATM must be able to meet both the operational needs as well as an appropriate analysis of the safety, performance and security implications for the ATM system.

WORK AREA 2 - ATM APPLICATION-ORIENTED RESEARCH

ATM application-oriented research will help mature new concepts for ATM that extend or go beyond those identified in the ATM Master Plan as well as help mature emerging technologies and methods to the level of maturity required to feed the applied research conducted in the Industrial Research and Validation phase of SESAR; thus connecting the ATM Exploratory Research to the ATM Applied Research in the context of the European ATM Master Plan.

In many cases, the research results from previous ATM Excellent Science & Outreach projects could be candidates for further research under Application-Oriented Research in order to increase the maturity and stakeholder buy-in to new ideas aligned to the European ATM Master Plan key features.

Sub Work Area 2.1 – High Performing Airport Operations

The research activities under this theme will include research of methods to increase the level of automation of airport processes, research of innovative concept for airport operations like the use of service drone and an enhanced coordination with other transportation modalities and research on improved use of meteorological information at the airport.

Sub Work Area 2.2 – Optimised ATM Network Management

The optimised ATM network management theme will include research activities in the areas of Digitalisation of the ATM Network (including network management operations and improved involvement of the Airline Operation Centre), innovations in network management (like innovative technics and models for uncertainty management and innovative route charging schemes) and fully dynamic airspace.

Sub Work Area 2.3 – Advanced Air Traffic Services

The research activities under advanced air traffic services will include research into the Automation of Air Traffic Services including advanced Human-Machine-Interactions for controllers and concepts for full automation in low density. They will further address innovation in Air Traffic Services like interfaces with orbital and very high level operations or concepts for formation flying, the long-term evolution of air/ground synchronisation, evolution of separation minima in En-route and TMA and the digital evolution of controller/pilot communication.

Sub Work Area 2.4 – Enabling Aviation Infrastructure

The research activities under enabling aviation Infrastructure will include research on concepts and methods for enhancing and securing CNS as well as approaches for integrated performance based CNS.

Furthermore, the infrastructure required to support digitalised ATM applications will itself need to evolve; in particular, the secure exchange of information in a deterministic time is an essential characteristic of the future infrastructure. An efficient security framework for data exchange is an essential component of the future digitalised ATM architecture. Methods to achieve this by exploiting best-practice techniques from other sectors is required.

Sub Work Area 2.5 – ATM Operations, Architecture, Performance & Validation

This research area will include research activities about performance and improved indicators and performance measuring methods for digitalisation, resilience, multi-model performance, environmental impact and cybersecurity. Further, it will include research activities to advance validation methods like E-OCVM and enhance approaches to detect emergent behaviour. Additionally, this research area will include topics addressing the digitalisation of the ATM Architecture and applying methods for enhancing cybersecurity of the ATM system.

The development of a scalable and secure target ATM Architecture is a necessary part of the vision towards 2035. Proposals that address a viable approach to achieving this ambition are encouraged.

The results from the research activities under this topic will directly contribute to the overall SESAR 2020 transversal activities of ATM design & integration, performance management, validation, verification & demonstration infrastructure and ATM Master Plan maintenance.

Sub Work Area 2.6 – IFR RPAS

This research area will address concept elements such as IFR multi-RPAS GCS, integration aspects further than those already covered in IFR RPAS topic in IR and reduced crew operations contingency management, in support of the full integration of IFR RPAS with manned aviation.

Sub Work Area 2.7 – U-space[47]

The activities to be performed under the sub work area ‘U-space’ need to take into consideration the outcomes of the on-going ER projects and lessons learnt from U-space demonstrations, which address U1 and U2 services. Automation principles originally developed for UAS traffic management in U-space may be a source of inspiration for application in Air Traffic Control. The concept elements that may be addressed include U3 services, U4 services, the interoperability of U-space service providers and U-

[47]In line with the Drones Outlook Study, the U-space blueprint document and the ATM Master Plan Roadmap for the safe integration of drones, this document uses the term ‘drones’ as a generic term to cover all types of unmanned aircraft systems (UAS), be they remotely piloted (RPAS - remotely piloted aircraft system) or automated. By exception, the term RPAS may be used when a specific aspect of such vehicles (the fact that it is operated by a pilot instead of being automated) is addressed.

space interface with ATM and manned aviation. The resulting projects will contribute to the mitigation of major risk with reference MP08 'The lack of R&D activities to cover U3/U4 developments beyond 2019 may endanger the realisation of MP objectives' (see annex VIII).

2.6.1.3.5 Expected results

ATM Excellent Science & Outreach aims at bridging ATM fundamental research with the research performed by the wider research community. It will provide for results that trigger innovation in ATM though either refinement of or disruption to the existing ATM norms.

ATM application-oriented research will help mature new high-potential ideas, technologies and concepts for ATM beyond those currently identified in the European ATM Master Plan as well as helping to mature emerging technologies and methods to the level of maturity required to feed the applied industrial research conducted in partnership with the Industrial member of the SESAR JU.

2.6.1.3.6 Duration and key milestones

The awarded projects will start preparing and executing their research activities between Q4 2019 and Q2 2020, and shall deliver their full results no later than end of Q4 2022 (maximum project duration of 30 months).

2.6.1.3.7 Budget-to-Scope allocation

The SESAR JU considers that proposals addressing topics in Work Area 1 can request a contribution from the EU between EUR 500.000 minimum and EUR 1.000.000 maximum and should end no later than Q4 2022 (including 6 months for dissemination activities after delivering final results). These conditions are intended to allow the specific challenges to be addressed appropriately and if additional EU contribution is requested this must be strongly justified in any proposal.

The SESAR JU considers that proposals addressing topics in Work Area 2 can request a contribution from the EU between EUR 1.000.000 minimum and EUR 2.000.000 maximum and should end no later than Q4 2022 (including 6 months for dissemination activities after delivering final results). These conditions are intended to allow the specific challenges to be addressed appropriately.

The overall budget for Work Area 1 is EUR 15.500.000. No specific share of the budget is assigned to individual Sub Work Areas of Work Area 1.

The overall budget for Work Area 2 is EUR 23.064.361. No specific share of the budget is assigned to individual Sub Work Areas of Work Area 2.

2.6.1.3.8 Funding rate, number of contracts and location

In accordance with standard H2020 conditions for each type of Action as set in provisions of H2020 Work Programme 2018-2020 Part 19. General Annexes section D. Types of action: specific provisions and funding rates.

Eligibility conditions for participation are set out in the Rules of Participation and to the provisions of H2020 Work Programme 2018-2020 Part 19. General Annexes section C. 'Standard admissibility conditions, page limits and supporting documents'.

A) For CSAs - at least one applicant established in a Member State or Associated Country shall participate in the activity;

B) For RIAs and IAs - at least three applicants shall participate in the activity. Each of the three shall be established in a different Member State or associated country. All three legal entities shall be independent of each other.

The list of associated country can be found in General Annexes section A of Horizon 2020 Work Programme 2018-2020.

2.6.1.3.9 Grant conditions

General conditions for the eligibility of costs are set in accordance with Article 26 of the H2020 Rules for Participation and Article of 6 of the Model Grant Agreement.

2.6.1.3.10 Complementary grants

Complementarity between particular topics may be specified within their scope, in the topics description although this will be limited to grants awarded under Work Areas I and II.

2.6.1.3.11 Eligibility criteria

For the ER4 call for proposals, this information is conform to the general conditions set in Paragraph 2.6.1.1 above.

2.6.1.3.12 Standard admissibility conditions, page limits and supporting documents

The admissibility conditions for this call are conform to the provisions of the H2020 Work Programme 2018-2020 Part 19. General Annexes section C. 'Standard admissibility conditions, page limits and supporting documents'. For this call, the page limit for the full proposal is set to 35 pages. This is clearly shown in the proposal templates in the Funding and Tenders Portal electronic submission system.

2.6.1.3.13 Award criteria

Type of Actions	**Excellence** The following aspects will be taken into account in order to assess the extent to which the proposed work corresponds to the topic description	**Impact** The following aspects will be taken into account in order to assess the extent to which the outputs of the project should impact at European and/or International level	**Implementation** The following aspects will be taken into account in order to assess the quality and efficiency of the implementation
Research Innovation Actions (RIAs)	1. Clarity and pertinence of the proposal: degree to which the objectives, scope, justification principles and requirements defined in the Technical Specifications are well understood and fully addressed. 2. Feasibility, adequacy and scientific quality of the proposed methodology, including elaboration of the research questions and hypotheses, as well as explicit justification of the	1. Degree to which the proposal demonstrates that the research would contribute to achieve both the expected impact outlined in the call specification and provide additional benefits to society. 2. Quality of the proposed measures to: - Exploit and disseminate the project results (including management of IPR), and to	1. Quality and effectiveness of the Project Management Plan: degree to which the proposed plan complies with the guidance material referred to in the call specification including extent to which the resources assigned to work packages are in line with their objectives and deliverables. 2. Appropriateness of the management structure and procedures: degree to which the proposed management structure are appropriate,

	assumptions essential to the research. 3. Level of awareness of the state-of-the-art: degree to which the proposal demonstrates knowledge of current operations and relevant previous R&D work (both in and outside of SESAR) and explains how their proposed work is beyond the state of the art, and demonstrates innovation potential	manage research data where relevant. - Communicate the project activities to different target audiences	including complementarity of the participants within the Project and the use of governance structure and advisory board as appropriate 3. Appropriateness of the technical expertise: degree to which the technical expertise is appropriate for undertaking the proposed tasks, and for ensuring that all participants have a valid role and adequate resources in the project to fulfil that role (including proposed mechanisms to ensure an appropriate involvement of stakeholders. 4. Consistency between the proposed activities and the estimated budget.

Table 33: Award criteria for the ER4 call for proposals with reference H2020-SESAR-2019-2

The scoring scheme used in evaluation for each criterion will be on a scale ranging from 0-5 with decimal points being valid. Pass thresholds per criterion and overall are established in the table below:

	Excellence	Impact	Implementation
Weight (%)	40	30	30
Threshold per criteria (n/5)	3	3	3
Overall Pass Threshold (%)	70		

Table 34: Scoring scheme and thresholds for the ER4 call for proposals with reference H2020-SESAR-2019-2

2.6.1.4 Finalisation of the preparation of the VLD Open 2 call for proposals (with reference H2020-SESAR-2020-1)

Considering that the Airspace Architecture Study will conclude at the end of 2018 and that the ATM Master Plan update campaign has been extended until the first quarter of 2019, the SESAR JU decided to postpone the launch of the VLD Open 2 call for proposals, initially scheduled in Q3 or Q4 2019, in Q1 2020. The reference of that open call for proposals is H2020-SESAR-2020-1.

The SESAR JU has already carried out in 2018 the consultation activities ('High-Level Definition' and 'Detailed Definition' phases) to define the content of this call for proposals, as was foreseen in the SPD 2018-2020 (see SPD 2018-2020 Section III, Paragraph 2.1.2 and especially the Paragraph 2.1.2.1). In Q2 or Q3 2019, the SESAR JU will carry out a last round of review of the planned content of the VLD Open 2 call for proposals (with reference H2020-SESAR-2020-1) with the ATM Master Planning Committee. The preparation of the call for proposals material will be carried out in view of launching the call for proposals in the beginning of 2020. The call conditions will be documented in the SPD 2020-2022; the rest of the call material required for launching the call based on the H2020 requirements (including technical specifications, proposal templates, evaluation procedure and execution framework) will be prepared by the SESAR JU by the end of 2019.

2.6.2 Financial Management

The SESAR JU will continue to develop its internal financial processes and procedures, continuing its pro-active approach to ensure the transparent and effective management of financial resources and a high level of budget implementation (both in terms of commitments and payments). The SESAR JU will also continue its services so that reimbursements to external experts, participants to governance bodies and candidates are carried out in accordance with the financial rules and the relevant contractual obligations.

During the course of 2019, the SESAR JU will:

- Reinforce its financial management system by establishing the SESAR JU Budget Control Committee, with the aim to provide appropriate budget scrutiny and quality control for future periods of the SPD horizon (N, N+1 and N+2) and with an outlook beyond (multi-annual budget),
- Introduce the Chief Financial Officer (CFO) function into the SESAR JU organisational structure (see Annex X) and initiate the recruitment procedure for the new position of a CFO and, in case of finalisation of the recruitment procedure within 2019, provide support to the CFO in taking over and executing his or her responsibilities,
- Continue to streamline workflows within the SESAR JU's finance-related IT systems (ABAC/SAP) with regards to the Horizon 2020 IT tools (SYGMA/COMPASS), while maintaining a high level of accuracy in budgetary forecasting.

In 2019, the provision of services that the SESAR Joint Undertaking has contracted to DG BUDGET will have reached full maturity. The procedures and tools at the SESAR JU related to those services will be fully adapted to this new scenario. Those services are Treasury, Accounting, Central Budgetary Framework, Recovery Actions, Validation of Local Systems and Reporting.

2.6.3 Legal and Procurement support to operations

In the field of Legal and Procurement support to operations, and in continuation with activities carried out over the past years, in 2019 the SESAR JU will

For Legal Affairs:

- Develop legal analysis on various matters requiring so. Such analysis could take the form of legal advices, opinions, legal risk assessments and the related mitigation actions, participation in SESAR JU technical and administrative projects, SESAR JU staff training activities, guidelines or other material on legal matters, drafting, review and/or update of the SESAR JU's internal rules and procedures within the SESAR JU QMS (see below Paragraph 2.6.5). They aim to ensure:
  - the regularity and legality of all SESAR JU's binding agreements, contracts, grants, decisions, processes, measures,
  - the respect of the PPP principles agreed with SESAR JU Members (Membership Agreement),
  - the respect of the agreements concluded with SESAR JU's founding members (European Commission Delegation Agreements, ECTRL agreement);
- Coordinate with the European Commission and relevant SESAR JU external stakeholders with regard to legal aspects,
- Contribute to inter-agency legal and procurement networks (IALN and NAPO) as well as to H2020 legal networks (NoL and LMIG);

For Procurement:

- Effective implementation of the procurement plan for 2019 (Annex IX of this document): preparation, launch and administration of procurement procedure files, contracts and archives;
- Develop legal analysis on various matters requiring so in the field of Procurement. Such analysis could take the form of legal advices, legal risk assessments and the related mitigation actions, SESAR JU staff training activities, guidelines or other material on procurement matters, drafting, review and/or update of the SESAR JU's internal rules and procedures related to procurement activities within the SESAR JU QMS (see below Paragraph 2.6.5).

2.6.4 Corporate Planning and Reporting activities

By 31 January 2019, the SESAR JU prepared the first amended version of the Single Programming Document 2019-2021, aiming for the adoption of the budget outturn and transfer of unused 2018 appropriations into the 2019 budget by the Administrative Board.

By 31 January 2019, the SESAR JU prepared and submitted to the Budgetary Authority its Single Programming Document for 2020, covering the period 2020-2022. This document will be further elaborated by the end of 2019 and submitted to the Administrative Board by the end of November for adoption in mid-December 2019.

By the end of 2019, the SESAR JU will prepare and submit to the Administrative Board the first draft of its Single Programming Document for 2021, covering the period 2021-2023. The submission of this document to the European Commission will be prepared for 31 January 2020.

In addition, the SESAR JU also prepared and submitted its Consolidated Annual Activity Report for 2018 to the Budgetary Authority by 30 June 2019.

2.6.5 Corporate Quality Management

In 2019, the SESAR JU will maintain its Quality Management System and monitor quality. Specific continuous improvement actions will be defined and followed up within the QICT Committee.

The SESAR JU will also run its Information & Document Management System and the supporting IDMS platform. Continuous improvement actions will be planned and undertaken, and will be followed up within the QICT Committee.

2.6.6 Human Resources

In 2019, the SESAR JU will seek to further raise staff competence and capability, delivering organisation-wide productivity improvements through the application and administration of a range of enablers such as effective training, staff development and transparent and fair staff appraisal and promotion exercises. Efficiency gains are presented in Section II, Paragraph 3.2.1 and will be monitored in 2019.

The SESAR JU will further strengthen its culture of excellence at all levels by providing targeted technical and other relevant training and development programmes for staff to develop a high-performing organisation. Assisting staff in identifying their training needs and supporting learning to allow access to appropriate generic and technical training courses and material will also remain a priority.

SESAR JU will also continue to develop leading practices in the recruitment, retention and recognition of staff with the emphasis in 2019 on improving staff retention and development through the introduction of a number of targeted initiatives designed to reduce potentially high turnover rates. These consist in conducting a staff survey, organising team-building activities and performing 360° degrees exercises in order to identify key areas of improvement in the way teams collaborate and communicate. Similar initiatives in previous years have helped keeping a high occupancy rate (90% at the end of 2017) and a low staff turnover rate of 9,2% at the end of 2017. It should be noted that the SESAR JU Staff Establishment Plan only has 39 temporary agent positions and 3 SNE positions, therefore each change in staff numbers accounts for a change of the occupancy and turnover rates of approximately 2,5%. During the last quarter of 2018, the selection process for a 'Financial Assistant' took place in order to create a reserve list. For one position, filled externally, the recruitment of the candidate was finalised in January 2019.

The main objectives in the field of HR are to ensure that the SESAR JU's Staff Establishment Plan is filled, ensure the efficient management of staff resources and an optimal working environment. HR activities will focus on the following during 2019:

- 42 positions to be filled throughout 2019 (39 TAs and 3 SNEs);
- In conjunction with the European Commission, the Administrative Board will continue to adopt the relevant Implementing Rules relating to HR policy where appropriate (middle management, learning & development, etc.);
- Follow-up of the Service Level Agreement with DG HR and DIGIT regarding the implementation of the 'Sysper for Agencies' software (HR information management system).

2.6.7 Facilities Management, ICT and Logistics

Facilities Management, ICT and Logistics are related to the following administrative routine and services:

- ICT Coordination, supporting the corporate governance by providing expert advice and input in the fields ICT & Unified Communications;
- Missions Coordination, supporting SESAR JU staff by providing core support for their travel bookings and execution of missions, as well as to the reimbursement of the travel expenses towards the travel agency's expenses and the traveller' claims;

- Facilities management Coordination, supporting intra-muros staff by providing facility coordination support in the Buildings and Logistics services;
- Insurance Coordination.

During the reporting period, a continuous care will be granted to ensure that the ICT infrastructure implemented and operating environment are suitable to meet the needs and budget of the SESAR JU, deviations could result or in Change Requests or in Transformation projects. Service level measurement and performance improvement activities will be safeguarded by Service Improvement Requests & Problem Management.

Ensuring continuity and interoperability of ICT service provided will require particular attention when renewing contracting elements of the infrastructure environment, of the centralised licencing portfolio, as well of for the ICT Coordination & Validation sourcing Services.

The execution of the SESAR JU Governance and the Business Continuity activities will be assured by studies services such as advice, benchmarking and high-level consultancy.

Missions support will also continue during 2019, consisting in mission process management and support to all staff across the SESAR JU while transitioning to new mission system over the period if necessary.

In 2019, in terms of Facilities management, work will continue on a number of initiatives in SESAR JU's premises in Brussels to improve the productivity, safety & efficiency of the working environment and facilities offered to SESAR JU staff. The team will work on continuous improvements in terms of facility maintenance and renovation (such as handyman works). The key initiatives are the Audit of the premises, the stocktake, the continuous monitoring, renewal and coverage in relation to the insurances and the Implementation of solutions to prevention and protection audit recommendations. Finally, a procurement call is planned for the provision of reception and reception back-office services of the SESAR JU. The outcome of this public call will result in a contract which is planned for May 2019.

2.6.8 Internal Control and Audits

2.6.8.1 Financial Procedures

In 2019 the SESAR JU will continue to ensure the robustness and appropriateness of its financial circuits. This will involve the continuous improvement of checklists, delegations of authority and backup systems in order to provide clarity and consistency between financial procedures. Special emphasis will be placed on continuing to integrate the relevant provisions and workflows stemming from Horizon 2020 rules and tools into the existing SESAR JU financial environment and set-up.

2.6.8.2 Ex-ante & Ex-post controls

Ex-ante controls

Ex-ante controls remain an important tool for the SESAR JU to prevent errors and avoid the need for ex-post corrective actions. In accordance with Article 74 of the EU Financial Regulation and Article 44 of the SESAR JU's Financial Rules 'each operation shall be subject at least to an ex ante control relating to the operational and financial aspects of the operation, on the basis of a multiannual control strategy which takes risk into account'. The main objective of ex-ante controls therefore is to ensure that the principle of sound financial management is applied. In 2019 the following ex-ante activities will take place:

- Generate and check grant agreements;

- Initiate, check and verify invoices for administrative expenditure;
- Assessment of periodic reports from grants and the verification and payment of cost claims.

Ex-post controls

One of the other major pillars of assurance for SESAR JU is its ex-post audit activity and as such, it represents a significant element of the Internal Control System. Its main objectives are to:

- Provide the Authorising Officer with the necessary elements of assurance in a timely manner on the operational expenditure;
- Assess the regularity and legality of the transactions;
- Attain residual error rates at an acceptable level at the closure of SESAR 2020 Programme, once the financial impact of all audits, correction and recovery measures has been taken into account;
- Determine the sound financial management of the transactions, with the support of the internal or external technical experts, with the overall objective to assess the value for money of the SESAR JU operations;
- Identify systemic errors through the analysis and synthesis of the results obtained and to formulate recommendations to address the issues;
- Provide the SESAR JU auditees with recommendations in order to improve the financial management, processes, procedures and practices applied to the activities related to the SESAR JU contracts.

In 2019, the audit activity will be split in two focal points: a) The second year of the SESAR 2020 Programme and b) the finalisation of any open audits under SESAR 1 (implementation of audit adjustments to previous cost claims).

For the former, the H2020 Audit Strategy applies. The SESAR JU's payment of costs will be included in the population of the Common Representative Sample that will be drawn by the Common Audit Service of the European Commission. This activity will be complemented by 'additional sample' and –if necessary- 'Article 10 sample' established to provide timely results in order to enable the SESAR JU to draw the conclusions and report on its specific error rates.

Additionally, in 2019 the audit activity will plan the execution of audits for grants signed in 2018, regarding assigned revenue for Geo-fencing, U-Space and Airspace Architecture.

2.6.8.3 Audits

Internal Audit Capability

The IAC will perform audit and consulting engagements based on risks identified in 2017 and 2018, with special focus on the recommendations from the interim evaluation of SESAR 2020 Programme conducted by the European Commission in 2017, and will coordinate activities of the IAS and ECA as described below.

Internal Audit Service (IAS) 2019 Audits

Internal audits are carried out by Internal Audit Service of the European Commission (IAS) in liaison with the SESAR JU's Internal Audit Capability (IAC). It is expected that a strategic risk assessment will be performed by the Internal Audit Service of the European Commission (IAS) in 2019. The outcome of this overall assessment of risks will lead to a list of potential audit topics to cover the period 2019-2021.

European Court of Auditors (ECA) 2018 Audits

At this stage, the SESAR JU is not aware of the external audits to be conducted by the ECA in 2019, with the exception of the recurring Annual Audit of the accounts for the financial year 2018.

2.6.9 Data Protection

As from the entry into force of the new Regulation[48], replacing Regulation 45/2001 and bringing in the principles of the GDPR[49], the following novelties, which started to be introduced during 2018, will be continued over the course of 2019 in the SESAR JU as across other EU institutions and bodies:

- Accountability and shift of responsibilities from the DPO to the 'Controller', as responsible for the compliance at three levels (insurance, demonstration and verification);
- Documentation and consultation obligations closely tied to the risks;
- Transparency and clear information to data subjects including new data subject rights;
- New obligation of the SESAR JU to notify data breach notifications;
- Strict data protection clauses in contracts.

For this purpose, the SESAR JU will continue implementing the following tasks.

- Plan, provide advice and report to the Controller on accountability at three levels.
- Later stage of implementation of the Action Plan.
- New system of records replacing the previous notification system. The priority setting for reformatting from notification into record has been based on the assessment of the risk of the processing operations. During the second quarter of 2019, the SESAR JU will participate in a joint procurement procedure with the other Joint Undertakings, for the development and maintenance of an on-line data protection register tailor made to the needs of a Joint Undertaking.
- Cooperation with EUROCONTROL Data Protection Officer.
- Follow up on the new or updated guidance to be issued by the European Data Protection Supervisor.

[48] Proposal for Regulation of the European Parliament and of the Council on the protection of individuals with regard to the processing of personal data by the Union institutions, bodies, offices and agencies and on the free movement of such data, and repealing Regulation (EC) No 45/2001 and Decision No 1247/2002/EC

[49] Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation, 'GDPR')

2.6.10 Indicators and measurements applicable for the Strategic Area of Operation 6

The SESAR JU has the following objectives to be delivered during 2019 which are outlined in the table below and which will be tracked according to the following indicators:

2019 Objectives	Indicators	Target for 2019
Implement the calls for proposals and grants management framework	Launch of the two calls for proposals under H2020 : • IR-VLD Wave 2 call for proposals with reference H2020-SESAR-2019-1 • ER4 call for proposals with reference H2020-SESAR-2019-2	100%
Call reference H2020-SESAR-2020-2 (IR Wave 3): preparation of content and call material	Call material prepared, call for proposals ready for publication and opening in early 2020	80%
	Call conditions documented in the SPD 2020-2022	100%
Call reference H2020-SESAR-2020-1 (VLD Open 2 call for proposals): preparation of content and call material	Call material prepared, call for proposals ready for publication and opening in early 2020	80%
	Call conditions documented in the SPD 2020-2022	100%
Implement remaining recommendations of European Commission's mid-term review of H2020 implementation	Percentage of interim review recommendations completed in 2019	100%
Follow up audit recommendations	Percentage of full implementation of IAS previous years audits recommendation implementation completed in 2019	100%
Ensure full compliance with programming and reporting requirements	Full compliance with programming obligations for JUs • First amended version of the SPD 2019-2021 submitted to ADB for adoption by January 31st, 2019 (transfer of unused 2018 appropriations into the 2019 budget) • Draft SPD 2020-2022 submitted to the Budgetary Authority by January 31st, 2019 • FiFi 2020 (budget request for 2020) submitted to the DG BUDG by January 31st, 2019 latest • SPD 2020-2022 submitted to Administrative Board by end November 2019 for adoption in mid-December 2019	Full compliance 100% 100% 100% 100%

	Full compliance with reporting obligations for JUs • CAAR 2018 adopted by the ADB and sent to the Budgetary Authority by June 30th, 2019 latest • Report on the implementation of the delegation agreements (see 3.2.2) submitted to the European Commission by February 15th, 2019 No critical observation from auditors	Full compliance 100% 100%
Monitor Exception and Non-Compliance Events Register	Exceptions and non-compliance events per SESAR JU Area	Max. 5% of transactions
Monitor efficiency and effectiveness of SESAR JU's legal and procurement activities	Percentage of completed legal and procurement aspects of the contractual action plan within deadlines	95%
	Provision of legal advice to the SESAR JU on: • H2020 grants • Non-H2020 grants Other matters in relation with European Network with Agencies and Common Support Center	In accordance with the plan agreed with the requestor
Monitor efficiency and effectiveness of SESAR JU's project audit activities	Percentage of SESAR 1 finalised project audits	100%
	H2020 project audits: provision of necessary inputs to CAS to execute 2018 audits	100%
	Deliver the plan for audits on non-H2020 activities: Geo-fencing, U-Space and Airspace Architecture	100%
Monitor efficiency and effectiveness of SESAR JU's corporate and management activities	Full compliance with Internal Control Framework by the end of 2019 (to be documented in the CAAR 2019)	100%
	Discrepancies against processes, and their translation in QMS improvement actions Continuous registration of improvement actions as part of the SESAR JU QMS	All process improvement actions are taken in due course
	Acceptable level of corporate risks as per risk management plan, and allow for leveraging of opportunities	All risk related actions implemented in due course
	Effective staffing management: • Maximum turnover rate: • Minimum occupancy rate:	 10% 90%
	Implementation of CDR and promotion exercise	100%
	Percentage of implemented SYSPER phase 2	100% 100%

	Implementation or opt-out of European Commission implementing decisions and models	
Balance payments to Members and beneficiaries	Percentage of SESAR 2020 balancing payments executed timely	100% of requested payments made
	Budget execution: the commitment appropriations and payment appropriations are executed as planned in the 2019 Budget	90% for commitment appropriations 70% for payment appropriations
	Percentage of managed SESAR 1 remaining financial transactions?	90%
	Completion of 2018 annual accounts	100%
	Support to ECA audit and provision of relevant documentation leading to an unqualified opinion on the 2018 accounts	100%
Deliver infrastructure services to enable teams and the SESAR JU to operate smoothly	Quality of IT, infrastructure and facilities and existence of Business Continuity and Disaster Recovery planning	No major disruption of service unless triggered under business continuity & disaster planning

Table 35: Objectives, indicators and 2019 targets for financial, administrative and corporate management

3 Budget & Resource Information 2019

3.1 Budgetary Information for 2019

Annexes I and II provide detailed budgetary information for 2019.

Title I – Staff expenditure

Title I expenditure is maintained at comparable levels to previous years for 2019.

Title II – Infrastructure and operating expenditure

Title II expenditure is maintained at comparable levels to previous years for 2019.

Title III – Operational expenditure

Title III includes operational activities directly conducted by the SESAR JU and those conducted by its Members.

These activities to be conducted in 2019 are detailed by Strategic Area of Operation, as documented above in Chapter 2.

3.2 Staff Establishment for 2019

The SESAR JU Staff Establishment Plan constitutes the document adopted by the Administrative Board defining the total number of positions by grade necessary to ensure the sound operational and financial management of the organisation and in order to execute its Work programme.

The positions requested for 2019 will thus remain at 39 TAs, plus the 3 SNEs positions authorised by the SESAR JU Administrative Board.

Since the SESAR JU Administrative Board decision of 31 May 2017, secondment of staff from SESAR JU selected Members do not occupy any longer positions from the SESAR JU establishment plan under Title I.

Annexes

Annex I: Resource Allocation (budget and human resources) per Area of Operation

Budget Allocation (Million EUR)

The table below provides information related to Titles I, II and III financial contributions broken down per Strategic Area of Operation, in accordance with Chapters 3 of Sections II and III.

Budgetary and staff figures laid out for 2019 in the tables of this annex are final while the figures laid out for 2020 and 2021 are indicative and subject to the outcome of future budgetary procedures.

Multi-Annual Strategic Area of Operation	Estimate COMMITMENT Appropriations		Estimate PAYMENT Appropriations	
	M EUR	%	M EUR	%
2019				
Multi-Annual Strategic Area of Operation 1: Provide Strategic Steering to the SESAR Programme	7,18	5%	6,75	4%
Multi-Annual Strategic Area of Operation 2: Deliver Exploratory Research	41,78	28%	7,87	5%
Multi-Annual Strategic Area of Operation 3: Deliver Industrial Research and Validation	66,47	44%	106,77	63%
Multi-Annual Strategic Area of Operation 4: Deliver Very Large Scale Demonstrations	29,83	20%	43,67	26%
Multi-Annual Strategic Area of Operation 5: Deliver SESAR Outreach	3,24	2%	2,73	2%
Multi-Annual Strategic Area of Operation 6: Deliver effective financial, administrative and corporate management	2,07	1%	2,07	1%
TOTAL 2019	**150,6**	**100%**	**169,9**	**100%**
2020				
Multi-Annual Strategic Area of Operation 1: Provide Strategic Steering to the SESAR Programme	5,80	5%	5,75	6%
Multi-Annual Strategic Area of Operation 2: Deliver Exploratory Research	1,08	1%	14,28	14%
Multi-Annual Strategic Area of Operation 3: Deliver Industrial Research and Validation	77,68	64%	55,99	57%
Multi-Annual Strategic Area of Operation 4: Deliver Very Large Scale Demonstrations	33,82	27%	17,75	18%
Multi-Annual Strategic Area of Operation 5: Deliver SESAR Outreach	1,17	1%	2,72	3%
Multi-Annual Strategic Area of Operation 6: Deliver effective financial, administrative and corporate management	2,05	2%	2,05	2%
TOTAL 2020	**121,61**	**100%**	**98,55**	**100%**

2021				
Multi-Annual Strategic Area of Operation 1: Provide Strategic Steering to the SESAR Programme	1,21	11%	2,16	4%
Multi-Annual Strategic Area of Operation 2: Deliver Exploratory Research	1,09	10%	18,52	32%
Multi-Annual Strategic Area of Operation 3: Deliver Industrial Research and Validation	4,21	38%	22,56	39%
Multi-Annual Strategic Area of Operation 4: Deliver Very Large Scale Demonstrations	1,43	13%	9,18	16%
Multi-Annual Strategic Area of Operation 5: Deliver SESAR Outreach	1,18	11%	2,61	5%
Multi-Annual Strategic Area of Operation 6: Deliver effective financial, administrative and corporate management	2,09	19%	2,09	4%
TOTAL 2021	**11,21**	**100%**	**57,11**	**100%**

Table 36: Financial resource allocation per Strategic Area of Operation per year in the period 2019-2021

Human Resources

The table below provides information related to human resources, broken down per Strategic Area of Operation, in accordance with Chapters 3 of Sections II and III.

Multi-Annual Strategic Area of Operation	Total HR	%
Estimate 2019		
Multi-Annual Strategic Area of Operation 1: Provide Strategic Steering to the SESAR Programme	5	12%
Multi-Annual Strategic Area of Operation 2: Deliver Exploratory Research	4	9%
Multi-Annual Strategic Area of Operation 3: Deliver Industrial Research and Validation	15	37%
Multi-Annual Strategic Area of Operation 4: Deliver Very Large Scale Demonstrations	5	12%
Multi-Annual Strategic Area of Operation 5: Deliver SESAR Outreach	4	9%
Multi-Annual Strategic Area of Operation 6: Deliver effective financial, administrative and corporate management	9	21%
TOTAL 2019	**42**	**100%**
Estimate 2020		
Multi-Annual Strategic Area of Operation 1: Provide Strategic Steering to the SESAR Programme	5	12%
Multi-Annual Strategic Area of Operation 2: Deliver Exploratory Research	4	9%
Multi-Annual Strategic Area of Operation 3: Deliver Industrial Research and Validation	15	37%
Multi-Annual Strategic Area of Operation 4: Deliver Very Large Scale Demonstrations	5	12%
Multi-Annual Strategic Area of Operation 5: Deliver SESAR Outreach	4	9%
Multi-Annual Strategic Area of Operation 6: Deliver effective financial, administrative and corporate management	9	21%
TOTAL 2020	**42**	**100%**
Estimate 2021		
Multi-Annual Strategic Area of Operation 1: Provide Strategic Steering to the SESAR Programme	5	12%
Multi-Annual Strategic Area of Operation 2: Deliver Exploratory Research	4	9%
Multi-Annual Strategic Area of Operation 3: Deliver Industrial Research and Validation	15	37%
Multi-Annual Strategic Area of Operation 4: Deliver Very Large Scale Demonstrations	5	12%
Multi-Annual Strategic Area of Operation 5: Deliver SESAR Outreach	4	9%
Multi-Annual Strategic Area of Operation 6: Deliver effective financial, administrative and corporate management	9	21%
TOTAL 2021	**42**	**100%**

Table 37: Human resource allocation per Strategic Area of Operation per year in the period 2019-2021

Annex II: Financial Resources (Tables) 2019 – 2021

In this annex, the financial resources are presented for the whole SESAR JU. Expenditure and revenue figures laid out for 2019 in the tables of this annex are final while the figures laid out for 2020 and 2021 are indicative and subject to the outcome of future budgetary procedures.

Table 1 – Expenditure

(EUR)

Expenditure	N (2018)		N+1 (2019)	
	Commitment appropriations	Payment appropriations	Commitment appropriations	Payment appropriations
Title I	6.040.300	6.040.300	6.044.372	6.044.372
Title II	3.476.234	3.476.234	3.612.935	3.612.935
Title III	143.921.427	131.392.685	140.901.014	160.199.891
Total expenditure	**153.437.961**	**140.909.219**	**150.558.321**	**169.857.198**

Table 38: SESAR JU Expenditure Budget per Title in 2018 (year N) and 2019 (year N+1) – Commitment & Payment appropriations

(EUR)

EXPENDITURE	Commitment appropriations						
	Executed Budget N-1 (2017)	Executed Budget N (2018)	Budget N+1 (2019)		*VAR N+1 / N*	Budget N+2 (2020)	Budget N+3 (2021)
			Agency request	Adopted Budget			
Title I - Staff Expenditure	**5.995.000**	**6.040.300**	**6.044.372**	**6.044.372**		**6.157.360**	**6.280.507**
11 Salaries & allowances	5.330.000	5.465.300	5.517.372	5.517.372	*1,0%*	5.630.360	5.742.967
- of which establishment plan posts	*4.730.000*	*4.853.300*	*4.913.132*	*4.913.132*	*1,2%*	*5.013.635*	*5.113.908*
- of which external personnel	*600.000*	*612.000*	*604.240*	*604.240*	*(1,3)%*	*616.725*	*629.060*
12 Expenditure relating to Staff recruitment	15.000	15.000	15.000	15.000	-	15.000	15.300
13 Mission expenses	470.000	335.000	335.000	335.000	-	300.000	306.000
14 Socio-medical infrastructure	-	-	-	-	-	-	-
15 Training	85.000	50.000	50.000	50.000	-	85.000	86.700
16 External Services	60.000	140.000	92.000	92.000	(34,3)%	92.000	93.840
17 Receptions and events	-	-	-	-	-	-	-
19 Other Staff related expenditure	35.000	35.000	35.000	35.000	-	35.000	35.700
Title II - Infrastructure and operating expenditure	**4.180.351**	**3.476.234**	**3.612.935**	**3.612.935**		**3.417.079**	**3.465.671**
20 Rental of buildings and associated costs[*]	819.816	964.953	918.880	918.880	(4,8)%	900.944	918.963
21 Information and communication technology	1.865.784	1.541.443	1.562.720	1.562.720	1,4%	1.564.948	1.570.747
22 Movable property and associated costs	55.000	62.018	10.000	10.000	(83,9)%	10.200	10.404
23 Current administrative expenditure	926.560	490.120	713.335	713.335	45,5%	530.987	547.357
24 Postage / Telecommunications	51.500	-	-	-	-	-	-
25 Meeting expenses	39.950	19.700	10.000	10.000	(49,2)%	10.000	10.200
26 Running costs in connection with operational activities	-	-	-	-	-	-	-
27 Information and publishing	421.741	398.000	398.000	398.000	-	400.000	408.000
28 Studies	-	-	-	-	-	-	-

Title III - Operational expenditure	**103.005.914**	**143.921.427**	**140.901.014**	**140.901.014**		**112.035.661**	**1.467.500**
SESAR 1 - 3.1 Studies/Development Conducted By the SJU	1.229.808	-	-	-	-	-	-
SESAR 1 - 3.2 Studies/Development Conducted By EUROCONTROL	-	-	-	-	-	-	-
SESAR 1 - 3.3 Studies/Development Conducted By Other Members	137.608	-	-	-	-	-	-
SESAR 2020 3.1 - Providing Strategic Steering to the SESAR programme	6.235.737	6.725.014	7.747.960	7.747.960	15,2%	5.913.494	1.212.500
SESAR 2020 3.2 - Deliver Exploratory Research	-	1.047.374	40.908.587	40.908.587	3805,8%	-	-
SESAR 2020 3.3 - Deliver Industrial Research and Validation	80.072.355	98.493.896	61.029.045	61.029.045	(38,0)%	73.477.567	-
SESAR 2020 3.4 - Deliver Very Large-Scale Demonstration activities	15.330.406	36.614.631	28.900.023	28.900.023	(21,1)%	32.389.600	-
SESAR 2020 3.5 - Deliver SESAR Outreach	-	1.040.512	2.315.400	2.315.400	122,5%	255.000	255.000
Title IV - Unused appropriations not required in current Year	**-**	**-**	**-**	**-**	**-**	**13.383.404**	**-**
TOTAL EXPENDITURE	**113.181.265**	**153.437.961**	**150.558.321**	**150.558.321**		**134.993.504**	**11.213.679**

[*] Including possible repayment of interest; detailed information as regards building policy can be found in Annex V

Table 39: Detailed SESAR JU Expenditure Budget over the period 2017 – 2021 (N-1 to N+3) – Commitment appropriations

(EUR)

EXPENDITURE	Payment appropriations						
	Executed Budget N-1 (2017)	Executed Budget N (2018)	Budget N+1 (2019)		*VAR N+1 / N*	Budget N+2 (2020)	Budget N+3 (2021)
			Agency request	Adopted Budget			
Title I - Staff Expenditure	**5.995.000**	**6.040.300**	**6.044.372**	**6.044.372**		**6.157.360**	**6.280.507**
11 Salaries & allowances	5.330.000	5.465.300	5.517.372	5.517.372	*1,0%*	5.630.360	5.742.967
- of which establishment plan posts	*4.730.000*	*4.853.300*	*4.913.132*	*4.913.132*	*1,2%*	*5.013.635*	*5.113.908*
- of which external personnel	*600.000*	*612.000*	*604.240*	*604.240*	*(1,3)%*	*616.725*	*629.060*
12 Expenditure relating to Staff recruitment	15.000	15.000	15.000	15.000	-	15.000	15.300
13 Mission expenses	470.000	335.000	335.000	335.000	-	300.000	306.000
14 Socio-medical infrastructure	-	-	-	-	-	-	-
15 Training	85.000	50.000	50.000	50.000	-	85.000	86.700
16 External Services	60.000	140.000	92.000	92.000	(34,3)%	92.000	93.840
17 Receptions and events	-	-	-	-	-	-	-
19 Other Staff related expenditure	35.000	35.000	35.000	35.000	-	35.000	35.700
Title II - Infrastructure and operating expenditure	**4.180.351**	**3.476.234**	**3.612.935**	**3.612.935**		**3.417.079**	**3.465.671**
20 Rental of buildings and associated costs[*]	819.816	964.953	918.880	918.880	(4,8)%	900.944	918.963
21 Information and communication technology	1.865.784	1.541.443	1.562.720	1.562.720	1,4%	1.564.948	1.570.747
22 Movable property and associated costs	55.000	62.018	10.000	10.000	(83,9)%	10.200	10.404
23 Current administrative expenditure	926.560	490.120	713.335	713.335	45,5%	530.987	547.357
24 Postage / Telecommunications	51.500	-	-	-	-	-	-
25 Meeting expenses	39.950	19.700	10.000	10.000	(49,2)%	10.000	10.200
26 Running costs in connection with operational activities	-	-	-	-	-	-	-
27 Information and publishing	421.741	398.000	398.000	398.000	-	400.000	408.000
28 Studies	-	-	-	-	-	-	-

Title III - Operational expenditure	**183.562.184**	**130.892.685**	**160.199.891**	**160.199.891**		**88.972.261**	**47.367.622**
SESAR 1 - 3.1 Studies/Development Conducted By the SJU	23.096.479	4.403.499	-	-	(100,0)%	-	-
SESAR 1 - 3.2 Studies/Development Conducted By EUROCONTROL	-	-	-	-	0,0%	-	-
SESAR 1 - 3.3 Studies/Development Conducted By Other Members	77.231.070	16.591.794	-	-	(100,0)%	-	-
SESAR 2020 3.1 - Providing Strategic Steering to the SESAR programme	4.642.255	5.811.343	8.677.883	8.677.883	49,3%	5.862.101	2.158.727
SESAR 2020 3.2 - Deliver Exploratory Research	12.061.467	16.315.319	5.034.925	5.034.925	(69,1)%	13.165.047	17.400.000
SESAR 2020 3.3 - Deliver Industrial Research and Validation	54.821.425	58.570.014	104.957.229	104.957.229	79,2%	51.785.588	18.348.658
SESAR 2020 3.4 - Deliver Very Large-Scale Demonstration activities	10.904.487	26.490.203	39.714.853	39.714.853	49,9%	16.349.525	7.775.236
SESAR 2020 3.5 - Deliver SESAR Outreach	805.000	2.710.512	1.815.000	1.815.000	(33,0)%	1.810.000	1.685.000
Title IV - Unused appropriations not required in current Year	**-**	**-**	**-**	**-**	**-**	**-**	**-**
TOTAL EXPENDITURE	**193.737.535**	**140.409.219**	**169.857.198**	**169.857.198**		**98.546.700**	**57.113.800**

[*] Including possible repayment of interest; detailed information as regards building policy can be found in Annex V

Table 40: Detailed Expenditure Budget over the period 2017 – 2021 (N-1 to N+3) – Payment appropriations

Table 2 – Revenue

(EUR)

Revenues	N (2018)	N+1 (2019)
	Executed Budget	Adopted Budget
EU contribution	122.563.000	112.618.000
Other revenue	30.874.961	37.940.321
Total revenues	**153.437.961**	**150.558.321**

Table 41: SESAR JU Revenues in 2018 (year N) and 2019 (year N+1)

IN-KIND CONTRIBUTION

all figures in Euro ***Title / Chapter***	Programme estimates (Sept. 2016)	Revenue Entitlements Budget 2018	Budget 2019	Budget 2020	Budget 2021
1. European Union Contribution					
1.1 H2020 Contribution to Administrative Expenditure					
1.2 H2020 Contribution to Operational Expenditure					
1.3 Com/EP Contribution to VLD (Assigned Revenue)					
2. Contribution from Eurocontrol	**467.256.781**	**73.388.672**	**81.733.361**	**71.114.629**	**64.870.400**
2.1 contribution in cash					
2.2 contribution in kind	467.256.781	73.388.672	81.733.361	71.114.629	64.870.400
3. Contributions from Other Members	**307.372.403**	**57.585.592**	**67.354.742**	**48.400.920**	**34.599.118**
3.1 contribution in cash					
3.2 contribution in kind	307.372.403	57.585.592	67.354.742	48.400.920	34.599.118
4. Other Revenue					
4.1 Revenue From Interests Yielded					
4.2 Revenue From Taxes Recovered					
4.3 Programme revenues from non Members					
4.4 Exceptional Revenues - Decommitments					
4.5 Interest to be returned to the EU					
Budget Outturn previous year					
TOTAL REVENUE	**774.629.184**	**130.974.264**	**149.088.103**	**119.515.548**	**99.469.518**

Table 42: Detailed net In-Kind Revenue Budget over the period 2018 – 2021 (N to N+3)

(EUR)

REVENUES	N-1 (2017)	N (2018)	N+1 (2019)		VAR N+1 / N	Envisaged Revenue N+2 (2020) (as amended)	Envisaged Revenue N+3 (2021)
	Executed Budget	Executed Budget	As requested by the agency	Adopted Budget			
1 REVENUE FROM FEES AND CHARGES	-	-	-	-	-	-	-
2 EU CONTRIBUTION	100.800.000	120.000.000	110.000.000	110.000.000	- 0	120.796.055	-
- of which Administrative (Title I and Title II) (Budget line 1100)	*3.241.507*	*3.250.683*	*3.252.411*	*3.252.411*	*0,1%*	*16.340.354*	-
- of which Operational (Title III) (Budget line 1200 - EU)	*96.758.493*	*106.749.317*	*106.747.589*	*106.747.589*	*(0,0)%*	*104.455.700*	-
- of which assigned revenues deriving from additional budget (Budget line 1300)	*800.000*	*10.000.000*	-	-	*(100,0)%*	*1*	-
3 THIRD COUNTRIES CONTRIBUTION (incl. EFTA and candidate countries)	2.440.000	2.563.000	2.618.000	2.618.000	*0*	2.911.185	-
- of which EFTA (Budget line 1200 - EFTA)	*2.440.000*	*2.563.000*	*2.618.000*	*2.618.000*	*2,1%*	*2.911.185*	-
- of which Candidate Countries							
4 OTHER CONTRIBUTIONS (Budget lines 2100 + 3100)	6.682.000	6.954.762	6.954.762	6.954.762	-	4.770.556	6.954.762
- of which delegation agreement, ad hoc grants							
5 ADMINISTRATIVE OPERATIONS					-		
6 REVENUES FROM SERVICES RENDERED AGAINST PAYMENT	-	-	-	-	-	-	-
7 CORRECTION OF BUDGETARY IMBALANCES	-	-	-	-	-	-	-
8 INTERESTS GENERATED	-	-	-	-	-	-	-
9 BUDGET OUTTURN AND UNUSED APPROPRIATIONS FROM PREVIOUS YEARS (Budget line 5100)	3.259.265	23.920.200	30.985.560	30.985.560	*29,5%*	6.515.708	4.258.917
TOTAL REVENUES	**113.181.265**	**153.437.961**	**150.558.321**	**150.558.321**		**134.993.504**	**11.213.679**

Table 43: Detailed SESAR JU Revenue Budget (financial contribution) over the period 2017 – 2021 (N-1 to N+3)

Table 3 – Budget Outturn and Cancellation of Appropriations

Budget outturn	2015	2016	2017
Revenue actually received (+)	123.174.781	143.211.209	202.760.405
Payments made (-)	-112.775.973	-102.973.228	-144.784.881
Carry-over of appropriations (-)	-3.027.976	-3.194.963	-374.682
Cancellation of appropriations carried over (+)			
Adjustment for carry over of assigned revenue appropriations from previous year (+)			
Exchange rate differences (+/-)			
Adjustment for negative balance from previous year (-)			
Total	**7.370.832**	**37.043.018**	**57.600.842**

Table 44: Budget Outturn and Cancellation of Appropriations

Annex III: Human Resources (Tables) 2019 – 2021

Staff figures laid out for 2019 in the tables of this annex are final while the figures laid out for 2020 and 2021 are indicative and subject to the outcome of future budgetary procedures.Table 1 – Staff population and its evolution; Overview of all categories of staff

Staff population		Actually filled as of 31.12 N-2 (2016)	Authorised under EU budget N-1 (2017)	Actually filled as of 31.12.N-1 (31.12.2017)	Authorised under EU budget for year N (2018)	Authorised under EU budget for year N+1 (2019)	Envisaged in N+2 (2020)	Envisaged in N+3 (2021)
Officials	AD							
	AST							
	AST/SC							
TA	AD	33	33	29	33	33	33	33
	AST	6	6	6	6	6	6	6
	AST/SC							
Total		38	39	35	39	39	39	39
CA GFIV			2	2				
CA GF III			1[50]					
CA GF II								
CA GFI								
Total CA		0	3	2	0	0	0	0

[50] One contractual agent was hired to cover a temporary agent position on long term absence

SNE	3	3	3	3	3	3	3
Structural service providers[51]	2	2	2	3	3	3	3
TOTAL	43	46	42	45	45	45	45
External staff for occasional replacement[52]	4	4	4	4	4	4	4

Table 45: Staff population and its evolution 2016 - 2021

[51] Service providers are contracted by a private company and carry out specialised outsourced tasks of horizontal/support nature, for instance in the area of information technology or reception services

[52] Replacement due to maternity leave, long term sick leave or unfilled positions

Table 2 – Multi-annual staff policy plan Year 2019 - 2021

Category and grade	Establishment plan in adopted EU Budget N-1 (2017)		Filled as of 31/12/N-1 (31.12.2017)		Modifications in year N-1 in application of flexibility rule[53] (2017)		Establishment plan in adopted EU Budget N (2018)		Modifications in year N in application of flexibility rule (2018)		Establishment plan in adoptedEU Budget N+1 (2019)		Modifications in year N+1 in application of flexibility rule (2019)		Establishment plan N+2 (2020)		Establishment plan N+3 (2021)	
	OF[54]	TA	OF	TA	OF	TA	OF	TA	OF	TA	OF	TA	OF	TA	OF	TA	OF	TA
AD 16																		
AD 15		1		1				1				1				1		1
AD 14																		
AD 13																		1
AD 12		4		3				4				4				5		5
AD 11		2		1				3				3				3		3
AD 10		2		3				2				2				2		2
AD 9		3		2				3				4		+1		5		6
AD 8		6		6				6				6		-1		7		7
AD 7		5		4				6				7				6		5
AD 6		9		8				7				6				4		3
AD 5		1		1				1										
Total AD		**33**		**29**				**33**				**33**		**0**		**33**		**33**
AST 11																		
AST 10																		
AST 9								1				1				1		1

[53] As provided in Article 37 of SESAR JU's Financial Rules.

[54] Officials (permanent posts).

Category and grade	Establishment plan in adopted EU Budget N-1 (2017)		Filled as of 31/12/N-1 (31.12.2017)		Modifications in year N-1 in application of flexibility rule[53] (2017)		Establishment plan in adopted EU Budget N (2018)		Modifications in year N in application of flexibility rule (2018)		Establishment plan in adoptedEU Budget N+1 (2019)		Modifications in year N+1 in application of flexibility rule (2019)		Establishment plan N+2 (2020)		Establishment plan N+3 (2021)	
	OF[54]	TA	OF	TA	OF	TA	OF	TA	OF	TA	OF	TA	OF	TA	OF	TA	OF	TA
AST 8		1		1														
AST 7		1		1				1				1				1		1
AST 6																		
AST 5																1		2
AST 4		1						2				2				2		1
AST 3		2		3				1				1		+1		1		1
AST 2												1		-1				
AST 1		1		1				1										
Total AST		6		6				6				6		0		6		6
AST/SC1																		
AST/SC2																		
AST/SC3																		
AST/SC4																		
AST/SC5																		
AST/SC6																		
Total		0																
TOTAL		39		35				39				39				39		39

Table 46: Multi-annual staff policy plan Year 2017 - 2021

Annex IV: Human Resources Policy

The main objective of the SESAR JU staff policy is to define the necessary framework for the recruitment, equal treatment, organisation, assessment, development and training of the SESAR JU staff members so that their collective skills and competencies which constitute an asset for the SESAR JU will contribute to the achievement of the SESAR JU mission and specific objectives.

The SESAR JU Staff Establishment Plan constitutes the document adopted by the Administrative Board defining the total number of positions by grade necessary to ensure the sound operational and financial management of the organisation and in order to execute its work programme.

A. Recruitment Policy

As of the entry into force of Council Regulation (EC) 1361/2008, the Staff Regulations of Officials of the European Union, the Conditions of Employment of other servants of the European Union[55] and the rules adopted jointly by the Institutions of the European Union for the purpose of applying these Staff Regulations and the Conditions of Employment apply to the staff of the Joint Undertaking and its Executive Director.

Following the Council Regulation (EU) 721/2014 amending the Council Regulation (EC) 1361/2008, the staff of the Joint Undertaking consists of TAs and CAs recruited for a fixed period that may be renewed once for a fixed period up to 5 years. Any other renewal shall be for an indefinite period in accordance with the EU Staff Regulations. The total period of engagement shall not exceed in any case the duration of the Joint Undertaking.

The staff of the SESAR JU shall consist of highly specialised technical staff members in charge of the management and implementation of the SESAR Programme and highly specialised and diversified administrative and financial staff to support the operations. In establishing the different job descriptions and the organisation chart of the SESAR JU, particular attention is paid to preserve the adequate separation of functions, to manage the risk of conflict of interest, to ensure an efficient and cost-effective functioning of the organisation.

It has to be recognised that it is difficult to attract highly skilled persons on TA contracts for a limited duration, especially on technical activities where the SESAR JU is in competition, on the recruitment point of view, with other entities such as EUROCONTROL.

1. Staff categories

1.1 Officials

The SESAR JU has currently no post occupied by an official from an Institution. Furthermore, the SESAR JU has no permanent posts in its establishment plan and, therefore, cannot appoint officials.

1.2 Temporary agents

On the basis of the missions and tasks set out by the SESAR JU Regulation, the SESAR JU considers that most of its existing workforce can be identified as positions of long term duration within the limits of

[55] As last amended by Regulation (EU, EURATOM) No 1023/2013 of the European Parliament and of the Council of 22 October 2013 amending the Staff Regulations of Officials of the European Union and the Conditions of Employment of Other Servants of the European Union (OJ L 287, 29.10.2013, p. 15–62)

the existence of the SESAR JU, whether in core business activities for which continuous expertise needs to be built and maintained or support activities in the area of Finance and Administration.

Where the type of expertise requested for a certain position is not easily available on the free market and is retained by personnel working for one of its Members, the SESAR JU fills in these highly specialised positions with secondments from its Members, ensuring that proper measures to manage potential conflict of interest are in place (segregation of duties, annual declarations on conflict of interest, etc.).

All temporary agent posts have been identified as post of long duration and are offered a 5-year contract (except for staff who were under Belgian contracts at 1 January 2009, in accordance with the transition provisions of Council Regulation (EC) 1361/2008, who are indefinite duration contracts still subject to the end of functioning of the SESAR JU on 31 December 2024 at the latest).

The table under point 3 provides the information on the key functions for which the positions have been filled by TAs. The process followed is in compliance with the SESAR JU Implementing Rules on the engagement and use of Temporary Staff.

The entry grades are determined in function of the level of the tasks to be performed and are those indicated in the staff establishment plan.

It should be noted that the SESAR Programme requires highly specialised skills and competencies, and – often – advanced seniority of staff members. The SESAR JU grading approved by the Administrative Board reflects the need of highly specialised staff members to fulfil the duties of the management of a high level research programme.

The European Commission guidelines on Staff Policy describe the flexibility as regard to the recruitment grades in agencies.

As already mentioned and notwithstanding the Transitional Provisions laid down in article 2 of Council Regulation (EC) 1361/2008, temporary agents are recruited for a fixed term contract, in principle of 5 years, renewable once and for a fixed period up to 5 years. Any other renewal shall be for an indefinite period. In exceptional cases, the Appointing Authority could decide on a different duration of the contract. The total period of engagement will not exceed in any case the duration of the SESAR JU (Article 2a of Council Regulation (EU) 721/2014).

1.3 Contract agents

Contract agents will serve the purpose of increasing capacity mainly in support functions (financial, legal or administrative).

In exceptional cases, the Appointing Authority could decide for the needs of the SESAR JU to recruit a CA on a short term employment (to replace TA on maternity or parental leave, work overload, specific need).

Contract agents are recruited for a fixed term contract, usually with a duration not exceeding 3 years, renewable once for a fixed period. Any other renewal shall be for an indefinite period. In exceptional cases, the Appointing Authority could decide on a different duration of the contract. The total period of engagement shall not in any case exceed the duration of the SESAR JU (Article 2a of Council Regulation (EU)721/2014).

1.4 Seconded national experts

For the need of specific expertise, the SESAR JU recruits SNEs from competent organisations in the EU or EUROCONTROL Member States, especially where expertise within Regulators or public authorities is requested.

1.5 Structural service providers

For the purpose of managing, plan and control reception services, the SESAR JU has signed a contract with a service provider called 'Receptel'. This service provider provides 1 to 2 FTE as receptionist/Back – office reception. It is not always the same person providing the services. In terms of ICT coordination, 1 person is provided by an external service provider.

1.6 The Programme Management Unit

In 2008, EUROCONTROL established a Unit hosted by the SESAR JU in order to provide the necessary support in the management of the SESAR Programme and consisting of a contribution in kind to the SESAR JU. The Programme Management Unit (PMU) provides programme management support to the SESAR JU in strict coordination with the other SESAR JU Teams. The number of staff part engaged in this function at the end of 2017 is 19 persons.

The PMU staff assigned to the SESAR JU for the execution of this Agreement shall remain subject to the EUROCONTROL's staff regulations and rules.

1.7 Seconded staff from SESAR JU Selected Members

At its meeting of 31 May 2017, the Administrative Board of the SESAR JU, having regard to Articles 5(1)(p) and 8 of the Annex to the SESAR JU Regulation and the SESAR Joint Undertaking Membership Agreement, which entered into force on 6 July and was signed by the SESAR JU, EROCONTROL and the SESAR JU's 19 Selected Members by virtue of Decision ADB(D)02-2016, decided:

- to adopt specific conditions on the secondment of staff of SESAR JU Selected Members, as detailed in Annex 1 to the ADB (D)07-2017,
- to delegate the Executive Director to establish the necessary agreements in line with the aforementioned conditions.

The decision of the Administrative Board is also motivated by the nature of the SESAR JU with its Selected Members as public-private partnership, where public and private resources are commingled for the achievement of objectives.

The secondment from the Selected Members constitutes a highly flexible mechanism to attract skilled experts, with contracts with specific duration and a low risk scheme.

In compliance with the Administrative Board decision, the SESAR JU launches a call for expression of interest to its Selected Members, to establish a list of potential candidates for specific positions.

The secondment to the SESAR JU is subject to the signature of a secondment agreement that will complement the SESAR JU Membership Agreement and detail the selected member's contribution under the secondment.

Any secondment accepted by the SESAR JU shall be considered as Additional Contribution in the meaning of Article 10.4 of the Membership Agreement and will be fully reimbursed under the conditions defined in Annex 1 to ADB Decision afore mentioned.

2. Selection procedure

The described selection procedure is the one applicable to the SESAR JU adopted by the SESAR JU administrative Board, ADB Decision (D)06-2016, on 28 April 2016.

The SESAR JU launches recruitment procedures for Temporary Agents through the announcement of vacant posts on its website and the EPSO website. The SESAR JU may also recruit Contract Agents from the European Personnel Selection Office - EPSO's reserve lists, for the specific needs here above identified.

Generally vacancies are online for one month. During this time candidates can submit their applications. Exceptionally, this period may be extended. The exact deadline to apply for a job is indicated in each vacancy notice of the selection procedure that provides as well information on the job requirements and the conditions of employment. Candidates are requested to submit their application exclusively by means of a functional email address specific to each vacancy notice.

The SESAR JU is an equal opportunity employer and strongly encourages applications from all candidates who fulfil the eligibility and requirements without any distinction on the grounds of nationality, age, race, gender, political, philosophical or religious conviction or sexual orientation and regardless of disabilities, marital status or other family situation.

Eligibility of candidates is assessed according to compliance with all formal requirements by the closing date for the submission of applications. Eligible candidates whose application shows evidence of all essential selection criteria described in the vacancy notice may be invited for an interview, which is held for the most part in English. During the selection process candidates may be required to undergo a competency assessment exercise.

Candidates invited to an interview are requested to submit, on the day of the interview, a copy of their diploma(s) and evidence of their professional experience, clearly indicating the starting and finishing dates, the function(s) and the exact nature of the duties carried out. However, prior to contract signature, selected candidates are requested to provide SESAR JU with original or certified copies of all relevant documents proving the eligibility requirements.

As a result of the interviews, the Selection Panel recommends the most suitable candidates for the post in question. The list of suitable candidates established by the Selection Panel may also be used for the recruitment for a similar post depending on the needs of the SESAR JU. All candidates are informed by letter about the outcome of the selection procedure. Candidates are informed that inclusion on a reserve list does not guarantee recruitment.

Selection Panel’s work and deliberations are strictly confidential and candidates are informed that any contact with its members is strictly forbidden.

The Executive Director, SESAR JU AIPN, takes the final decision to offer the job to a selected candidate from the reserve list established by the selection panel.

3. Table of 39 positions per area and activity on 31/12/2017:

The table below shows the situation on 31/12/2017, as required by the SPD guidance. It does not include the position of CFO referred to in paragraph 2.6.2 of Section III and in Annex X. This position will be included in the Single Programming Document 2021-2023 which will include the table of 39 positions per area and activity on 31/12/2019.

Activity	Function / Job title	Contract Type/duration	Position entry grade
Executive Director	Executive Director	TA fixed term + renewable	AD 14
TBD (planned as of 2019: Finance and Budget, incl. corporate quality, planning and reporting)	TBD (planned as of 2019: Chief Financial Officer)	TA fixed term + renewable	AD 12
Audit	Internal Audit Capability	TA fixed term + renewable	AD 5
Executive secretariat	Assistant to the Executive Director	TA indefinite (*)	AST 1
Corporate Affairs including corporate support and corporate quality, planning and reporting	Deputy Executive Director Corporate Affairs	TA indefinite (*)	AD 12
	Head of Corporate Support	TA indefinite (*)	AD 7
	Administrative Assistant	TA indefinite (*)	AST 3
	Head of Corporate Quality, Planning & Reporting	TA fixed term + renewable	AD 8
Strategies and relations with ICAO, follow up of MoC with third countries and communication	Chief Strategies & External Relations	TA indefinite (*)	AD 12
	Head of International Affairs	TA fixed term + renewable	AD 10
Relations with different stakeholders and coordination of ED activities	Head of Stakeholders and Institutional Relations	TA fixed term + renewable	AD 10
Communication internal/external, media	Senior Communications & Media Relations Officer	TA fixed term + renewable	AD 5
Implementation of the day-to-day communication strategy	Communications & Events Officer	TA fixed term + renewable	AD 5

Development & delivery, Release and validation	Head of Release Management & Validation	TA fixed term + renewable	AD 7
Development & delivery, grant management and development framework	Call Coordinator	TA fixed term + renewable	AD 9
	Grant Manager	TA fixed term + renewable	AD 6
	Grant Manager	TA fixed term + renewable	AD 6
	Grant Manager	TA fixed term + renewable	AD 6
	Administrative Assistant – Expert Coordinator	TA fixed term + renewable	AST 1
	ATM Architecture Framework Expert	TA fixed term + renewable	AD 5
ATM	Chief ATM	TA fixed term + renewable	AD 10
	ATM Expert – Architecture & Systems Engineering	TA fixed term + renewable	AD 8
	ATM Expert - Airport & Airspace User Operations	TA fixed term + renewable	AD 6
	ATM Expert - TMA, En-route & Network Operations	TA fixed term + renewable	AD 6
	ATM Expert - CNS & Avionics	TA fixed term + renewable	AD 5
AU relations, business case, Master Planning	Chief Economist & Master Planning	TA indefinite (*)	AD 10
Digital transformation and innovation	Manager Digital Transformation & Innovation	TA fixed term + renewable	AD 8
General administration, Finance, legal and HR	Chief Administration Affairs	TA fixed term + renewable	AD 12
Project Audit	Project Auditor	TA fixed term + renewable	AD 5
Finance and Budget Coordination and responsibility for the follow up of the SESAR JU Budget	Head of Finance & Budget	TA fixed term + renewable	AD 8
Accounting	Deputy Accounting Officer	TA fixed term + renewable	AST 5
Financial administration and budget	Financial Officer	TA fixed term + renewable	AD 6
	Financial and Budget Officer	TA fixed term + renewable	AD 5

Legal Affairs and Contract	Head of Legal Affairs and Procurement	TA indefinite (*)	AD 8
Procurement procedures, personal data protection, day-to-day legal issues	Legal & Procurement Officer, Data Protection Officer	TA fixed term + renewable	AD 5
	Legal & Procurement Officer	TA fixed term + renewable	AD 5
	Legal & Procurement Officer	TA fixed term + renewable (**)	AST 3
HR Legal matters	HR Legal Officer	TA fixed term + renewable (**)	AD 7
Recruitment, HR Administration, staff development	HR Officer	TA indefinite (*)	AST 7

Table 47: List of the 39 SESAR JU positions (31/12/2017)

(*) Staff member eligible to Transitional Provisions Article 2 of Council Regulation (EC) 1361/2008 (8 staff)

(**) Positions currently covered by a CA indefinite duration contract. These staff members are not additional to the 39 posts included in the Staff Establishment Plan approved by the Administrative Board of the SESAR Joint Undertaking, but they are contractual forms used by the SESAR JU to fill in specific positions taking into consideration the needs and expertise requested. The same is applicable for the staff seconded by the Members to the SESAR JU, in accordance with Article 8 of the SESAR JU Statutes.

B. Appraisal of performance and reclassification/promotions

Reclassification of temporary staff/promotion of officials

Category and grade	Staff in activity at 1.01.2016		How many staff members were promoted / reclassified in Year N-1 (2017)		Average number of years in grade of reclassified / promoted staff members
	officials	TA	Officials	TA	
AD 16					
AD 15					
AD 14		1		1	N/A
AD 13					
AD 12		3			
AD 11		1			
AD 10		3			
AD 9		2			
AD 8		5		1	6,3
AD 7		4		1	3
AD 6		9		2	3
AD 5		1		1	3
Total AD		29			
AST 11					
AST 10					
AST 9					
AST 8		1			
AST 7					
AST 6		1		1	4
AST 5					
AST 4					
AST 3		2			
AST 2					

Category and grade	Staff in activity at 1.01.2016		How many staff members were promoted / reclassified in Year N-1 (2017)		Average number of years in grade of reclassified / promoted staff members
	officials	TA	Officials	TA	
AST 1		1			
Total AST		5			
AST/SC1					
AST/SC2					
AST/SC3					
AST/SC4					
AST/SC5					
AST/SC6					
Total AST/SC					
Total		32		7	

Table 48: Reclassification of temporary staff/promotion of officials

Reclassification of contract staff

Function Group	Grade	Staff in activity at 1.01.2016	How many staff members were reclassified in Year N-1 (2017)	Average number of years in grade of reclassified staff members
CA IV	18			
	17			
	16			
	15	2	1	4
	14	1		
	13	0		
CA III	12			
	11			
	10			
	9			
	8			

CA II	7			
	6			
	5			
	4			
CA I	3			
	2			
	1			
Total		**3**	**1**	**4**

Table 49: Reclassification of contract staff

Since 2012, an individual development review is launched at the beginning of the year for a given year, laying down the objectives and the performance of the staff member in relation to the Work Programme and the tasks related to the staff member's job description. A career Development Report (CDR) is carried out on the basis of the Appraisal guide that is published at the beginning of the exercise. Currently, all TA's and CA's are going through the annual appraisal of performance as described in the ADB Decisions (D)14-2017 and (D)15-2017 both adopted on 11 September 2017..

C. Mobility policy (internal mobility, between EU Bodies and between EU Bodies and the institutions)

1. Mobility within the SESAR JU

Vacancy notices are accessible internally as well as externally and staff members are always given the opportunity to apply.

2. Mobility among Union agencies

Following the adoption of the "Decision laying down general implementing provisions on the procedure governing the engagement and use of temporary staff under Article 2(f) of the CEOS", ADB Decision (D)06-2016, the SESAR JU staff can benefit of mobility between the agencies.

3. Mobility between the SESAR JU and the Institutions

The SESAR JU has currently no post occupied by an official from an Institution[56]; nevertheless, where appropriate the SESAR JU can consider favouring mobility with the Institutions.

D. Gender and geographical balance

[56] There is one temporary agent (Liaison Officer) who is in secondment from the European Commission in its own interest respectively for 4 years.

Since its establishment, the SESAR JU has ensured equal opportunities for staff and has done its best to attract specialised technical staff of the highest calibre. The equal opportunities policy is applied to recruitments in order to secure gender and geographical balance in a domain of operations that appears to be highly unbalanced.

Geographical balance is regularly sought in accordance to Article 27 of the Staff Regulations and 12 and 82(1) of the Conditions of Employment of Other Servants; bearing in mind the small size of the SESAR JU, that search for the best qualified staff for the vacant post will be the first priority.

To date, the SESAR JU has not noted any significant gender and geographical imbalance in its staff. At 31/12/2017, the Establishment Plan (i.e. including TAs and CAs) is as follows:

Nationalities	#	Of which women
Belgium	6	3
Bulgaria	1	0
Czech	1	1
France	5	3
Greece	1	1
Germany	1	0
Italy	3	3
Ireland	2	2
Lithuania	1	1
Netherlands	3	2
Portugal	1	1
Spain	5	3
Sweden	1	0
UK	5	1
TOTAL	**36**	**21**

Table 50: Gender and geographical balance

Gender/Grade	Male	Female	Total
AD	14	15	29
AST	1	6	7
Total	**15**	**21**	**36**
AD	39%	42%	81%
AST	2,5%	16,5%	19%
Total	**41,5%**	**58,5%**	**100%**

Table 51: Grade vs. gender balance (excluding 3 Seconded National Experts)

E. Schooling

European Schools in Brussels should cover the SESAR JU staff needs in this respect, for the staff currently eligible.

Annex V: Buildings (table)

The SESAR JU has already established its location in Brussels through the rental of suitable office accommodation and ancillary space secured for the duration of the extended SESAR JU. There is no plan to acquire any property or buildings in the future.

Current building(s):

	Name, location and type of building	Other Comment
Information to be provided per building:	Avenue de Cortenbergh 100 – 1000 Brussels	Joint occupancy building with non-EU bodies.
Surface Area (m2)	1828	
Surface Area (m2): Office space	1765	
Surface Area (m2): Non-Office space	63	There are an additional 28 Car Parking Spaces (not measured in surface area)
Annual rent (in EUR)	427 925	Excluding gratuities and other reductions
Type and duration of rental contract	9 year lease from 2016	With Diplomatic Clause for rupture of rental contract with 6 months' notice.
Host country grant or support	N/A	
Present value of the building	N/A	

Table 52: Buildings

Building projects in planning phase: n/a.
Building projects submitted to the European Parliament and the Council: n/a.

Annex VI: Privileges and Immunities (table)

Agency privileges	Privileges granted to staff	
	Protocol of privileges and immunities / diplomatic status	Education / day care
VAT exemption as of 16.10.2008, Administrative Agreement with the Belgian Authorities since 30.03.2009	Protocol of Privileges and Immunities applicable to staff with regard to VAT.	N/A

Annex VII: Evaluations

The SESAR Joint Undertaking was subject to two evaluations in 2017. One concerned the closure of the SESAR 1 Programme (Final Evaluation of SESAR 1: 2007-2016), while the second focused on the ongoing research activities under the SESAR 2020 Programme (Interim Evaluation of SESAR 2020: 2014-2020). The reports are based on the work of independent experts and the results of a stakeholder consultation.

Overall, the SESAR JU managed to complete over 300 projects, 350 validation exercises leading to 63 SESAR Solutions which are currently being deployed in EU in order to maintain high safety levels and improve cost and environmental efficiency of air traffic management in Europe.

The reports clearly show that SESAR, which has already been active for 10 years, is delivering on its objectives, helping to overcome fragmentation and create continuity of research goals. The commitment of the members is evident and there are high expectations for its outputs. At the same time, the evaluation reports outline a series of elements on which the future work of SESAR should focus upon.

Overall, the results of the interim evaluations of all public-private and public-public partnerships supported by Horizon 2020 concluded that Research partnerships between the EU, the private sector and the Member States are on track to deliver their objectives, improving people's lives, and boosting Europe's international competitiveness.

The full report on the final evaluation of SESAR 1 and the interim evaluation of SESAR 2020 Programme can be found here: https://ec.europa.eu/transport/transport-modes/news/2017-10-10-transport-join-undertakings-are-delivering-expected-results_en.

The full H2020 evaluation can be found here:
http://ec.europa.eu/research/evaluations/index_en.cfm?pg=h2020evaluation

Annex VIII: Risk Management in 2019

During 2017, following an audit from the IAS, the previous Risk Management Policy has been entirely revisited to be better aligned with the specificities of the SESAR 2020 Programme. In February 2017, the SESAR JU Executive Director adopted the new 'SESAR JU Risk Management Policy' (SESAR JU/ED/613). This decision repeals the 'Internal Control Framework and Risk Management Policy' (SESAR JU/ED/ 64) and the 'Risk, Issue and Opportunity Management Process' (SESAR JU/ED/305) both applicable at the time of the audit. The policy addresses 4 threads of risks: Corporate risks, Master Plan risks, SESAR JU internal risks and SESAR 2020 Programme Risks. In addition to this new Risk Management Policy, in May 2017, the SESAR JU formalised in the context of its Quality Management Process, 'the Corporate Risk Management Process' (SESAR JU Business Process no 14.2).

The revised SESAR JU Corporate Risk Management better integrates the bottom-up approach with the top-down approach. Indeed, the bottom-up approach comprises the risk management performed by SESAR 2020 participants who identify and manage risks at project level while Programme Managers are in charge of identifying and monitoring the critical risks at the programme level. The top-down approach consists in an analysis of risks linked to strategic objectives.

Care has been taken to streamline the current approach to reduce disproportionate requirements and to increase the focus on the management of **critical risks** defined as a risk that:

- endanger the realisation of objectives outlined in the European ATM Master Plan;
- cause serious damage to the SESAR partners (SESAR JU Members, broader stakeholder community involved in the execution of the European ATM Master Plan);
- result in critical intervention at political level (European Commission/European Council/European Parliament) regarding SESAR JU's performance;
- result in infringement of laws and regulations;
- result in misuse of public money;
- put the safety levels of aviation at stake;
- or in any way seriously impact the SESAR JU's image and reputation.

Ref.	Risk description	Criticality	Risk owner	Impact on SESAR JU Objectives 2019	Mitigation actions
CORP01	R&D activities do not deliver solutions allowing to reach expected ATM performance	High	SESAR JU		- Launch Wave 2 projects in 2019
CORP03	IOP solution supporting the PCP and developed in SESAR 2020 may not be delivered on time for deployment	High	SESAR JU	Delivery of Wave 1 project results (sol candidate SESAR Solution PJ.18-02b)	- Continuous close monitoring of the progress by a PC dedicated Decision Team (supported by an Analysis Team at technical level); this set-up established at end of SESAR 1 to secure recovery towards PCP objective will continue its operations until final solution delivery defining specific actions to be put in place when necessary
CORP05	The SESAR JU may not be able to take up new challenges due to limited HR capabilities	High	SESAR JU	- Support to the European Commission on the technological pillar of SES - Strengthened Global Interoperability activities (ICAO, US FAA/NextGen etc.) - Active cooperative arrangements with actors in Aviation	- Assess gaps in required skills linked to new or known coming tasks and plan actions sufficiently in advance to let time to acquire new skills - Secure resources for SESAR JU core business
CORP06	The BREXIT may have an impact on SESAR JU objectives	High	European Commission	All objectives linked to SAoO 2, 3 and 4 and to a limited extent SAoO 5	- Mitigations actions will be stemming from decisions and actions from the European Commission's tasks force.
MP08	The lack of R&D activities to cover U3/U4 developments beyond 2019 may endanger the realisation of MP objectives	High	European Commission, SESAR JU	Support to the European Commission on the technological pillar of SES	Include a topic on U-space in the coming open calls (ER4 and VLD)

Table 53: Main SESAR JU risks and related actions

Annex IX: Procurement plan for 2019

As per Article 110 of the EU Financial Regulation, "a budgetary commitment shall be preceded by a financing decision adopted by the Union institution or by the authority to which powers have been delegated by the Union institution". This financing decision, which at the same time constitutes the annual or multiannual work programme, shall in particular set out certain essential elements for an action involving expenditures from the budget for procurement and prizes.

Note: In accordance with Art. 110 (5) of the EU Financial Regulation and the principle of sound financial management, the SESAR JU Authorising Officer may decide to make non-substantial changes and amend the indicative budget and/or timing identified above for a given procurement procedure if this allows for an improved adherence to SESAR JU objectives. A change of more than 20 % in the volume of appropriations, introduction of a new action or other changes affecting the political choices in the SPD are to be considered as substantial.

Operational expenditure

The maximum global budgetary envelope reserved for procurements covered by operational appropriations is EUR 2.502.396 in 2019.

Strategic Area of Operation #1 – Provide Strategic Steering to the SESAR programme

Reference	Budget line	Procurement area	Procurement description	Target signature date	Total est. budget (EUR)	Type of contract / procedure	Comments
Op.1.1.	B03400	ATM expertise	New Framework Contract (optional)	Q2-Q3 2019	n.a.	Framework Contract / Open call for Tender	New call for tender– EUR 1 000 000 as maximum budget Specific Contracts. Optional in case the SESAR JU finds it necessary and there is no alternative means to provide the SESAR JU with such expertise.
Op.1.2.	B03400	ATM expertise	Implementation of FWC for 2019 – SC1 (optional)	Q3 2019	125.000	Specific contract under SJU Framework Contract	Optional in case the SESAR JU finds it necessary and there is no alternative means to provide the SESAR JU with such expertise.
TOTAL for Strategic Area of Operation #1 – Provide Strategic Steering to the SESAR programme					**125.000**		

Strategic Area of Operation #2 – Deliver Exploratory Research

Reference	Budget line	Procurement area	Procurement description	Target signature date	Total est. budget (EUR)	Type of contract / procedure	Comments
Op.2.1.	B03800	Young Scientist Award	Award to a young scientist for exceptional achievements in the field of the ATM research	Q4 2019	5.000	Prize	
TOTAL for Strategic Area of Operation #2 – Deliver Exploratory Research					**5.000**		

Strategic Area of Operation #5 - Deliver SESAR Outreach

Reference	Budget line	Procurement area	Procurement description	Target signature date	Total est. budget (EUR)	Type of contract / procedure	Comments
Op.5.1.	B03800	Professional Staff Organisations support Lot 1	Implementation of FWC for 2019	Q1 2019	60.000	Specific contract under SJU Framework Contract	
Op.5.2.	B03800	Professional Staff Organisations support Lot 2	Implementation of FWC for 2019	Q1 2019	60.000	Specific contract under SJU Framework Contract	
Op.5.3.	B03800	Professional Staff Organisations support Lot 3	Implementation of FWC for 2019	Q1 2019	60.000	Specific contract under SJU Framework Contract	
Op.5.4.	B03800	Professional Staff Organisations support Lot 4	Implementation of FWC for 2019	Q1 2019	60.000	Specific contract under SJU Framework Contract	
Op.5.5.	B03800	Professional Staff Organisations support Lot 5	Implementation of FWC for 2019	Q1 2019	60.000	Specific contract under SJU Framework Contract	
Op.5.6.	B03800	Airspace Users Lot 1	Implementation of FWC for 2019 – SC3	Q2 2019		Specific contract under	

Reference	Budget line	Procurement area	Procurement description	Target signature date	Total est. budget (EUR)	Type of contract / procedure	Comments
					2.072.396,50	SJU Framework Contract	
Op.5.7.	B03800	Airspace Users Lot 2	Implementation of FWC for 2019 – SC3	Q2 2019		Specific contract under SJU Framework Contract	
Op.5.8.	B03800	Airspace Users Lot 3	Implementation of FWC for 2019 – SC3	Q2 2019		Specific contract under SJU Framework Contract	
Op.5.9.	B03800	Airspace Users Lot 4	Implementation of FWC for 2019 – SC3	Q2 2019		Specific contract under SJU Framework Contract	
Op.5.10.	B03800	Airports expertise support	Implementation of FWC for 2019 – SC4	Q1 2019		Specific contract under SJU Framework Contract	
TOTAL for Strategic Area of Operation #5 - Deliver SESAR Outreach					**2.372.396,50**		

Table 54: Main procurement activities to be conducted in 2019 covered by operational appropriations

Administrative expenditure

Although not necessary in the case of administrative appropriations, SESAR JU decided to identify below its main Administrative Support Expenditures for transparency purposes. This list is for information purposes only and non-exhaustive.

Strategic Area of Operation #5 - Deliver SESAR Outreach

Reference	Procurement area	Procurement description	Target signature date	Total est. budget (EUR)	Type of contract / procedure	Comments
Ad.5.1.	Realisation and PR activities/material Lot 2 (Digital communication)	Implementation of FWC SC 5	Q1 2019	35.000	Specific contract under SJU Framework Contract	
Ad.5.2.	Realisation and PR activities/material Lot 3 (Event Support)	Implementation of FWC SC10	Q1 2019	90.000	Specific contract under SJU Framework Contract	
Ad.5.3.	Realisation and PR activities/material Lot3 (Event Support)	Implementation of FWC SC11	Q1 2019	30.000	Specific contract under SJU Framework Contract	
Ad.5.4.	Digital Communication, Event Support and other PR activities/ material	Realisation and PR activities/material – New Framework Contract	Q2 2019	n.a.	SJU Framework Contract / Open call for tender	New call for tender – EUR 1.454.000 as maximum budget to be implemented through Specific Contracts
Ad.5.5.	Digital Communication, Event Support and other PR activities/ material	Realisation and PR activities/material – SC under new FWC	Q2 2019	70.000	Specific contract under SJU Framework Contract	Implementation of new FWC
Ad.5.6.	Digital Communication, Event Support and other PR activities/ material	Realisation and PR activities/material – SC under new FWC	Q3 2019	70.000	Specific contract under SJU Framework Contract	Implementation of new FWC
Ad.5.7.	Digital Communication, Event Support and other PR activities/ material	Realisation and PR activities/material – SC under new FWC	Q4 2019	70.000	Specific contract under SJU Framework Contract	Implementation of new FWC

Reference	Procurement area	Procurement description	Target signature date	Total est. budget (EUR)	Type of contract / procedure	Comments
Ad.5.8.	Digital Communication, Event Support and other PR activities/ material	Realisation and PR activities/material – SC under new FWC	Q4 2019	70.000	Specific contract under SJU Framework Contract	Implementation of new FWC
TOTAL for Strategic Area of Operation #5 - Deliver SESAR Outreach				**435.000**		

Strategic Area of Operation #6 – Deliver effective financial, administrative and corporate management

Reference	Procurement area	Procurement description	Target signature date	Total est. budget (EUR)	Type of contract / procedure	Comments
Ad.6.1.	Works and repairs	Realisation of works and repairs in SJU premises (including flooring)	Q3 2019	60.000	Direct Service Contract - Negotiated call for tender	New call for tender
Ad.6.2.	Facility Coordination	Facility services for maintenance and renovation	Q1-Q4 2019	100.000	Specific order forms under SJU Framework Contract	
Ad.6.3.	Facility Coordination	Security audit on level of compliance of SJU premises with relevant security rules and security notices	Q1 2019	20.000	Direct Service Contract - Negotiated call for tender	LSO obligation to carry out checks on compliance with the relevant security rules and Security Notices
Ad.6.4.	Facility Coordination	Supply, installation and replacement of kitchen equipment	Q1 2019	10.000	Specific Contract under the European Commission Framework Contract	
Ad.6.5.	Facility Coordination	Supply, installation and replacement of office equipment	Q3 2019	10.000	Specific Contract under the European Commission Framework Contract	
Ad.6.6.	IT System maintenance and	ICT communications - Testa-NG II	Q4 2019	20.000	Specific Contract under the European Commission Framework Contract	

Reference	Procurement area	Procurement description	Target signature date	Total est. budget (EUR)	Type of contract / procedure	Comments
	unified Communication					
Ad.6.7.	ICT - Software	ICT software - Microsoft suite	Q2 2019	20.400	Specific Contract under the European Commission Framework Contract	
Ad.6.8.	ICT - Software	ICT software - Adobe Maintenance renewal	Q4 2019	11.220	Specific Contract under the European Commission Framework Contract	
Ad.6.9.	ICT - Software	ICT software - VMware Maintenance renewal	Q4 2019	2.040	Specific Contract under the European Commission Framework Contract	
Ad.6.10.	ICT coordination	ICT coordinator services – transitional period	Q1 2019	15.000	Direct Service Contract - Negotiated call for tender	New call for tender.
Ad.6.11.	ICT coordination	ICT coordinator services	Q1 2019	994.500	Direct Service Contract - Open call for tender	New call for tender. Maximum 4 years contract duration.
Ad.6.12.	ICT advice	ICT advice, benchmarking and consulting services (ABC III)	Q1 2019	65.000	Specific Contract under the European Commission Framework Contract	
Ad.6.13.	Legal Support	Legal support to be required on a case-by-case basis	Q2 2019	20.000	Service Contract / Open call for tender	New call for tender
Ad.6.14.	Quality Management	Maintenance Contract for I-DMS and/or purchase of a third party tool	Q1 2019	50.000	Specific Contract under the European Commission Framework Contract and/or Direct Contract	
Ad.6.15.	Mission coordination	Travel agency service including transaction fees	Q2 2019	100.000	Service contract / European Commission Open Joint procurement procedure	4 years contract duration
Ad.6.16.	Mission coordination	Set-up and maintenance fee for the on-line booking tool (optional)	Q3 2019	200.000	Direct Service Contract - Negotiated call for tender	New call for tender. 4 years contract duration. Only applicable if not provided through Travel agency services.

Reference	Procurement area	Procurement description	Target signature date	Total est. budget (EUR)	Type of contract / procedure	Comments
Ad.6.17.	Data protection	Data protection support and development of an online register	Q2-Q3 2019	8.000	Service Contract – Middle value negotiated procedure	Renewable every year, maximum until the end of 2024. Joint procurement procedure, led by Shift to Rail JU, with a total of 7 EU Joint Undertakings participating. The total value of the procedure is EUR 144.000 for the whole duration of the contract.
TOTAL for Strategic Area of Operation #6 – Deliver effective financial, administrative and corporate management				**1.706.160**		

Table 55: Main procurement activities to be conducted in 2019 covered by administrative appropriations

Annex X: 2019 SESAR JU Organisation Chart

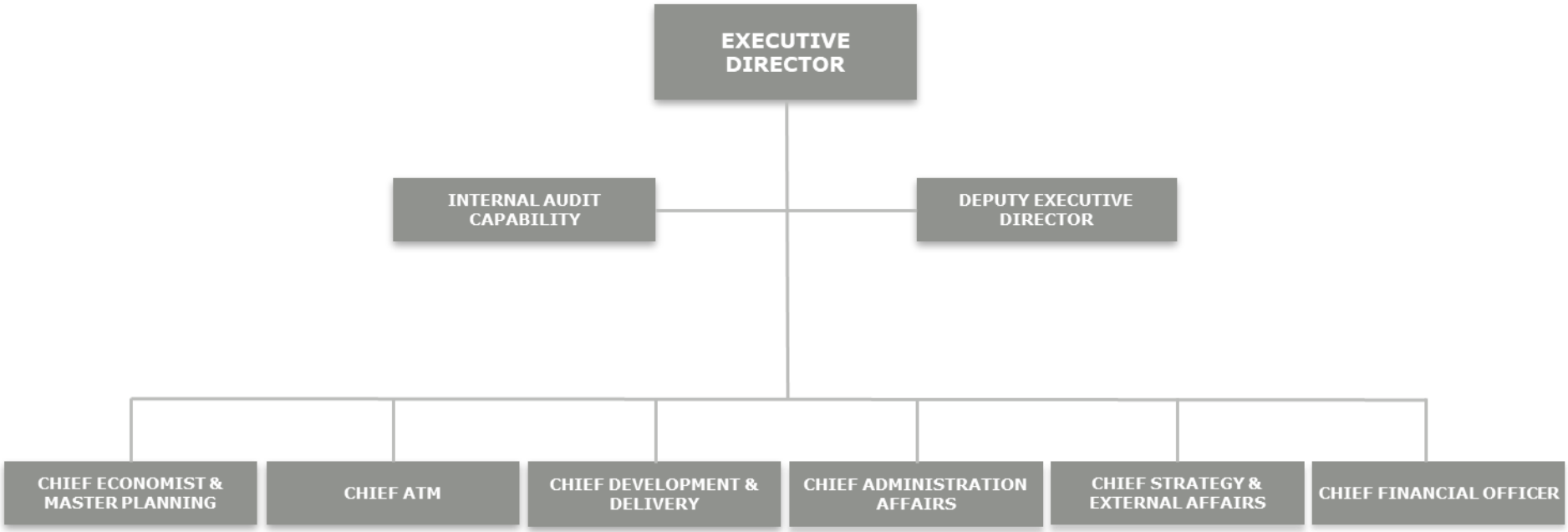

Figure 17: SESAR JU Organisation chart as at 06/06/2019

Annex XI: List of Members of the SESAR Joint Undertaking

The SESAR JU Members and their respective constituent entities are listed below:

	Name of Member	Constituent Entities	Country
	The European Union, represented by the European Commission (Founding Member)		
	EUROCONTROL, the European Organisation for the Safety of Air Navigation, represented by its Agency (Founding Member)	Single Entity	
	Airbus SAS	Single Entity	FR
	AT-One Consortium	Deutsches Zentrum für Luft-und Raumfahrt e. V. (German Aerospace Center, DLR)	DE
		Stichting Nationaal Lucht- en Ruimtevaartlaboratorium (National Aerospace Centre, NLR)	NL
	B4 Consortium	POLSKA AGENCJA ŻEGLUGI POWIETRZNEJ, the Polish Air Navigation Services Agency: (PANSA)	PL
		RIZENI LETOVEHO PROVOZU CESKE REPUBLIKY STATNI PODNIK, the Air Navigation Services of the Czech Republic: (ANS CR)	CZ
		Letové prevádzkové služby Slovenskej republiky, štátny podnik: (LPS SR s.p.) – State owned ANSP of Slovakia	SK
		Valstybes imone 'Oro navigacija', the State Enterprise 'Oro Navigacija' (ON) – State owned ANSP of Lithuania	LT
	COOPANS Consortium	Naviair	DK
		Irish Aviation Authority: (IAA)	IE
		Croatia Control, Croatian Air Navigation Services ltd: (CCL)	HR
		Austro Control Österreichische Gesellschaft für Zivilluftfahrt mbH: (ACG)	AT
		Luftfartsverket: (LFV)	SE
	Dassault Aviation SA	Single Entity	FR
	DFS Deutsche Flugsicherung GmbH: (DFS)	Single Entity	DE
	République Française, Ministère de L'écologie, du Développement Durable, et de L'Energie,	Single Entity	FR

	acting via Direction Générale de L'Aviation civile, represented by Direction des Services de la Navigation Aérienne: (DSNA)		
	ENAV S.p.A	Single Entity	IT
	Entidad Pública Empresarial ENAIRE	Single Entity	ES
	Frequentis SESAR Partners (Consortium)	Frequentis AG	AT
		Hungarocontrol Zrt (HC)	HU
		Atos Belgium SA/NV	BE
	Honeywell Aerospace SAS	Single Entity	FR
	INDRA Sistemas, S.A.	Single Entity	ES
	Leonardo	Single Entity	IT
	NATS (En Route) Plc	Single Entity	GB
	North European ATM Industry Group NATMIG Consortium	Stiftelsen SINTEF	NO
		Saab AB	SE
		Airtel ATN Ltd.	IE
	SESAR European Airports Consortium (SEAC 2020)	Heathrow Airport Limited	GB
		Aéroports de Paris S.A.	FR
		Flughafen München GmbH	DE
		Flughafen Zürich AG	CH
		Schiphol Nederland B.V.	NL
		Swedavia AB	SE
		Avinor AS	NO
	Skyguide, Swiss civil and military Air Navigation Services Ltd	Single Entity	CH
	Thales Air Systems SAS	Single Entity	FR
	Thales Avionics SAS	Single Entity	FR

Table 56: List of SESAR JU Members

Annex XII: Results of closed projects under the SESAR 2020 Programme

Projects under the ER1 call for proposals

The 28 ER1 projects have delivered the following results until mid-2018 and are now closed:

ATM Excellent Science & Outreach[57]

Topic Project reference	Project results	Max. total co-financing value (in EUR)
Automation, Robotics and Autonomy		
AUTOPACE	**AUTOPACE** (Automation pace) proposes research on a Psychological Model to quantitatively predict how automation would impact human performance based on cognitive resources modelling, tasks characteristics (automation) and psychological factors modelling.	EUR 599.868
TACO	**TACO** (Take control) aims to define an automated system sufficiently powerful to both accomplish complex tasks involved in the management of surface movements in a major airport and self-assess its own ability to deal with non-nominal conditions. When needed, such system should be sensitive enough to transfer responsibilities for traffic management back to the controller, in a timely and graceful manner and in way that makes him/her comfortable with the inherited tasks.	EUR 599.993
AGENT	**AGENT** (Adaptive self-Governed aerial ecosystem by negotiated traffic) seeks to implement a new framework extending the functionalities of TCAS to act at pre-operational and at operational level as a robust collision avoidance system for different context scenarios in which human behaviour and automatism interdependencies will be considered with realistic aircraft performances.	EUR 598.750
STRESS	**STRESS** (Human performance neurometrics Toolbox for highly automated systems design) project will explore human performance in highly automated systems, in order to provide new knowledge and guidelines needed for the design and implementation of higher levels of automation, with the related procedures and humans' roles. For doing that, the project will collect technologies and methods already validated in non ATM sectors and apply them in realistic future ATM scenarios.	EUR 596.875

[57] The ER research topics 'ATM role in intermodal transport' and 'CNS for ATM' were not covered in the ER1 call

Topic Project reference	Project results	Max. total co-financing value (in EUR)
MINIMA	**MINIMA** (Mitigating negative impacts of monitoring high levels of automation) will research new human-automation interaction design concepts.	EUR 582.780
Complexity, Data Science and Information Management		
BigData4ATM	**BigData4ATM** (Passenger-centric big data sources for socio-economic and behavioural research in ATM) will investigate how ATM and aviation data can be analysed and combined with more traditional demographic, economic and air transport databases to extract relevant information about passengers' behaviour and use this information to inform ATM decision-making processes.	EUR 599.733
DART	**DART** (Data-driven aircraft trajectory prediction research) explores the applicability of data science and complexity science techniques to the ATM domain. It will investigate on the suitability of applying big data techniques for predicting multiple correlated aircraft trajectories based on data driven models and accounting for ATM network complexity effects.	EUR 598.524
MALORCA	**MALORCA** (Machine learning of speech recognition models for controller assistance) proposes a general, cheap and effective solution to automate re-learning, adaptation and customisation process to new environments, taking advantage of the large amount of speech data available in the ATM world.	EUR 538.104
BEST	**BEST** (Achieving the benefits of SWIM by making smart use of semantic technologies) will determine how semantic technologies can be used effectively to maximise the benefits of adopting system-wide information management.	EUR 593.129
Environment & Meteorology		
TBO-MET	**TBO-MET** (Meteorological uncertainty management for trajectory-based operations) will address the problem of analysing and quantifying the effects of meteorological uncertainty in Trajectory-based operations (TBO).	EUR 488.750
ATM4E	**ATM4E** (Air traffic management for environment) will explore the scope for the potential reduction of air traffic environmental impacts in European airspace on climate, air quality and noise through optimisation of air traffic operations.	EUR 599.625

Topic Project reference	Project results	Max. total co-financing value (in EUR)
PNOWWA	**PNOWWA** (Probabilistic nowcasting of winter weather for airports) will produce methods for the probabilistic short-term forecasting of winter weather and enable the assessment of the uncertainty in the ground part of 4D trajectories.	EUR 597.500
Performance, Economics, Legal & Regulation		
COCTA	**COCTA** (Coordinated capacity ordering and trajectory pricing for better-performing ATM) proposes coordinated economic measures aiming to pre-emptively reconcile air traffic demand and airspace capacity. The project primarily aims to reduce the cost arising from lack of coordination in the ATM system, stemming both from divorced planning horizons of ANSPs and aircraft operators (AOs), and from an inadequate pricing of navigation services.	EUR 534.158
Vista	**Vista** (Market forces trade-offs impacting European ATM performance) will examine the effects of conflicting market forces on European performance in ATM, through the evaluation of impact metrics on four key stakeholders and the environment.	EUR 599.188
COMPAIR	**COMPAIR** (Competition for air traffic management) will investigate how to introduce competitive incentives in the ATM sector so as to best contribute to the achievement of the European high-level policy objectives for aviation.	EUR 599.804

ATM application-oriented research

Key Feature Project reference	Project results	Max. total co-financing value (in EUR)
 **High-performing airport operations**		
MOTO	**MOTO** (the embodied remote tower) will perform research on ATM human performance of using two senses: sight and hearing in the context of remote tower operations. The goal is to enhance human performance, by exploiting other channels than the already overloaded visual channel	EUR 999.000
RETINA	**RETINA** (Resilient Synthetic Vision for Advanced Control Tower Air Navigation Service Provision) project will investigate the potential and applicability of synthetic vision tools and virtual/augmented reality display techniques for the air traffic control service provision by the airport control tower	EUR 949.160

Key Feature Project reference	Project results	Max. total co-financing value (in EUR)
Advanced air traffic services		
Separation Management & Separation Standards		
SALSA	**SALSA** (Satellite-based ADS-B for lower separation minima application) is an exploratory research project relating to multi-source ADS-B system. A multi-source ADS-B system that combines the benefit of all possible type of relays (space, maritime, air or ground based) of ADS-B messages could provide a global surveillance system to overcome the prevailing continuous surveillance constraints in the non-radar airspace (NRA)	EUR 995.064
R-WAKE	**R-WAKE** (Navigation of airborne vehicle with integrated space and atomic signals) will propose a novel concept of APNT for small aircraft that will integrate novel technologies and will merge multiple navigation avionics into one with no major impact on avionics	EUR 997.130
Trajectory-based operations		
OptiFrame	**OptiFrame** (An optimisation framework for trajectory-based operations) will research the application of principles of mathematical modelling and optimisation to optimally configure and assess the performance of the Trajectory Based Operations (TBO) concept. OptiFrame will allow to verify the viability of the TBO concept, to identify the major issues that need to be addressed, and to understand whether, under which conditions, and to what extent the objectives of flexibility of airspace users and predictability of the ATM system can be achieved	EUR 727.501
COPTRA	**COPTRA** (Combining probable trajectories) aims to develop new methods to build the probabilistic traffic prediction by combining the probabilistic trajectories (based on TBO). The main concepts defined, modelled and studied by COPTRA are the notions of probabilistic trajectories and traffic situations	EUR 999.391
PARTAKE	**PARTAKE** (Cooperative departures for a competitive ATM networK service.) will propose a causal model to enhance the potential synergies that could be achieved by exploiting to the maximum extend the gap provided by the strategic decision variables and the operational decision making at flight execution	EUR 985.750

Key Feature Project reference	Project results	Max. total co-financing value (in EUR)
Enabling aviation infrastructure		
NAVISAS	**NAVISAS** (Navigation of airborne vehicle with integrated space and atomic signals) will propose a novel concept of APNT for small aircraft that will integrate novel technologies and will merge multiple navigation avionics into one with no major impact on avionics	EUR 584.979
SAPIENT	**SAPIENT** (Satcom and terrestrial architectures improving performance, security and safety in ATM) project addresses a new innovative application in the field of CNS/ATM system focusing exploitation of the synergies of communications and navigation technologies and the 4D trajectory management concept Note: the SAPIENT project was closed at the end of 2017	EUR 859.500
ATM Operations, Architecture, Performance & Validation (see Chapter 2.1)		
PACAS	**PACAS** (Participatory Architectural Change Management in ATM Systems) will model and analyse changes at different layers of the ATM system to support change management, while capturing how architectural and design choices influence the overall system	EUR 998.355
INTUIT	**INTUIT** (Interactive toolset for understanding trade-offs in ATM performance) will explore the potential of visual analytics, machine learning and systems modelling techniques to improve our understanding of the trade-offs between ATM key performance areas	EUR 998.125
AURORA	**AURORA** (Advanced user-centric efficiency metrics for air traffic performance analytics) will propose advanced metrics to assess the operational efficiency of the ATM system. These new metrics will be developed with the aim of encapsulating the airspace users' operational objectives, considering fuel consumption, schedule adherence and Cost-efficiency of the flights	EUR 829.313

Key Feature Project reference	Project results	Max. total co-financing value (in EUR)
APACHE	**APACHE** (Assessment of performance in current ATM operations and of new Concepts of operations for its holistic enhancement) proposes a new framework to assess European ATM performance based on simulation, optimisation and performance assessment tools that will be able to capture complex interdependencies between KPAs at different modelling scales	EUR 783.838

Table 57: ER1 projects outline (under the call for proposals with reference H2020-SESAR-2015-1)

