SESAR JOINT UNDERTAKING

Single Programming Document for years 2022-2024 (public version)

Edition date:	**29 November 2021**
Edition:	**01.00**
Status:	**Approved**

Abstract

This document is the public version of the Single Programming Document of the SESAR Joint Undertaking (SESAR JU) for the 2022–2024 period.

It provides multiannual (2022 to 2024) and annual (2022) programming components and forms the multiannual and annual work programmes of the SESAR JU. Once adopted, this Single Programming Document will replace the *Single Programming Document 2021–2023* insofar as it refers to the years 2022 and 2023.

FINAL DOCUMENT (PUBLIC)

Founding Members

EUROPEAN UNION EUROCONTROL

SESAR JOINT UNDERTAKING

ISBN 978-92-9216-166-8 doi: 10.2829/710384 MG-04-21-025-EN-N

Contents

Foreword

In support of European policy and legislation, the SESAR Joint Undertaking (SESAR JU), founded by the European Union and EUROCONTROL, is a key enabling organisation for the modernisation of European and global air traffic management (ATM), and the coordination and concentration of all ATM-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 ATM Master Plan ([1]) and with its performance ambition in terms of environmental efficiency, capacity, cost-efficiency and safety. The SESAR JU thus stimulates aviation ecosystem development, generating employment and business opportunities while ensuring the delivery of 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 ATM along the priorities established in the 2020 edition of the European ATM Master Plan and the Airspace Architecture Study ([2]) published in 2019. It continues 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 Sustainable and Smart Mobility Strategy, while providing investors with a sound return on investment. Additionally, the SESAR JU is continuously reinforcing the role of the EU as a global actor in the field of aviation.

The SESAR JU's *Single Programming Document 2022–2024* addresses the final delivery stage of the SESAR 2020 programme, while taking stock of the new challenges emerging from the post-COVID-19 crisis for the aviation domain. This document describes six strategic areas of operation (the ones already described in previous single programming documents) that the SESAR JU will pursue during the outlined programming period. In the period from 2022 to 2024, the SESAR JU will finalise research and investment efforts under the SESAR 2020 Programme through the finalisation and closure of Wave 2, Wave 3, ER4 and VLD Open 2 projects, all closely coupled with the EU's aviation policy. This work will lead to the delivery of the last batch of SESAR solutions in critical domains such as automation support, virtualisation and trajectory-based operations. It will pave the way to future research and innovation activities in the ATM and aviation domains. By continuing these efforts in cooperation with its Members and with other organisations involved in ATM-related research, the SESAR JU will progress towards delivering the research necessary to achieve the performance ambitions set out in the European ATM Master Plan. The period from 2022 to 2024 will also see the completion of work by the current SESAR JU and the establishment of the SESAR 3 Joint Undertaking, when confirmed by the Council (after consultation of the European Parliament).

([1]) SESAR Joint Undertaking, *European ATM Master Plan*, 2020 edition, Publications Office of the European Union, Luxembourg, 2019.

([2]) SESAR Joint Undertaking, *A proposal for the future architecture of the European airspace*, Publications Office of the European Union, Luxembourg, 2019.

While delivering on its strategic objectives, the SESAR JU remains committed to strengthening its effective and efficient organisation by continually improving its processes, procedures, performance and risk management and information and communication technologies infrastructure, as well as by investing in its talented people.

Richard Frizon

Executive Director *ad interim* of the SESAR Joint Undertaking

Document history

Edition	Date	Status	Justification
01.00	29.11.2021	Approved	Version adopted by the Administrative Board

List of acronyms, initialisms and definitions

Acronym	Long name / definition
ADSP	ATM data service provider
AI	artificial intelligence
AIM	aeronautical information management
ANS	air navigation service
ANSP	air navigation service provider
A-PNT	alternative position, navigation and timing
ATC	air traffic control
ATM	air traffic management
ATSU	air traffic system unit
AU	airspace user (civil)
CA	contract agent
CAS	Common Audit Service of the Directorate-General for Research and Innovation of the European Commission
CEF	Connecting Europe Facility
CIC	Common Implementation Centre
CNS	communications, navigation and surveillance
DCB	demand and capacity balancing
DFMC	dual-frequency multi-constellation
DMSC	Delivery Management Sub-Committee
EASA	European Union Aviation Safety Agency
EDA	European Defence Agency
E-TMA	extended TMA (terminal manoeuvring area)
EATMA	European ATM (air traffic management) architecture
EFTA	European Free Trade Association
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
FIR	flight information region
Flightpath 2050	report of the High Level Group on Aviation and Aeronautics Research established by the European Commission in December 2010, setting out a new vision for the aviation sector by 2050
FTE	full-time equivalent (staff)
GANP	Global Air Navigation Plan (from the International Civil Aviation Organization)
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
HR	human resources
IAC	Internal Audit Capability
IALN	Inter Agencies' Legal Network
IAS	Internal Audit Service of the European Commission
ICAO	International Civil Aviation Organization
ICT	information and communication technology
IFR	instrument flight rules
IR	industrial research and validation
JU	joint undertaking
KPA	key performance area
L-DACS	L-band Digital Aeronautical Communications System
LMIG	Legal Mechanism Issue Group
Members	Two founding members of the SESAR JU (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

MoC	memorandum of cooperation
NAPO	Network of Agencies' Procurement Officers
NM	Network Manager
NSA	national supervisory authority
PC	Programme Committee
PMU	Programme Management Unit
QMS	SESAR JU's quality management system
R & I	research and innovation
RBT	reference business trajectory
RPAS	remotely piloted aircraft system
SBAS	satellite-based augmentation system
SES	Single European Sky
SESAR	Single European Sky ATM Research
SESAR 2020	SESAR 2020 innovation R & I 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, being undertaken by the SESAR JU Members and managed by the SESAR JU
SESAR JU	Single European Sky ATM Research Joint Undertaking, established as a joint undertaking within the meaning of Article 187 of the Treaty on the Functioning of the European Union, established under the SESAR JU basic act
SESAR JU basic act	Council Regulation (EC) No 219/2007 of 27 February 2007 (OJ L 64, 2.3.2007, p. 1) on the establishment of a joint undertaking to develop the new generation European air traffic management system (SESAR), as amended by Council Regulation (EC) No 1361/2008 of 16 December 2008 (OJ L 352, 31.12.2008, p. 12) and by Council Regulation (EU) No 721/2014 of 16 June 2014 (OJ L 192, 1.7.2014, p. 1)
SESAR 3 JU	Single European Sky ATM Research 3 Joint Undertaking, established under the new Council Regulation adopted on 19 November 2021, with entry into force on the 30 November 2021.
SNE	seconded national expert
SPD	single programming document
SWIM	system-wide information management
TA	temporary agent
TMA	terminal manoeuvring area
TRL	technology readiness level
UAS	unmanned aerial system

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 operations
UTM	unmanned traffic management
VLD	very large-scale demonstration

Table 1: List of acronyms and definitions

Mission statement

The mission of the Single European Sky ATM Research Joint Undertaking (SESAR JU), created under Article 171 of the Treaty establishing the European Community ([3]), 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), the SESAR JU is responsible for the modernisation of the European ATM system by coordinating and concentrating all relevant ATM research and innovation (R & I) efforts in the EU. The SESAR JU is also responsible for executing the European ATM Master Plan, which provides the basis for reporting by stakeholders and key institutions on the execution of SESAR. It aims to define and develop the next generation of ATM systems capable of ensuring the worldwide safety and fluidity of air transport by 2050. Finally, the SESAR JU is responsible for ensuring international collaboration on ATM modernisation, under the principles established by the European Union (EU).

The figure below depicts the central role of the SESAR JU in driving and coordinating ATM R & I in relation to EU policy.

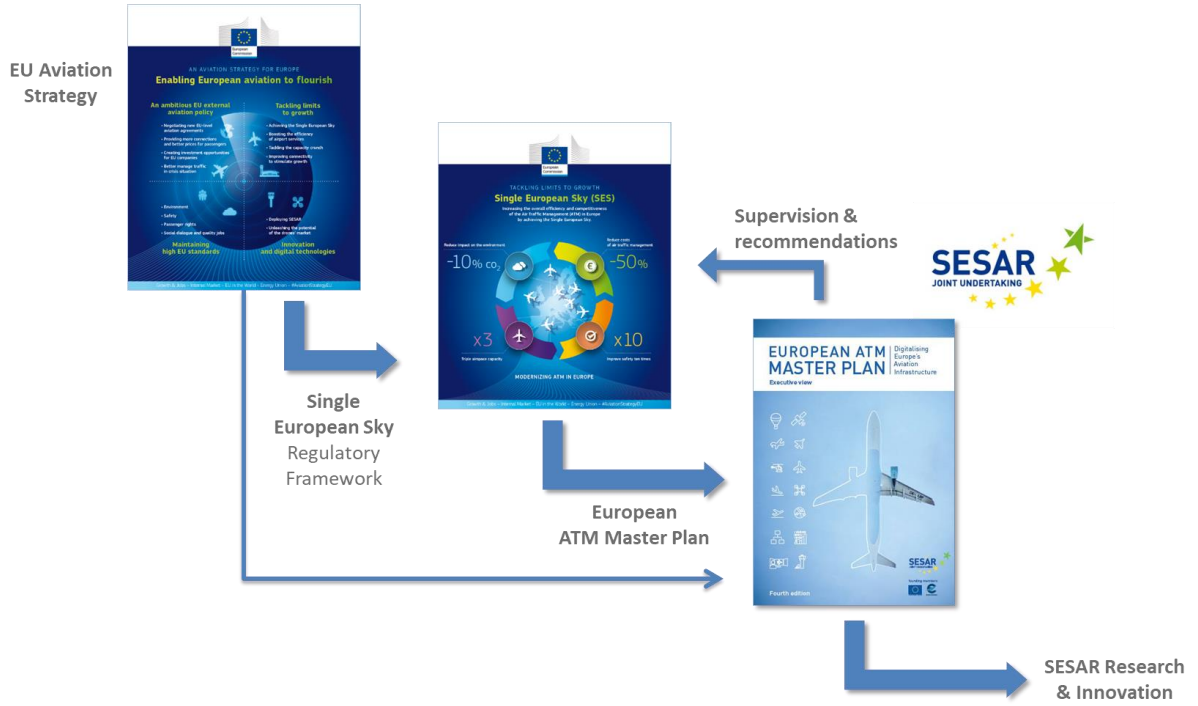

Figure 1: The central role of the SESAR JU in driving and coordinating ATM research in the EU

Founded by the EU and EUROCONTROL, in 2009 the SESAR JU became a Community body. It was initially augmented by 15 stakeholder Members and then in 2016 a further four members acceded to membership, all committing to underpinning the mission of the JU up 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

([3]) Now Article 187 of the Treaty on the Functioning of the European Union (OJ C 202, 7.6.2016), following the entry into force of the Treaty of Lisbon amending the Treaty on European Union and the Treaty establishing the European Community, on 1 December 2009.

military airspace users (AUs), staff associations, academia and research centres. Through these partnerships and further collaboration with staff associations, regulators and the wider scientific community, the SESAR JU unites the skills of more than 3 000 experts to fast-track research, leading to change in European ATM in accordance with the ATM Master Plan while ensuring alignment with the EU Aviation Strategy and the Single European Sky (SES) regulation ([4]).

As an integral part of the SESAR project, the SESAR JU is the technological pillar of the SES policy and contributes to the 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 came from the EU ([5]) (until 2016), and then around an additional EUR 1.6 billion, of which EUR 596.3 million comes from the EU ([6]) (until 2024), the SESAR JU has established a contiguous research 'pipeline to innovation'. This comprises 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 validation (IR) and very large-scale demonstrations (VLDs).

The SESAR JU is linked to the European Commission's mobility and transport policy, and makes a substantial positive contribution to its objectives in terms of 'decarbonisation, digitalisation, investment and people'.

In addition, the SESAR JU operates in close coordination with other European organisations with direct links to the SESAR project, including EUROCONTROL (founding member), the EU Aviation Safety Agency (EASA), the European Organisation for Civil Aviation Equipment (EUROCAE) and the SESAR Deployment Manager.

Vision

The objective of the SESAR JU is to coordinate research that delivers solutions that can modernise European ATM by defining, developing and delivering new or improved technologies and procedures (SESAR solutions).

SESAR's vision builds on the notion of trajectory-based operations and relies on the provision of air navigation services (ANS) in support of the execution of the business or mission trajectory – meaning that aircraft can fly their preferred (optimal performance and environmental) 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 for improved resilience and the use of standardised and interoperable systems. The system infrastructure will gradually evolve with digitalisation technology, allowing ANSPs, irrespective of national borders, to plug in their operations where needed, supported by a range of

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([4]) Regulation (EC) No 549/2004 of the European Parliament and of the Council of 10 March 2004 laying down the framework for the creation of the single European sky (the framework Regulation) (OJ L 96, 31.3.2004, p. 1), as amended by Regulation (EC) No 1070/2009 of the European Parliament and of the Council of 21 October 2009 amending Regulations (EC) No 549/2004, (EC) No 550/2004, (EC) No 551/2004 and (EC) No 552/2004 in order to improve the performance and sustainability of the European aviation system (OJ L 300, 14.11.2009, p. 34).

([5]) The EU's contribution of EUR 700 million up to 2016 was composed of EUR 350 million under the seventh EU framework programme for research and innovation and EUR 350 million under the trans-European transport network programme.

([6]) The EU's contribution of EUR 585 million until 2024 is established under the Horizon 2020 programme. An additional EU contribution of EUR 11.3 million is established under three delegation agreements through which the SESAR JU has been mandated by the European Commission to carry out additional activities in the area of ATM (for details, see point 1.1.3.3 'Funding the innovation pipeline' below).

information services. Airports will be fully integrated into the ATM network level, which will facilitate and optimise airspace user operations and enable efficient links to other modes of transport.

Going beyond 2035 towards 2050, performance-based operations will be implemented across Europe, with multiple options envisaged such as seamless (borderless) coordination between ANSPs or full end-to-end ANS provided at the network level. Furthermore, it is widely recognised that to increase performance, ATM modernisation should look at the flight as a whole, within a flow and network context, rather than at segmented portions of its trajectory as is the case today. With this in mind, the vision will be realised across the entire ATM system, offering improvements at every stage of the flight.

European ATM Master Plan

ATM is a critical element in the European air transport value chain and is key to connecting regions and making Europe a global hub for mobility and prosperity. ATM modernisation therefore needs to reflect a greater focus on increased efficiency and effectiveness while sustaining or even improving the levels of safety, security and environmental performance. At the same time, it must also recognise the need to provide solutions to address critical capacity bottlenecks.

Within the framework of the EU Aviation Strategy and of the SES, the European ATM Master Plan is the main planning tool for defining the SESAR project. The Master Plan defines the vision and the objectives of the SESAR project, ensuring that priorities and commitments made for SESAR development and deployment activities remain strongly connected to the EU's policy priorities.

All SES R & I activities (ER, IR, VLDs) are carried out in line with the ambitions in the European ATM Master Plan. The Master Plan is an evolving roadmap that also builds on SESAR results and solutions and on a strong collaboration between all European ATM stakeholders, beyond the Members of the SESAR JU. Not only does it set out a high-level view of actions needed to deliver a high-performing ATM system and, ultimately, a 'digital European sky', it also explains why and by when. The critical path towards the vision of a digitalised aviation infrastructure is based on a few key components that are presented in Figure 2.

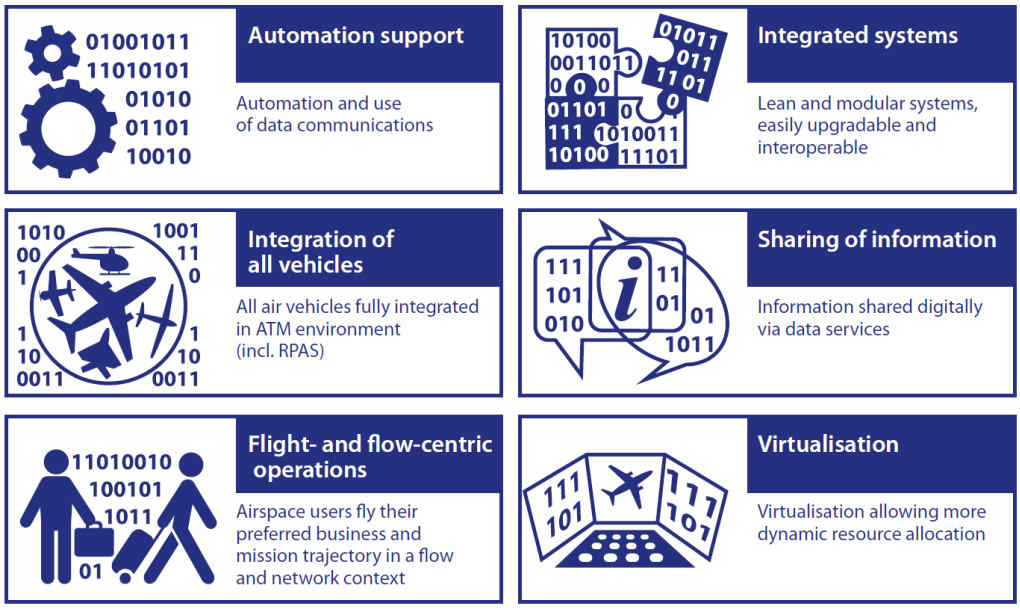

Figure 2: Components of the SESAR vision

The 2020 edition of the Master Plan is the fourth edition of that document. It developed an ambitious vision for the future of SESAR, as described below.

- It describes for the first time the vision beyond the existing SESAR 2020 Programme. It explains the ambition for SESAR 2020 delivery, by when and for what benefits. Beyond this, it also describes what will still be needed to achieve the ultimate goal of a fully digitalised aviation infrastructure; delivering by 2040 a fully scalable and digitalised system able to handle all traffic in a safe, efficient and environmentally friendly way. This paves the way to the detailed identification of additional research and innovation (R & I) needs beyond the current SESAR 2020 Programme.
- It incorporates the R & I needed for the full, safe and effective integration of all aerial vehicles, manned and unmanned, into all categories of airspace. It internalises and describes the different phases for delivering U-space services, including a preliminary business case, and describes the emerging R & I planned and needed to enable this concept.
- It structures the R & I into nine newly defined 'essential operational changes' – the 'game changers' that are necessary to deliver the SESAR vision.
- It contains a more integrated air/ground roadmap for enabling a rationalised and gradually digitalised aviation infrastructure, and in particular a critical path towards a performance- and service-oriented communication, navigation and surveillance infrastructure.
- It updates the macroeconomic impact of SESAR from the 2012 edition, confirming the weight of aviation for the European economy and the importance of effective ATM for passengers and EU citizens.
- It builds explicit links with the recommendations of the Airspace Architecture Study and its transition plan, and shows that the Master Plan contains the technological elements needed to implement their recommendations where and when they are decided.

Section I – General context

The SESAR JU defines and implements its multiannual work programme to support the achievements of the objectives of the European Commission and especially the objectives and ambitions set in the EU Aviation Strategy. By doing so, the SESAR JU analyses and monitors the major risks, which are twofold: external risks are identified, analysed as far as possible at the SESAR JU's level, and followed; risks affecting the implementation of the SESAR JU's work programme are described in Section II paragraph 1.1.4. '*Risks affecting the implementation of the work programme in the 2022-2024 period*'.

The description of both categories of major risks can be found in Annex XV '*SESAR JU's critical risks for 2022*'.

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

In December 2015, the publication of 'An *Aviation Strategy* for Europe' ([7]) provided additional focus on and momentum towards completion of the Single European Sky (SES), aiming to generate faster growth for the 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, in particular in relation to preparing aviation for the digital age and contributing to its decarbonisation, as well as fostering the EU's leadership as a global actor in this domain. The Aviation Strategy poses challenges and enablers as represented in the figure below.

Figure 3: Key infographics from 'An Aviation Strategy for Europe'

([7]) Please see: http://ec.europa.eu/transport/modes/air/aviation-strategy

Within 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 maintaining a competitive advantage for Europe is key to the continued successful evolution of ATM.

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 threefold 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 R & I activities in the form of SESAR solutions ([8]) made available for implementation, and therefore makes a positive contribution both to achieving the SES and to the wider ambition of Flightpath 2050 and the EU Aviation Strategy. The contribution of the SESAR programme to achieving the SES's high-level goals appears in Figure 8, found later in this document.

([8]) 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 7). Once validated at V3 level of maturity, they are packaged and referred to as 'SESAR solutions'.

2. Drivers shaping the European aviation landscape: towards a digital European sky

Aviation, in particular air transport supported by ATM, is a key driver of EU economic growth, job creation and trade expansion. It is 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 amounting to approximately EUR 4 billion annually. The role of the SESAR JU in steering the SESAR R & I programme, is to define and develop solutions needed to build a more connected, greener and safer ATM system while ensuring that the latter is standardised and globally interoperable.

This work is currently undertaken through the SESAR R & I programme ('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 Horizon 2020 rules and processes for all its activities relating to the awarding and management of these grants. The European Commission also grants the SESAR JU 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 Organization (ICAO).

The challenges for ATM are captured and maintained in the European ATM Master Plan. Both the 2015 edition and the new 2020 edition describe the SESAR performance ambitions for 2035, the 'essential operational changes' across four key features of the ATM system and the relationship to the supporting key R & I activities. Some of these challenges and solutions are described below. Major developments require a more profound transformation of ATM technology to support safe operations in both controlled and uncontrolled airspace; growth in the volume and diversity of air traffic; evolution towards automation in the ATM sector; parallel evolution towards automation in other transport sectors; and increasing reliance on digitally shared information.

- **Growth in the volume and diversity of air traffic.** By 2050, air traffic will consist of tens of millions of annual flights. As shown in the figure below, the vast majority of this traffic will originate from new types of vehicles (such as drones) operating in airspace previously not used – very low-level airspace (initially below 150 m or 500 feet) away from aerodromes. In the airspace at and above 500 feet, which includes both controlled and uncontrolled airspace, in 2050 manned traffic will still outnumber unmanned aviation, but this airspace will be profoundly different from today's due to the increased density and diversity of traffic. In addition, the interactions between the various types of traffic will not necessarily be driven entirely by humans (e.g. single pilot operations leading to an increased degree of airborne automation, unmanned cargo requiring fully automated ATM interactions). The most significant entries into service of these new types of aircraft are expected to gradually scale up as from 2030, the time at which the supporting infrastructure needs to be ready to accommodate this new air traffic. Demand for access to lower-level airspace is already growing rapidly, as more and more drones are taking to the sky every day for leisure but also increasingly to deliver professional services (e.g. inspections and data collection, and public safety and security, but soon also for parcel delivery and urban air mobility). Two key implications follow from this. First, managing this level of air traffic at current productivity

levels will be unsustainable given the cost implications and limited gains in efficiency achieved through further splitting of sectors (airspace elasticity). Second, increased traffic levels and new forms of traffic (including military traffic such as remotely piloted aircraft systems (RPAS) and fifth-generation fighter aircraft) with diverse communication technologies, flight and speed patterns, etc. will lead to unprecedented levels of heterogeneity and complexity in vehicles requiring further automation, connectivity and interoperability. For both, the uncertainty of timing and the magnitude of change require the future ATM system to be fully scalable to ensure a cost-efficient ATM system with safety above the current levels.

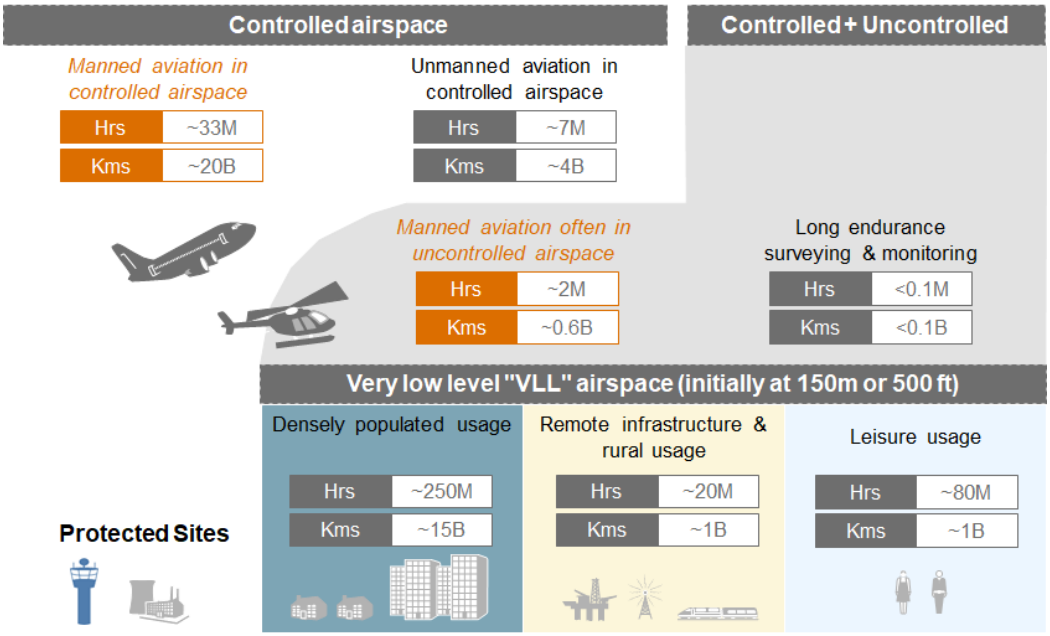

Figure 4: Impact of manned versus unmanned operations in airspace by 2050 ([9])

- **European Green Deal for Aviation**. The objective of net-zero greenhouse gas emissions by 2050 set by the European Green Deal, in line with the EU's commitment to global climate action under the Paris Agreement, requires accelerating the shift to smarter and more sustainable mobility. The aviation industry has committed in the long-run to bring into service a new generation of aircraft that will be cleaner and quieter (based on alternative propulsion systems, new airframes and energy sources). However, this ambitious target cannot be achieved if ATM does not allow aircraft and airspace users to fully exploit their potential and thus to reduce emissions to a maximum. Therefore, ATM must evolve at a faster pace than today to bring environmental benefits in the shorter term. Indeed, despite the ATM modernisation efforts undertaken in the past years, 5 to 10 % of CO2 emissions generated by flights are still thought to be avoidable and caused by a fragmented ATM infrastructure that does not fully exploit the advantages of digitalisation and automation. In support of this goal, the SESAR project will gradually contribute to the elimination of environmental inefficiencies caused by the underlying aviation infrastructure, by ensuring that it offers solutions that will fully exploit the potential offered by next-generation aircraft for cleaner and quieter flight (see paragraph 1.4.1. 'Building on SESAR success toward engaging into the European environmental commitment and the Green Deal').

([9]) *Source: Drones Outlook Study*, SESAR Joint Undertaking, 2016.

- **Shaping Europe's digital future for Aviation**. The desired change is profound and goes far beyond the narrow understanding of going paperless' or 'replacing analogue with digital'. A 'digitally transformed aviation' will use targeted data and information through automated and connected solutions to improve the overall performance of the system from safety, efficiency and cost perspectives. Aviation will take full advantage of advanced digital technologies to generate new services and optimise current ones while delivering a better experience and benefits to all stakeholders. The progress made in the fields of machine learning and AI will open the door to a multitude of innovative applications in ATM. Tasks will be performed collaboratively by hybrid human-machine teams, in which advanced adaptable and adaptive automation principles could dynamically guide the allocation of tasks. The goal is not automation per se but optimising the overall performance of the socio-technical ATM system and maximising human performance and engagement at all times. The synchronisation of the air and ground automation systems will make it possible to increase the efficiency of the controller and flight crew activities.
- **Optimal use of air navigation services infrastructure and use of scarce resources**. The move from physical assets to services, as well as standardisation between systems, will result in a rationalised aviation infrastructure. This is especially the case for CNS, which will rely on more integrated solutions, increased civil-military synergies, and combined ground based-and satellite-based services. This rationalisation and integrated approach to CNS will result in a more efficient use and long-term availability of spectrum. Similarly, the virtualisation of ANS and sharing of data services will enable the delivery of ATC services irrespective of the location of the infrastructure. Virtual control centres and use of remote towers will allow a more efficient and flexible use of resources, substantially improving the cost efficiency of service provision. As a result, ANSPs will have leaner, more modular and scalable systems that are easier to upgrade and more interoperable. Because of this, the system will become more resilient to unexpected traffic downturns or rapid returns to growth.
- **Evolution towards automation in other sectors will also shape the future of flight.** The convenience of using a technology or a service increases with the number of users that adopt it. Public acceptance of change and the aviation technology landscape at large will therefore increasingly be influenced by evolutions towards automation stemming from other safety- and security-critical sectors (such as automotive, energy and banking), as has already been observed for the rapidly expanding leisure or semi-professional drone sector.
- **Increasing reliance on digitally shared information.** The evolution of technology will make it possible for companies to collect, store and use large amounts of data to deliver new, innovative services whose relevance for flight safety will also continue to increase. This increased reliance on digitally shared information will further affirm the need for strong cybersecurity systems.

Primarily driven by the growth in the volume and diversity of air traffic, these additional evolutions call for the ATM sector to set the performance ambition to deliver a fully scalable system that is even safer than today's system while contributing to the elimination of environmental inefficiencies due to the underlying aviation infrastructure.

The planned evolution of today's aviation ecosystem towards a new (digital) ecosystem covering all aviation operations is presented in the following figure:

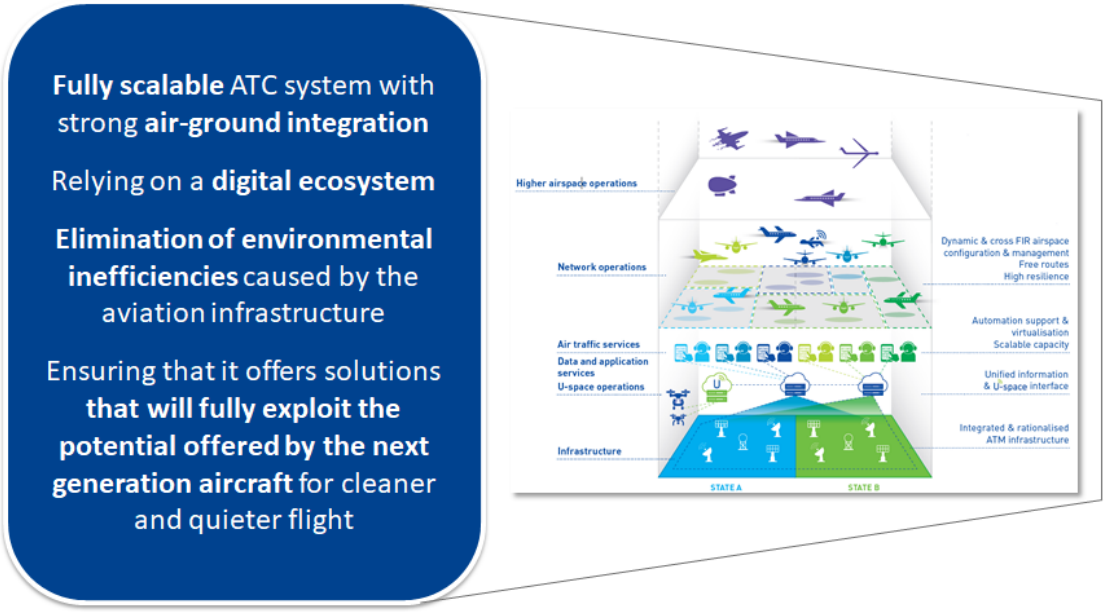

Figure 5: A new ecosystem for aviation

This view of a digital European sky remains as relevant post COVID-19 as it was before, and there is now also an opportunity to accelerate its priority characteristics. These are as follows.

- **Scalable.** The capacity of the ATM system needs to be able to adapt quickly and flexibly to traffic-demand variations without generating negative externalities (cost, delay, emissions, etc.).
- **Economically sustainable.** Fixed ATM costs need to be reduced to a minimum, so that the unit costs of the service are less dependent on the volume of traffic handled.
- **Environmentally efficient.** Building on low traffic levels, optimal trajectories should be the new norm.
- **Resilient.** System resilience is urgently needed to reduce the risk that a progressive return to operations over the course of the summer is subject to unforeseen airspace closures or capacity disruptions.
- **Predictable.** The new sanitisation measures will increase complexity and interdependencies; a safe and reliable passenger journey will require the elimination of any uncertainty, whether airborne or at the airport.

Section II – Multiannual programming for years 2022–2024

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 six strategic areas of operation and presents the multiannual objectives for the period from 2022 to 2024 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 to the EU frameworks within which the SESAR JU operates. It will replace the *Single Programming Document 2021–2023* insofar as it refers to the years 2022 and 2023.

1. Multiannual work programme for years 2022-2024

1.1. Introduction

The SESAR JU's 2022–2024 multiannual programme aims to ensure complete operational delivery of the SESAR 2020 R & I programme by the end of 2022 and its effective administrative closure by the end of 2023. As outlined in the SESAR 2020 multiannual work programme adopted by the SESAR JU Administrative Board in July 2015 ([10]), the SESAR 2020 Programme has been designed to encourage the implementation of the SESAR innovation pipeline outlined in point 1.1.3.1.

This chapter provides information on the strategic areas of operation according to which the SESAR JU multiannual work programme is established. In the following paragraphs, the activities, source and structure of funding and governance of each strategic area of operation are described. This structure also allows for the reporting provided during the year at Administrative Board level, and ultimately in the Consolidated Annual Activity Report.

1.1.1. Six strategic areas of operation

In continuity with the plan established in previous years and building on the structure of the SESAR 2020 Programme set in the multiannual work programme, the following six strategic areas of operation each constitute a strategic objective the SESAR JU will follow in the period from 2022 to 2024.

- Strategic area of operation **1 – Provide strategic steering to the SESAR programme**. The SESAR JU will continue to provide strategic steering to the SESAR R & I programme and to contribute to the implementation of the EU Aviation Strategy, in particular through the links with the SES policy framework, by maintaining the European ATM Master Plan and providing guidance on the SESAR concept, architecture and performance. This strategic area of operation is further presented in paragraph 1.2 of this section and in Section III, paragraph 2.1.
- Strategic area of operation **2 – Deliver exploratory research**. Within the pipeline for innovation (see Figure 7 in point 1.1.3.1 'SESAR innovation pipeline' below), the first phase concerns ER, further categorised into the elements/projects that deal with relevant fundamental scientific subjects (excellent science and outreach) and those that investigate the initial applications of such science for the ATM sector (application-oriented research).

([10]) The multiannual work programme was adopted by the Administrative Board in 2015 (Decision ADB(D)05-2015).

This strategic area of operation is further presented in paragraph 1.3 of this section and in Section III, paragraph 2.2.

- Strategic area of operation **3 – Deliver industrial research and validation**. The second phase of the pipeline for innovation is IR, which includes applied research, pre-industrial development and validation projects, and is delivered by the Members of the SESAR JU other than the EU. This phase is further split into three waves: Wave 1 covering the 2016–2019 period, Wave 2 (launched in 2019) to cover the period from 2020 to 2022 and Wave 3 covering the 2021–2022 period, i.e. the final years of the SESAR 2020 Programme. It aims for the progressive delivery of a number of specific operational or technical improvements – candidate SESAR solutions – systematically validated to support the decision on their individual implementation and synchronised deployment. The three waves will together cover the ambitions of the ATM Master Plan for the development phase. Paragraph 1.4 below and paragraph 2.3 in Section III further present this strategic area of operation.
- Strategic area of operation **4 – Deliver very large-scale demonstration activities**. The third phase of the pipeline for innovation deals with VLDs, which are designed as demonstrations of particular (some key) programme concept elements and SESAR solutions. These demonstrations provide the bridge between the development and deployment phases of SESAR and are delivered through work undertaken by SESAR JU Members other than the EU, supplemented by open calls for proposals to ensure the widest possible stakeholder participation.

  In some cases, the results of application-oriented ER can be passed to this third phase after a proper validation process in the context of ATM but without a full development process. 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.

  This strategic area of operation is further presented in paragraph 1.5 and in Section III, paragraph 2.4.
- Strategic area of operation **5 – Deliver SESAR outreach**. The SESAR JU ensures global outreach relating to the ATM Master Plan and the ongoing and planned SESAR activities, in full coordination with the European Commission and EUROCONTROL. This strategic area of operation is described in paragraph 1.6 below and in Section III, paragraph 2.5.
- Strategic area of operation **6 – Deliver effective financial, administrative and corporate management**. The SESAR JU must ensure it operates fully in accordance with its obligations, while also striving continually to improve its financial, administrative and corporate management as these elements of the SESAR JU's operations remain an integral part of the delivery of its mission and values. This area also addresses the follow-up of audit recommendations and is outlined in further detail in paragraph 1.7 below and in Section III, paragraph 2.6.

1.1.2. SESAR 2020 Programme research topics to be addressed within the innovation pipeline

Recognising that by their nature there is a range of different paces for research activities across the programme, then 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 research topics and maturity levels to be progressed by the SESAR 2020 Programme, which, in its current state, is depicted in the figure below. Based on the initial description established as part of the SESAR 2020 multiannual work programme in 2015, the SESAR JU maintains this structure continuously. It is expected that the

maintenance of the ATM Master Plan, and in particular the Master Plan update campaign carried out in 2018–2019, could result in refinements of the structure of research topics.

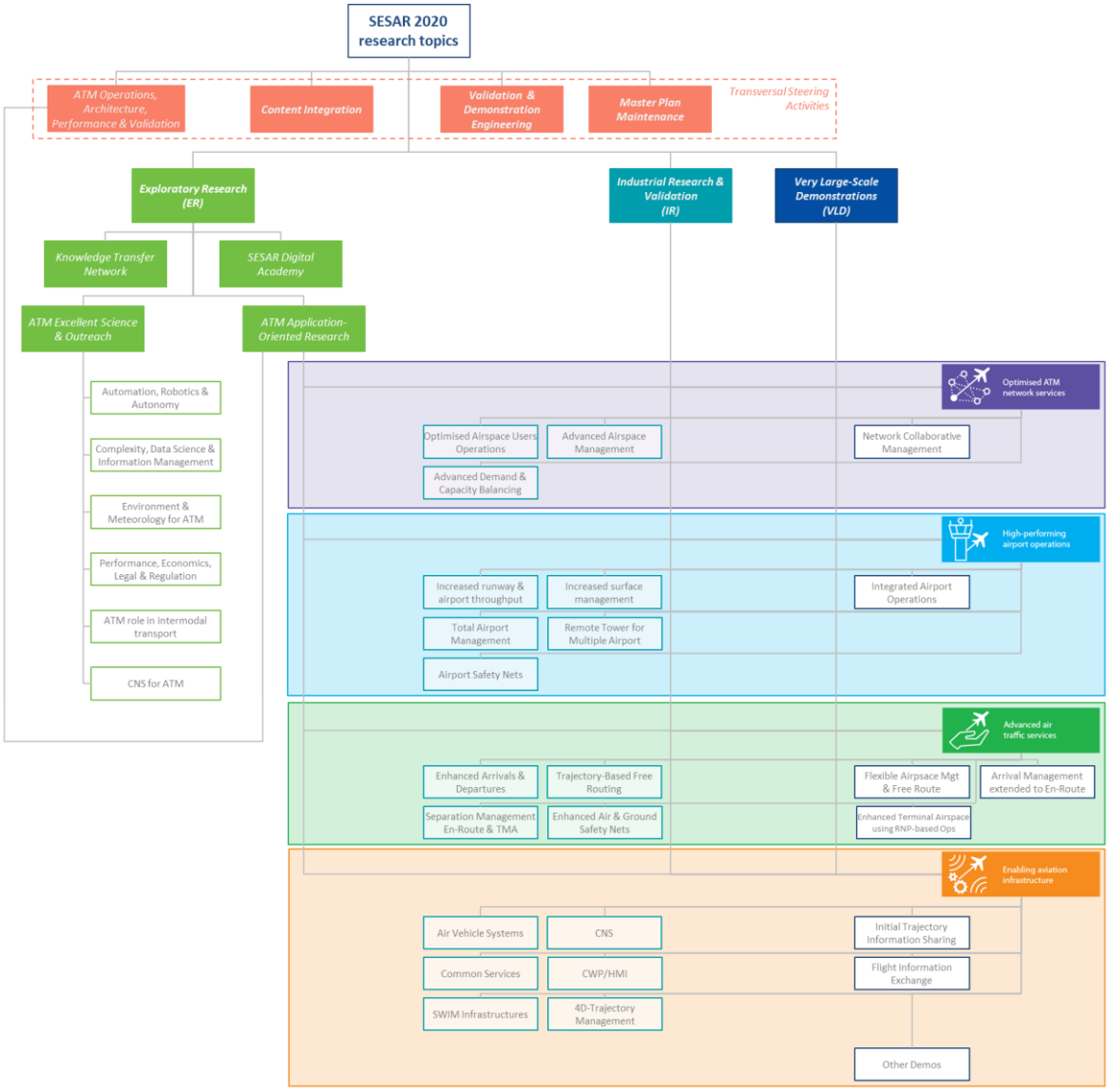

Figure 6: Structure of research topics covered by the SESAR 2020 Programme

In addition to the activities mapped in the figure above, in 2017 the European Commission entrusted the SESAR JU with the management of U-space related activities at EU level ([11]).

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

1.1.3. SESAR 2020 Programme objectives

1.1.3.1. The SESAR innovation pipeline

As depicted in Figure 1, the SESAR JU plays a central role in driving and coordinating ATM research in the EU. This role materialises mostly in the maintenance of the European ATM Master Plan and in the SESAR R & I programme.

The second SESAR R & I programme for the period from 2016 to 2022, the SESAR 2020 Programme is structured into three main R & I phases that aim to deliver a pipeline of innovation. This matures operational and technology solutions through the European operational concept validation methodology's well-established control and monitoring process, which is linked to technology readiness level (TRL) ([12]).

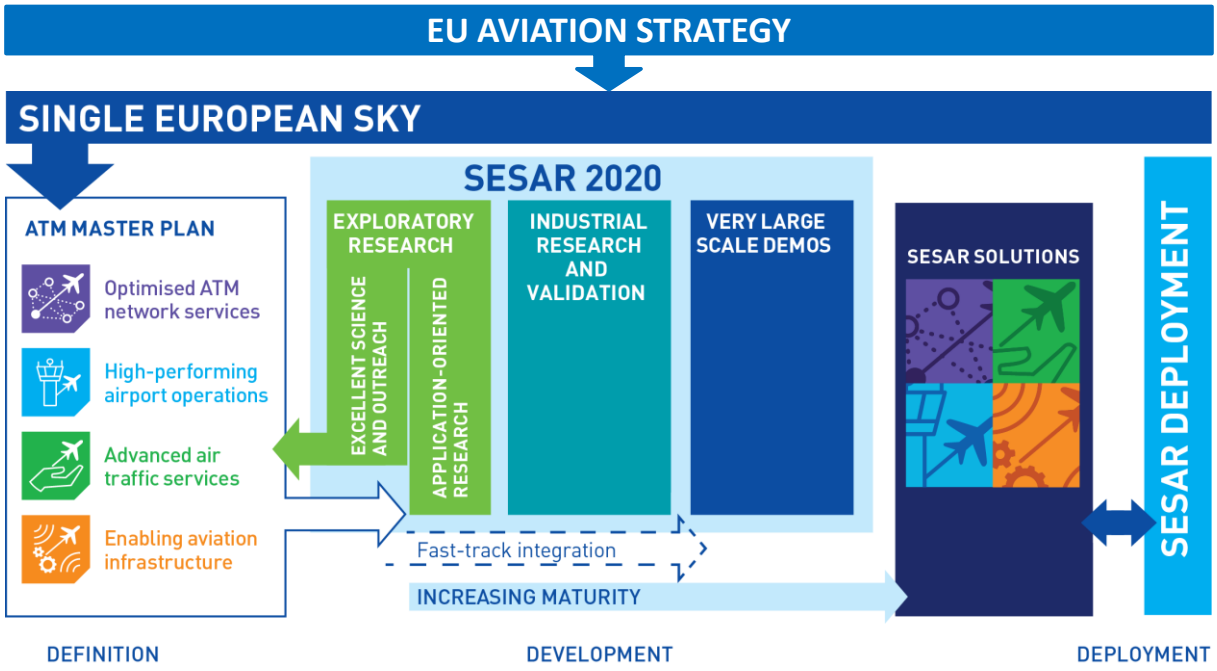

Figure 7: SESAR's innovation pipeline – from the EU Aviation Strategy to SESAR solutions

This pipeline starts with the EU Aviation Strategy and the SES objectives (see Section I) that feed into the European ATM Master Plan, the main planning tool that defines the ATM modernisation roadmap and priorities that are maintained and updated on a regular basis. 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 upon with contributions from the SESAR JU Members other than the EU that undertake 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 (VLDs).

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 provided that it includes a proper validation in the context of ATM. This is the case in particular when the focus is more

([12]) As defined in the 'Horizon 2020 work programme 2018–2020', Part 19 'General Annexes', Section G 'Technology readiness levels (TRL)'.

on the adaptation of that mature technology for ATM than on developing the technology (for instance, activities related to U-space, described in subparagraph 2.5.2 of the *Single Programming Document 2020–2022* on VLDs).

1.1.3.2. The European Master Plan: main planning tool for the modernisation of the European ATM

Within the framework of the EU Aviation Strategy and of the SES, the European ATM Master Plan is the main planning tool for the modernisation of the European ATM.

The Master Plan is the official European roadmap building on SESAR results and solutions and strong collaboration between all European ATM stakeholders, not just the Members of the SESAR JU. The new 2020 edition of the Master Plan defines the vision (the 'digital European sky') for the SESAR project as a whole (bringing together SESAR development and deployment activities) and related priorities to realise the digital transformation of the ATM, making European airspace the most efficient and environmentally friendly sky to fly in the world.

1.1.3.2.1. The four SESAR key features

In this single programming document (SPD), SESAR solutions are categorised according to the four key features, forming a coherent way to present the solutions over the time span of the multiannual work programme and across all ATM in Europe, as explained in this document in Section II, Chapter 1 'Multiannual work programme for years 2022-2024' and Section III 'Annual work programme for 2022' 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 enhancing airport operations, ensuring a seamless process through collaborative decision-making and developing collaborative recovery procedures in adverse conditions. In this context, this feature mainly addresses the need for increasing 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, allowing them to better address traffic demand with increased en-route available capacity. This 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 enables better consideration of the expected traffic demand in advance, with the aim of making the required en-route capacity available. It also enables the en-route and airport plans and capabilities to be linked to consider traffic demand from gate to gate and to optimise the network capacity accordingly.

This feature includes activities in the areas of advanced airspace management, advanced Demand and Capacity Balancing (DCB) and optimised airspace user operations, along with optimised ATM network management through a fully integrated network operations plan 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 are new policy priorities that are reflected in the dedicated roadmap delivered in 2017 ([13]) and in calls for proposals organised by the SESAR JU within the SESAR 2020 Programme. The drones roadmap's key findings and results are incorporated into the 2020 edition of the European ATM Master Plan to achieve the overall goal of securing the integration of all air vehicles into the airspace.

1.1.3.2.2. The European ATM Master Plan performance framework

The SESAR JU results in the 2021–2023 period will continue to contribute to the achievement of the SES and the European ATM Master Plan performance ambition milestone for 2035, as well as its ambition across the six main performance areas illustrated in the figure below.

([13]) SESAR Joint Undertaking, *European ATM Master Plan: Roadmap for the safe integration of drones into all classes of operations*, 2018. This document is available on the SESAR JU website

Key performance area	SES high-level goals 2005	Key performance indicator	Performance ambition vs. baseline: Baseline value (2012)	Ambition value (2035)	Absolute improvement	Relative improvement
Capacity	Enable 3-fold increase in ATM capacity	**Departure delay**[4], min/dep	9.5 min	6.5-8.5 min	1-3 min	10-30%
		IFR movements at most congested airports[5], million	4 million	4.2-4.4 million	0.2-0.4 million	5-10%
		Network throughput IFR flights[5], million	9.7 million	~15.7 million	~6.0 million	~60%
		Network throughput IFR flight hours[5], million	15.2 million	~26.7 million	~11.5 million	~75%
Cost efficiency	Reduced ATM services unit costs by 50% or more	**Gate-to-gate direct ANS cost per flight**[1] - EUR(2012)	EUR 960	EUR 580-670	EUR 290-380	30-40%
Operational efficiency		**Gate-to-gate fuel burn per flight**[2], kg/flight	5280 kg	4780-5030 kg	250-500 kg	5-10%
		Additional gate-to-gate flight time per flight, min/flight	8.2 min	3.7-4.1 min	4.1-4.5 min	50-55%
		Within the: Gate-to-gate flight time per flight[3], min/flight	(111 min)	(116 min)		
Environment	Enable 10% reduction in the effects flights have on the environment	**Gate-to-gate CO_2 emissions**, tonnes/flight	16.6 tonnes	15-15.8 tonnes	0.8-1.6 tonnes	5-10%
Safety	Improve safety by factor 10	**Accidents with direct ATM contribution**[6], #/year Includes in-flight accidents as well as accidents during surface movement (during taxi and on the runway)	0.7 (long-term average)	no ATM related accidents	0.7	100%
Security		**ATM related security incidents resulting in traffic disruptions**	unknown	no significant disruption due to cyber-security vulnerabilities	unknown	-

1 Unit rate savings will be larger because the average number of Service Units per flight continues to increase.
2 "Additional" means the average flight time extension caused by ATM inefficiencies.
3 Average flight time increases because the number of long-distance flights is forecast to grow faster than the number of short-distance flights.
4 All primary and secondary (reactionary) delay, including ATM and non-ATM causes.
5 Includes all non-segregated unmanned traffic flying IFR, but not the drone traffic flying in airspace below 500 feet or the new entrants flying above FL 600
6 In accordance with the PRR definition: where at least one ATM event or item was judged to be DIRECTLY in the causal chain of events leading to the accident. Without that ATM event, it is considered that the accident would not have happened.

Figure 8: Performance ambitions for 2035 for controlled airspace ([14])

The realisation of the SESAR target vision will not only bring significant direct and quantifiable performance gains to ATM, air transport and aviation, but it is also expected to deliver wider benefits for the EU economy and society in general.

1.1.3.2.3. SESAR delivery: upgrade phases of the European ATM system

The delivery of these results in the form of SESAR solutions, as defined above in subparagraph 1.1.3 'SESAR 2020 Programme objectives', will contribute to the various phases of the upgrade of the ATM system as outlined in the Master Plan. These phases are depicted in the figure below.

([14]) *Source:* European ATM master plan (performance improvement ambitions are baselined against the situation in 2012).

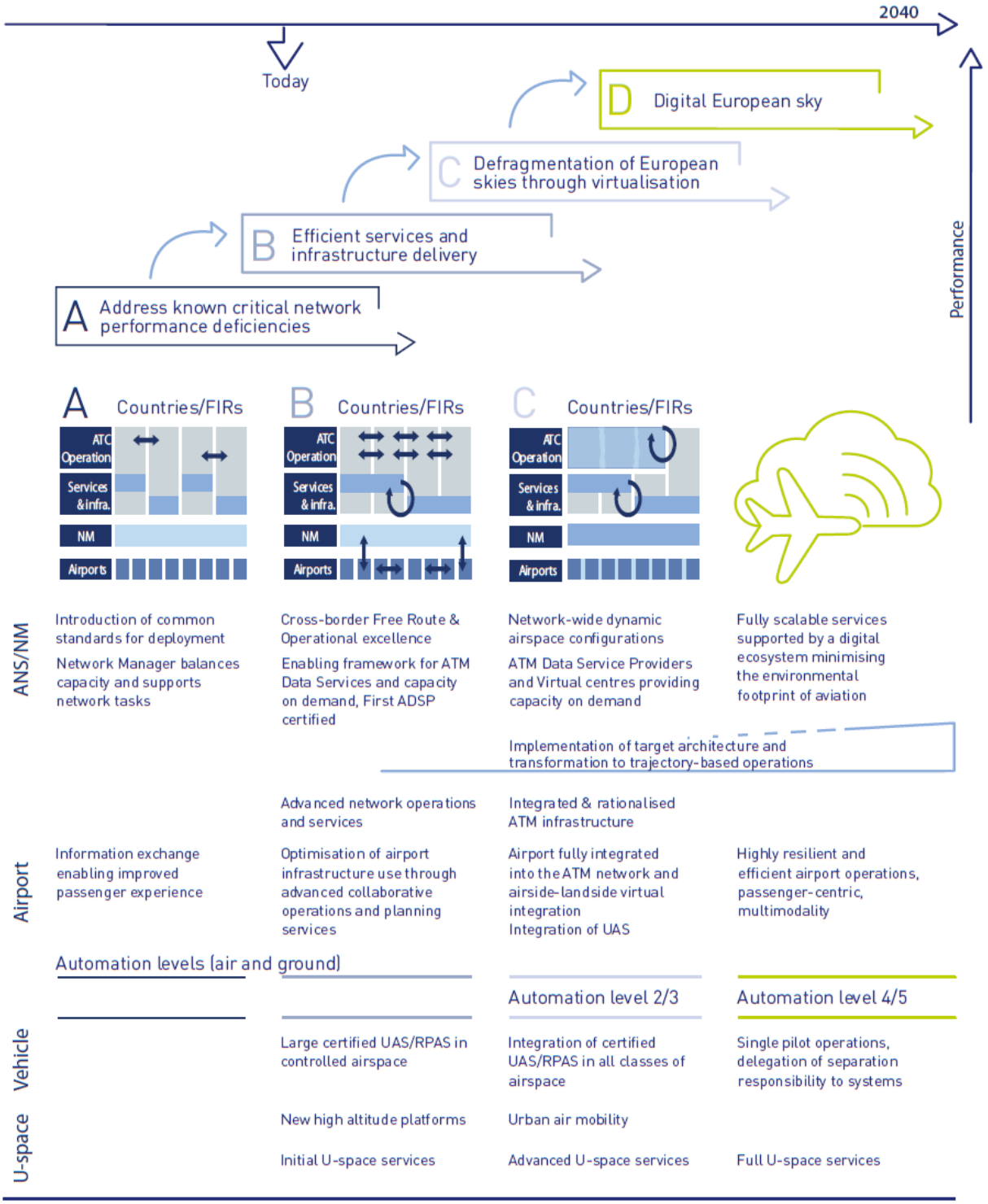

Figure 9: European ATM system upgrade phases as per ATM Master Plan

Until 2018, the primary objective of the SESAR solutions delivered was to contribute to phases A and B, while preparing the ground for those solutions that will be further developed in the next period. Driven by the 2020 update of the ATM Master Plan and building on the results of Wave 1 and the ER outcome, candidate SESAR solutions will be delivered under Wave 2 of the SESAR 2020 Programme from 2019 to 2022. A mix of these will be further developed up to pre-industrialisation maturity level

(V3 or TRL6 then recognising SESAR solutions, covering up to phase C ([15])) in continuation of those delivered under Wave 1, and will bring new topics with new concepts developed within the ER 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 III, paragraph 2.4 'Strategic area of operation 4: Deliver very large-scale demonstration activities (operational activity)' provides the list of candidate SESAR solutions under development and their contribution to the European ATM system upgrade phases, to the SESAR vision and to the performance areas of the SES.

1.1.3.3. Funding the innovation pipeline

The SESAR JU has received funds from various sources in the EU in order to execute the SESAR 2020 Programme. These funds were delegated to the SESAR JU under four different legal frameworks, namely Horizon 2020 ([16]), the Connecting Europe Facility (CEF) ([17]) and two types of assigned revenues ([18]), each allowing execution of either grants (following calls for proposals) or studies (following calls for tenders). The diversity of the applicable legal frameworks under which the SESAR JU operates, each with its own requirements and obligations, also comes with a high degree of complexity. This is due to the number of derogations from these legal frameworks that have been defined in the corresponding delegation agreements between the European Commission (the delegator) and the SESAR JU.

Besides the EU's contribution of EUR 585 million established under the Horizon 2020 programme, an additional EU contribution of EUR 11.3 million was provided to the SESAR JU by the European Commission under three delegation agreements under which the SESAR JU was mandated to carry out additional activities in the area of ATM. These delegation agreements are the following.

- Delegation agreement EC/SESAR JU (ref. MOVE/E3/DA/2016-669/SI2.743803), signed on 6 December 2016 ([19]), with a delegated budget of EUR 500 000 in assigned revenue to organise a call for proposals for a geofencing demonstration.
- Delegation agreement EC/SESAR JU (ref. MOVE/E3/DA/2017-477/SI2.766828), signed on 10 November 2017, with a delegated budget of EUR 800 000 in assigned revenue to procure a study to develop a proposal for the future architecture of European airspace.

([15]) Pending the outcome of the results of the SESAR 2020 programme and excluding the delivery of U-space related solutions, which are only partly covered in the current programme.

([16]) The rules applicable to the grants co-funded by the SESAR JU under the Horizon 2020 programme are defined in 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, p. 81).

([17]) The rules applicable to the grants co-funded by the SESAR JU under the CEF are defined in Regulation (EU) No 1316/2013 of the European Parliament and of the Council of 11 December 2013 establishing the Connecting Europe Facility, amending Regulation (EU) No 913/2010 and repealing Regulations (EC) No 680/2007 and (EC) No 67/2010 (OJ L 348, 20.12.2013, p. 129).

([18]) The rules applicable to the grants co-funded by SESAR JU through use of the assigned revenue are defined in 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 (EU financial regulation) (OJ L 193, 30.7.2018, p. 1).

([19]) In accordance with Article 54(2)(a) and Article 58(1)(c)(iv) of 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 (EU financial regulation) (OJ L 193, 30.7.2018, p. 1).

- Delegation agreement EC/SESAR JU (ref. MOVE/E3/DA/2017-564/si2.771010), signed on 13 December 2016, with a delegated budget of EUR 10 million in assigned revenue from CEF funds to organise a call for proposals on U-space demonstrations.

The three phases of the pipeline and the steering of the programme will be delivered using the following instruments: ER and part of the VLDs being secured using open calls for proposals, and the IR and the remaining part of the VLDs using calls restricted to the Members of the SESAR JU other than the EU.

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 further detailed in paragraphs 1.2 to 1.5 of this section.

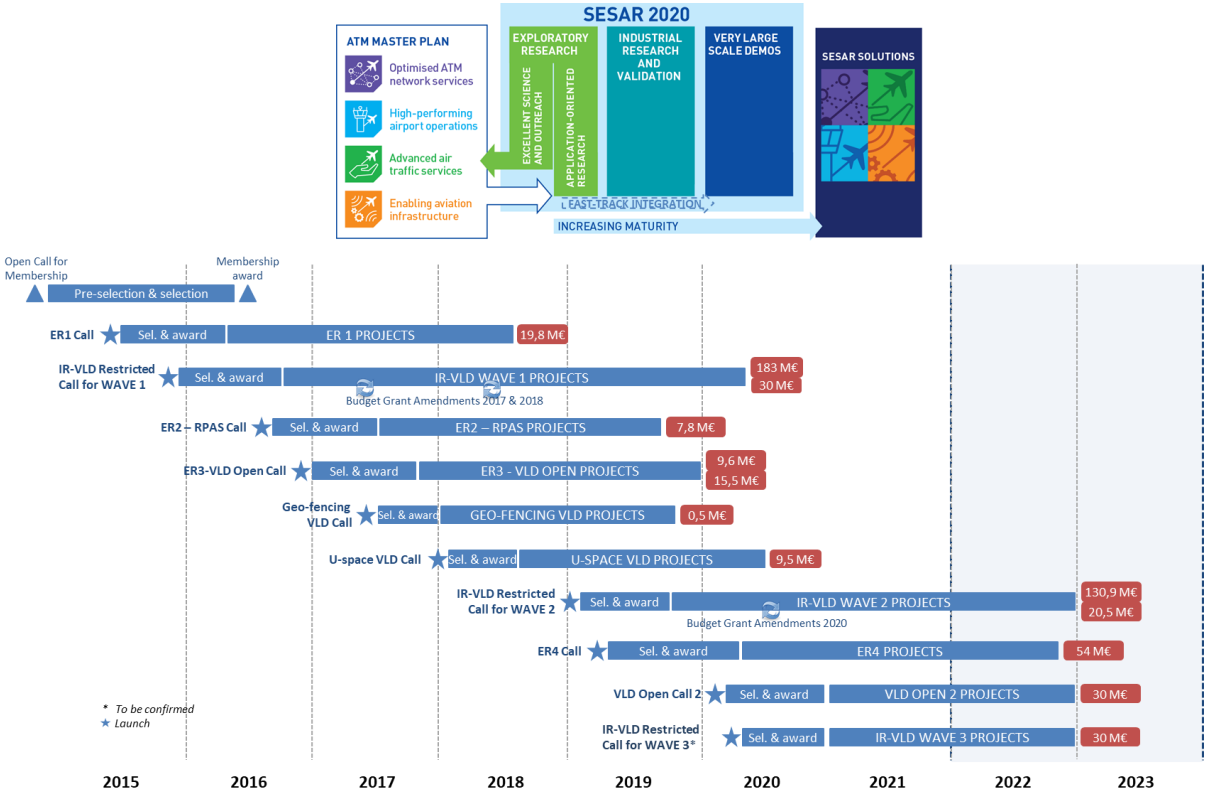

Figure 10: Call activities of the SESAR 2020 Programme over the 2015–2022 period

As shown in the figure above, the SESAR JU plans to have, where possible, all calls for proposals related to the SESAR 2020 Programme launched and all related grant agreements signed by the end of 2020 or the beginning of 2021 ([20]), while at this stage all projects are expected to complete their activities and be closed by the end of 2022.

In addition to the calls for proposals listed above, the SESAR JU undertakes studies in relation to technical topics that are relevant to the technological pillar of the SES. Of these, the list of procurement

([20]) According to Article 1 of the basic act of the SESAR JU, 'calls for proposals under the Joint Undertaking shall be launched at the latest by 31 December 2020. In duly justified cases calls for proposals may be launched until 31 December 2021'. According to Article 6 of the general agreement between the European Commission and the SESAR JU signed on 19 December 2014, 'grant agreements shall not be signed later than 31 August 2021, or 31 August 2022 in duly justified cases under Article 1(1) of the SJU Regulation or beyond that date in exceptional and duly justified cases under Article 20(3) of the Rules of Participation'.

actions related to studies the SESAR JU will undertake in 2022 appears in Annex XII 'Procurement plan for 2022'.

1.1.3.4. Overview of the SESAR 2020 Programme portfolio of projects at the beginning of 2021

As a result of the calls for proposals already completed by the end of 2020, the SESAR 2020 Programme is composed of the following 81 closed and 48 ongoing projects (129 in total), which implement the research topics presented in subparagraph 1.1.2 'SESAR 2020 Programme research topics to be addressed within the innovation pipeline' (Figure 6). In addition, 24 projects are in the grant agreement preparation phase and are expected to be launched by Q1 2021. Each topic of the ER is covered by one or several projects, while topics of the IR and VLD are generally covered by one project each.

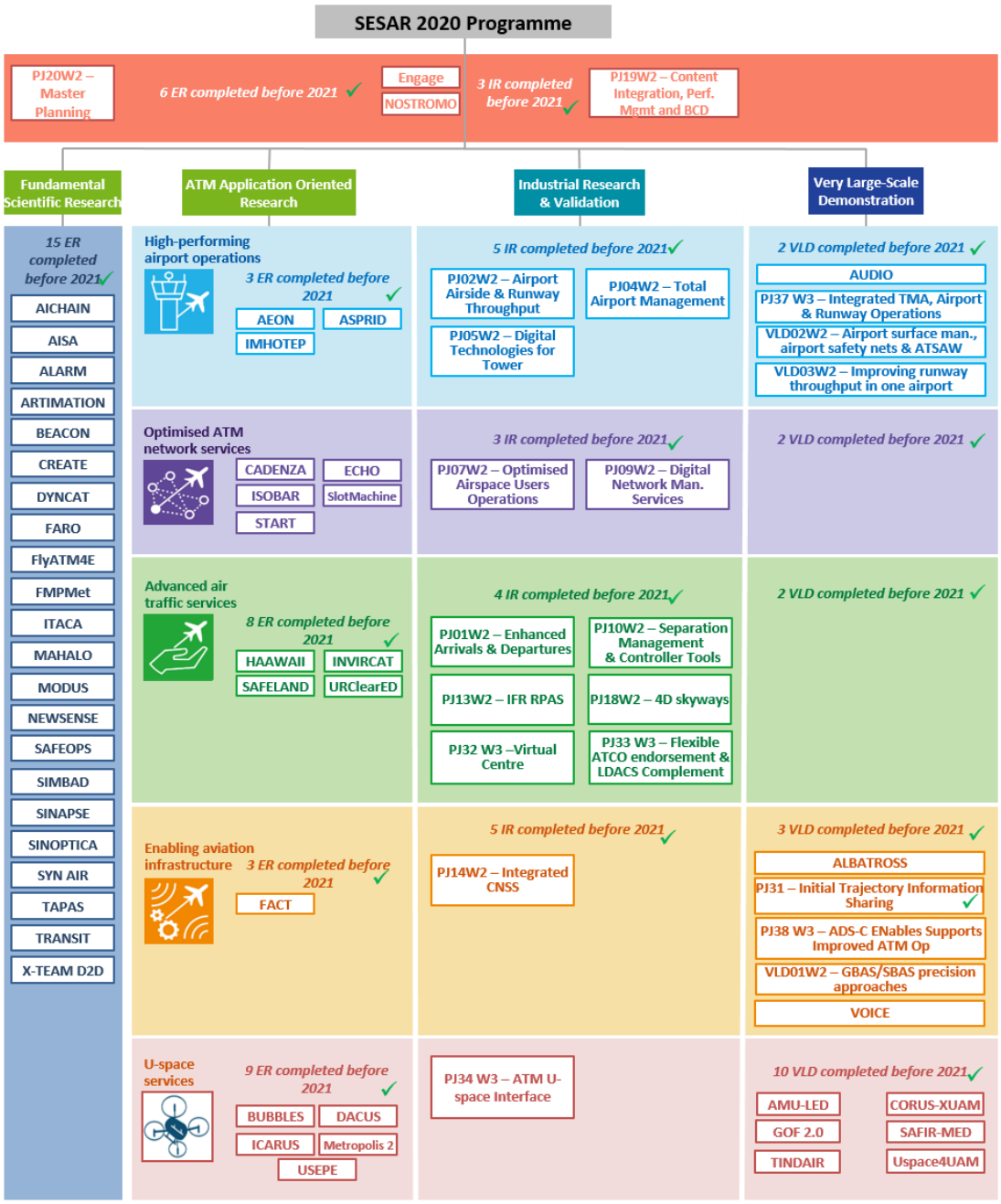

Figure 11: SESAR 2020 Programme portfolio of projects matching the research topics at the beginning of 2021 (projects in execution or closed)

As can be seen in the figure above and in relation to Figure 6, most of the research topics of the SESAR 2020 Programme are covered by projects in execution or already closed (closed projects, i.e. those that had completed their activities by the end of 2020, are marked with the symbol ✓.) The approach covering the remaining topics is presented in Section III, paragraphs 2.1 to 2.4.

1.1.3.5. Dissemination of 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 overview of the progress achieved in each financed project against the targets outlined in the SESAR JU's annual and multiannual work plans. Such data collection will enable a holistic view of the SESAR 2020 activities and their impact. Output from projects, such as standardisation material, publications and patents, will be made available on the SESAR JU's website (via either uploaded documents or links to relevant websites) and through direct dissemination of material to the appropriate bodies in support of the preparation for deployment. Information on Horizon 2020 calls for proposals and projects will continue to be made available through the Horizon 2020 Funding and Tenders Portal and other Horizon 2020 reporting mechanisms. In addition, the SESAR JU will continue to publish and promulgate SESAR solutions once they are available and validated through the release process.

The SESAR 2020 Programme will comply with all provisions of the Horizon 2020 programme. However, while ER and VLD Open projects will comply with all the provisions of the '*Horizon 2020 work programme 2018–2020*', Annex L, related to open access to research data, IR and VLD projects receiving co-financing following restricted calls for proposals, as defined in Section III, subpoint 2.6.1.1.3 of the SPD for 2020–2022, may decide to opt out of these provisions in order to protect results that are expected to be commercially or industrially exploited and/or to protect the project's main aim, as explained in Section II, subparagraphs 1.4.1 'Wave 2 projects (from 2019 to 2022)' and 1.5.1 (VLD) 'Calls for proposals in execution'. In addition, the justification for a project-by-project opt-out by IR and VLD projects can be further reinforced due to the complementary nature of co-financed projects. This means that their results, including the research data, will be published and accessible as SESAR solutions, rather than individual project-by-project results and/or research data. The publication of SESAR solutions is coordinated and carried out by the SESAR JU.

1.1.4. Risks affecting the implementation of the work programme in the 2022-2024 period

Over the 2022-2024 period, the SESAR JU's work programme may be affected by risks which are described in Annex XV. Two of these risks may have particular impact on the SESAR JU's ability to reach its objectives in the 2022-2024 period:

- the COVID-19 (risk with reference CORP08) crisis brings different types of challenges to the SESAR JU relating to:
  - Risk to SJU Members ability to support the established programme delivery due to the financial/resource situation of the Aviation sector;
  - Risk on the Members' financial contribution to SJU running costs;
  - Impacts on the internal functioning of the SESAR JU: restrictions issued by the Belgian Authorities and/or the European Commission on travel, access to the office and mandatory telework can lead to inefficiencies, misunderstandings and errors being made, psychological impacts on staff.
- the transition towards the final phase of the SESAR 2020 programme and a possible 'SESAR 3' partnership for ATM research under the multiannual financial framework 2021-2027 (risk

with reference CORP05 analysed in subparagraph 1.1.6. 'The future of ATM research' further in this document).

The Annex XV identifies measures taken by the SESAR JU to mitigate these risks, to reduce their likelihood of occurrence and/or to reduce their impact.

1.1.5. Governance of the SESAR 2020 Programme

The governance of the SESAR 2020 Programme is shown in the following figure.

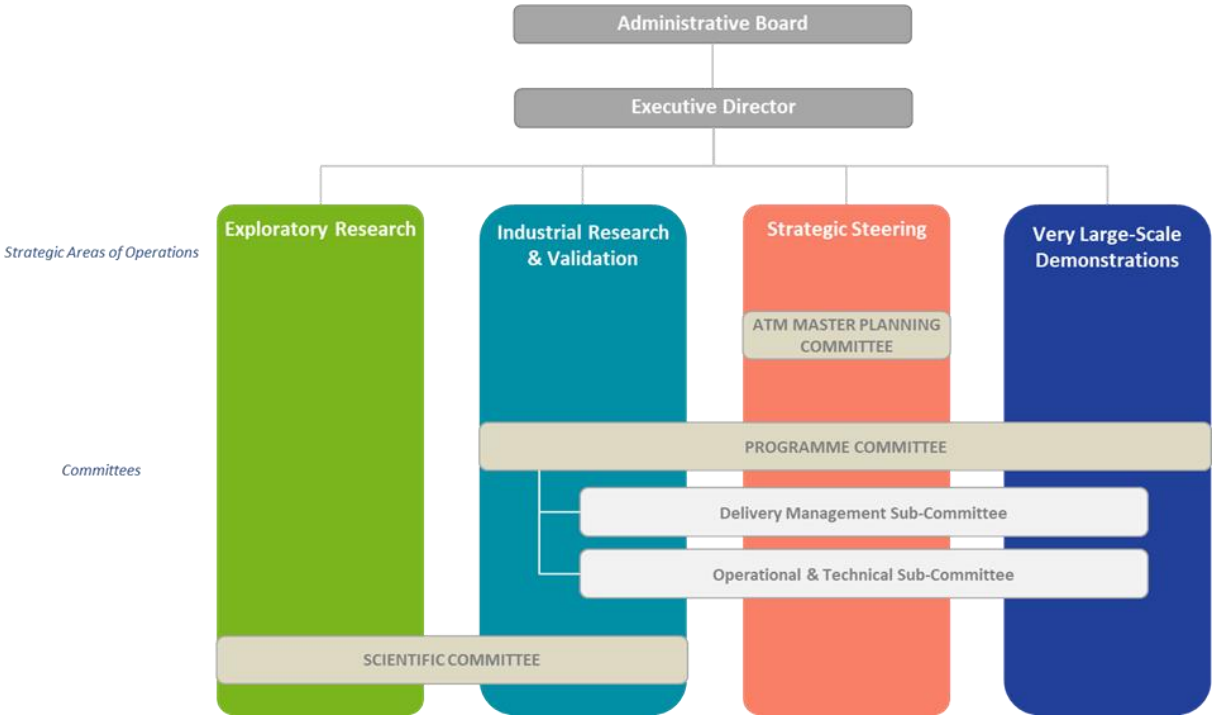

Figure 12: Governance of the SESAR 2020 Programme

1.1.5.1. Administrative Board

The Administrative Board is the main governance body of the SESAR JU. It is responsible for the strategic orientation and effective operation of the SESAR JU, supervises the implementation of its activities in accordance with Article 5 of the Statutes of the Joint Undertaking and efficiently manages any potential situation or risk of conflict of interest arising in the implementation of the programme. In accordance with the SESAR JU basic act, the Administrative Board is chaired by the European Commission, representing the EU, and with the EUROCONTROL representative acting as a vice-chair. It is constituted of one representative from each Member of the JU ([21]), the military, civil airspace users, ANSPs, equipment manufacturers, airports, ATM staff and the scientific institutions/community.

1.1.5.2. Executive Director

Appointed by the Administrative Board, the SESAR JU's Executive Director is responsible for the appointment of staff and their assignments and 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, including taking responsibility for necessary technical, operational and architectural decisions, within guidelines established by the Administrative Board to which he or she is responsible. He or she provides the

([21]) The list of members of the SESAR JU is provided in Annex XIV.

Administrative Board with all information necessary for the performance of its functions. This includes in particular the drawing up and regular updating of the multiannual and annual work programmes of the JU, including an estimate of programme costs and the assurance that the activities of the JU are being carried out with complete independence and without any conflicts of interest. He or she also submits any proposal involving changes in the design of the SESAR project to the Administrative Board.

1.1.5.3. Programme Committee

The Programme Committee (PC) is composed of representatives of each of the Members of the SESAR JU other than the EU. In addition to this, one representative of civil airspace users and another from the European Commission act as permanent observers. The secretariat and the chair are provided by the SESAR JU.

By representing their organisations, the PC members commit to implementing decisions taken by the committee that affect the SESAR programme with regard to technical and contractual matters.

The PC supports the SESAR JU's Executive Director in the delivery of the SESAR 2020 Programme, covering the IR and VLD phases of the programme.

The PC is supported by two subcommittees: a Delivery Management Sub-Committee (DMSC), which focuses on the management of the programme and of the various contributions, and an Operations and Technical Sub-Committee, which focuses on steering the content of the activities.

1.1.5.4. ATM Master Planning Committee

This committee is composed of representatives of the European Commission, EUROCONTROL, civil airspace users, the European Defence Agency (EDA) representing the military, ANSPs, ground and airborne equipment manufacturers, airports, professional staff organisations in the ATM sector, the European Union Aviation Safety Agency (EASA), EUROCAE, the SES Network Manager and the SESAR Deployment Manager.

These representatives were put forward to the Executive Director by the relevant Members of the SESAR JU Administrative Board for formal appointment to the committee. The committee provides advice to the Executive Director on the progress of the implementation of the European ATM Master Plan and monitors coherence between its three levels ([22]). In particular, it identifies potential gaps in or opportunities for improving the Master Plan priorities and advises the Executive Director on measures it considers are needed.

1.1.5.5. Scientific Committee

The Scientific Committee supports the SESAR JU's Executive Director in ensuring the scientific excellence of the SESAR 2020 Programme. In particular, under the chair of the SESAR JU, this committee monitors the ER activities (content and results) of the SESAR 2020 Programme and the transition to IR. It also provides the Executive Director with scientific advice covering the whole range of the SESAR JU's research activities under the SESAR 2020 Programme.

The committee-member seats are filled by experts selected as a result of an open call for scientists and researchers from across the research community, along with one observer from each of the founding

([22]) Level 1 – Executive view; Level 2 – Planning view for SESAR development activities; Level 3 – Planning view for SESAR deployment activities.

members (the European Commission on behalf of the EU, and EUROCONTROL). In order to foster the transition between the ER and IR, an observer seat is reserved for a representative of the PC.

The membership of the Scientific Committee was valid until the end of February 2021. Following an internal needs assessment, a one year extension to the contracts of its experts was granted in order to ensure continuity in the governance role of the Scientific Committee during the period until early 2022.

1.1.6. The future of ATM research

According to its current basic act, the SESAR JU will cease to exist in its present organisational form on 31 December 2024, as stipulated in Article 1(2) of the amended SESAR JU basic act.

In 2019, the European Commission launched activities to determine options for an integrated ATM partnership (SESAR 3) in the next multiannual financial framework (2021–2027). The European Commission published a legislative proposal in February 2021, which led to a new Council Regulation adopted on 19 November 2021, with entry into force on the 30 November 2021. In accordance with Article 174(9), by this regulation, the SESAR 3 JU 'is the legal and universal successor in respect of all contracts, including employment contracts and grant agreements, liabilities and acquired property of the SESAR JU […], which shall replace and succeed'.

The SESAR JU is, under the leadership of the European Commission, anticipating and assessing the potential consequences of the changing regulatory and financial conditions governing the SESAR JU and its programme, which are summarised in risk identified in the Annex XV with the reference CORP05 'The SESAR JU may not be able to manage the transition towards the ending phase of the SESAR 2020 programme execution and/or future ATM research due to limitations in the field of human resources, legal framework, stakeholders support contract etc.'. The mitigation measures identified in that annex aim to secure continuity of required expertise, completion of the existing SESAR 2020 Programme under the current set of rules, as well as being able to support transition arrangements defined by the European Commission to establish SESAR 3 and its respective programme. This approach aims at adapting as quickly and efficiently as possible to any changes once the decisions affecting the future partnership are made effective.

In particular, the SESAR JU will have to transition all applicable contracts, agreements and decisions towards the new legal entity. Details of this transition will have to be provided for in the basic act of the new legal entity, in spite of which the following risks could impact the new partnership severely:

- Risk related to financial resources: actions and activities carried out under the current SESAR JU basic act have a level of funding from all Members of the SESAR JU, which correspond to direct (in the form of grants and contracts) and indirect costs (including SESAR JU running costs). The repeal and replace scenario must include a carry-over of all financial resources towards the new legal entity. Not carrying over all financial resources to cover both direct and indirect costs would put the ability of the SESAR JU to achieve its objectives at very high risk;
- Risk related to human resources: the SESAR JU must have a staff establishment plan which is commensurate to its complete mandate, and must keep the level of resources that are currently carrying out actions and activities under the SESAR 2020 programme until the end of 2023 (see above the schedule of actions in paragraph 1.1. 'Introduction'). Furthermore, it must be in a position to adapt its range of competencies to new elements of its work programme, implemented as from 2021, especially the ones related to the challenges of digitalisation, automation, environmental performance and contribution to the European

Green Deal, which are identified in Section I of this document and which form the backbone of the Digital European Sky Strategic Research and innovation Agenda (SRIA). The completion of the SESAR 2020 Programme operational, financial and administrative activities, and the preparation and launch of the SESAR 3 Programme, together with ongoing activities of the SESAR JU and SESAR 3 JU in support of the Commission's policy-making, requires the staff establishment plan to be maintained at least at the current level, skills and experience. Not having the number and types of human resources would jeopardise the implementation of the SESAR JU's work programme dramatically;

- Risk related to private partners contribution: the future ATM partnership will leverage both financial and in-kind contribution of private partners (air navigation service providers, airports, manufacturing industry, operators, airspace users, institutional partners…). The provisions of the SESAR 3 JU's basic act must enable the mechanisms (financing rate, funding schedule, research phases, conditions for participation…) to establish a work programme that will adequately leverage the capacity of the partners to deliver research and innovation activities and to de-risk their participation to the partnership.

Taking consideration of these risk factors, the risk with reference CORP05 is assessed at a high level of criticality. While the European Commission manages the process required to establish the future partnership, the SESAR JU will, under the supervision of its Administrative Board, provide support as requested in order to adequately respond to any final decision from the EU.

Further information on related proceedings from a multiannual perspective is available in Section II, paragraph 1.7 'Strategic area of operation 6: Deliver effective financial, administrative and corporate management'.

1.2. Strategic area of operation 1: Provide strategic steering to the SESAR programme

Under the leadership of the SESAR JU, all SESAR 2020 R & I activities are undertaken under a common framework. As introduced with the SESAR 2020 Programme research topics diagram (Figure 6), this framework applicable to IR relies on the following elements:

- maintenance of the European ATM Master Plan;
- content-integration activities aiming for transversal steering of the programme through the concept of operations, architecture activities and the performance framework;
- system engineering support activities aiming to create traceability and coverage reports between high level concept and operational requirements with requirements, validation objectives and validation results at the level of solution development.

In the 2021–2023 period, in continuation of the activities carried out in the period from 2016 to 2020 and subject to the outcome of the IR-VLD Wave 2 call for proposals in 2019, the following projects should support the execution of this framework in 2021–2022, as depicted in Figure 11: PJ.20 W2 'Master Plan maintenance', covering the maintenance of the ATM Master Plan and PJ.19 W2 'Content integration', covering the required coordination of IR projects to develop the concept of operations, architecture and performance, and alignment with the ATM Master Plan.

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

In this role, the SESAR JU benefits from additional support from airspace users, professional staff organisations, EASA and national aviation authorities (see subparagraph 1.2.5 'Support contracts and agreements / working arrangements'). They mainly provide the SESAR JU with advice to help the broader buy-in on the results of the SESAR 2020 Programme.

In addition to these projects, in continuation of the work done in previous years and upon the request of the European Commission, the SESAR JU may carry out additional activities in the period from 2021 to 2023 to assist stakeholders in other areas related to the technological pillar of the SES.

1.2.1. ATM Master Plan maintenance

The significant Master Plan update campaign conducted in 2018–2019 enabled the definition of the vision towards a digital European Sky, highlighting the R & I that supports the digital transformation of the ATM industry through increased resilience, scalability and automation.

In light of the COVID-19 crisis in 2020, a broad dialogue conducted at the level of the Master Planning Committee confirmed that the overall vision and the objectives of the 2020 edition of the European ATM Master Plan (Level 1 – Executive view) remain valid, while adjustments to the shorter-term (2020–2025) implementation milestones may be necessary. Many of which are dependent on on-going regulatory decisions impacting the SESAR Development (SESAR 3) and SESAR Deployment phases (CP1, RP3).

On this basis, it was decided to postpone the formal update of the implementation levels for the Master Plan for SESAR Development activities (level 2) and SESAR Deployment activities (level 3) until the aforementioned supporting regulatory decisions enter into force.

In 2022, the planned ATM Master Plan maintenance activities therefore will consist in:

- Delivering the annual updates for Level 2 and 3 with consideration for the associated standardisation and regulatory needs;
- The implementation of actions resulting from the advice provided by the Master Planning Committee.

The governance of the ATM Master Plan maintenance is materialised by the support provided to the SESAR JU's Executive Director by the ATM Master Planning Committee, as described in point 1.1.5.4 'ATM Master Planning Committee'.

Providing input to the Executive Director and facilitating his consultation of the ATM Master Planning Committee, in continuation of project PJ.20 over the 2016–2019 period, in 2022 the project PJ.20 W2 will support the SESAR JU in the maintenance of the ATM Master Plan in accordance with the signed grant agreement. The expected delivery of the PJ.20 W2 transversal activities is as follows.

PJ.20 W2 transversal deliverables	2022
Update of Master Plan level 1	X (if need is confirmed by the Board)
Update of Master Plan level 2 (published on MP portal and supporting level 1 GAP and impact assessment)	X (for endorsement by the Board)
Update of Master Plan level 3 (Plan & report)	X (for endorsement by the Board)
Update of standardisation needs	X
Update of regulatory needs	X

Table 2: Transversal deliverables of PJ.20 W2 supporting the Master Plan maintenance

Further information on the follow-on activities of the update of the 2020 edition of the European ATM Master Plan are provided in Section III, paragraph 2.1 'Strategic area of operation 1: Provide strategic steering to the SESAR programme (operational activity)'.

1.2.2. Content integration and transversal programme steering

The SESAR 2020 Programme requires expert guidance and steering to achieve the objectives of the European ATM Master Plan. While the decisions are taken by the SESAR JU in coordination with the SESAR governance, content-integration activities, supported by PJ.19 W2, coordinate and integrate operational and technical solutions, and as such support and guide the execution of the transversal processes (e.g. safety, security assessment, cost–benefit analysis) to ensure their completeness, consistency and coherence from a holistic perspective. The content-integration activities also cover the maintenance and support of the performance framework and ensure its implementation by the SESAR 2020 projects. These activities provide support to the activities that monitor the programme and that lead to the SESAR JU's necessary further decision-making.

The objective of project PJ.19 W2 is to support programme execution and IR project developments for the delivery of the SESAR solutions in line with the ATM Master Plan. To achieve that objective, the project will support the SESAR JU in:

- organising and executing content-integration change processes;

- organising on a continuous basis the activities needed at programme level aiming to coordinate and consolidate the ATM architectural content elements;
- contributing to the solution maturity assessment;
- ensuring the translation of the Master Plan performance ambition into validation targets;
- supporting solution projects in their performance evaluation and aggregate performance results in business cases, which will then be consolidated by PJ.20 W2 as part of its Master Planning maintenance activities;
- proposing concept-of-operations evolutions aligned with the SESAR target vision and the European ATM Master Plan performance ambitions;
- enabling and supporting the system engineering data management framework, allowing system engineering data to be captured (requirements and validation / demonstration objectives and results) in a structured way and ensuring consistency, coherence and coverage analysis at programme level.

The expected delivery of the PJ.19 W2 transversal activities is as follows.

PJ.19 W2 transversal deliverables	2022
Operational concept and High level Operational Requirements documents	X
Architecture description document	X
Consolidated performance assessment and gap analysis	X
Architecture release (Master Plan level 2) and eATM portal release note	X
Service roadmap and Service, Information and Terminology (RSIT) reports	X

Table 3: Concept, architecture and performance steering activities deliverables in 2022

1.2.3. Transversal and strategic steering activities funding

Strategic steering activities are supported by projects funded through ER and IR calls for proposals (see paragraphs 1.3 and 1.4 of this section), as follows:

Ref.	Title	Short project description	Call for proposals	Status (beg. 2021)	Max. total co-financing value (EUR) ([23])
PJ.19 W2	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 completeness, consistency and coherency from a holistic perspective as expressed in the SESAR concept of operations.	H2020-SESAR-2019-1	Ongoing during the period from 2020 to 2022	4 500 702

([23]) For closed projects, final grant amounts are indicated.

Ref.	Title	Short project description	Call for proposals	Status (beg. 2021)	Max. total co-financing value (EUR) ([23])
PJ.20 W2	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 as and when necessary the Master Plan, and in managing the Master Plan update campaigns.	H2020-SESAR-2019-1	Ongoing during the period from 2020 to 2022	2 088 795
NOSTROMO	Next-Generation Open-Source Tools for ATM Performance Modelling and Optimisation	The ATM system is composed of elements that interact with each other generating a number of properties characteristic of complex adaptive systems. NOSTROMO aims to develop new approaches to ATM performance modelling able to reconcile model transparency, computational tractability and ease of use with the necessary sophistication required for a realistic representation of the ATM system.	H2020-SESAR-2019-2	Ongoing during the period from 2020 to 2022	1 771 361
One transversal project ('Engage') addressing the Knowledge Transfer Network under the open ER 3 call (with reference H2020-SESAR-2016-1) is expected to be completed by the end of June 2022 (as a result of a grant extension request under finalisation).					

Table 4: SESAR 2020 programme transversal and strategic steering activities with related co-financing

Furthermore, as presented in Section II, point 2.3.1.2 'Expenditure', 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 carrying out the programme steering activities. The overall funding for strategic area of operation 1 is indicated in Annex II. Support contracts / agreements / working arrangements with additional stakeholder groups are funded through a dedicated budget subject to procurement actions.

1.2.4. Other activities carried out to assist stakeholders in matters related to the technological pillar of the SES

Following the delivery of the tasks entrusted to the SESAR JU in relation to the Airspace Architecture Study and its Transition Plan, the SESAR JU will carry out R & I tasks in 2022 in the context of the IR-VLD Wave 3 call (outlined below in subparagraph 1.4.3 'Wave 3 projects (from 2020 to 2022)').

Furthermore, in the 2022–2024 period, the SESAR JU will support the European Commission in relation with the preparation of the future ATM research agenda and practical steps as part of the new EU multiannual financial framework for 2021–2027.

The SESAR JU will also support the European Commission in the transition between the Pilot Common Project and the Common Project 1.

1.2.5. Support contracts and agreements / working arrangements

The SESAR JU has set up an external support contract to help in steering the SESAR 2020 Programme: the SESAR Development Support Services contract covering industrial support, programme management support and the provision of a collaborative programme management platform until the end of December 2022.

In addition, until the end of 2022, the SESAR JU will benefit from four main agreements with additional stakeholder groups to provide strategic advice to the SESAR JU:

- airspace-user support contracts (with civil airspace users),
- working arrangements with professional staff organisations,
- authority working arrangements (with national aviation authorities),
- the support contract with airports.

Furthermore, in 2022 the SESAR JU will continue to cooperate closely with EASA on the basis of the current memorandum of cooperation that is planned to be replaced by an inter institutional service level agreement for the provision of services in support of the execution of the European ATM Master Plan that were not covered by the EASA fees and charges or by a financial contribution and subsidies from the EU.

1.3. Strategic area of operation 2: Deliver exploratory research

As outlined in the SESAR 2020 Programme, ER topics presented in subparagraph 1.1.2 'SESAR 2020 Programme research topics to be addressed within the innovation pipeline' (Figure 6), are all essential and integral components of the R & I scope funded and managed by the SJU. These activities are structured around three key areas.

- One transversal area: the 'Knowledge Transfer Network'. Aims to assess and coordinate project results to contribute to spotting innovative ideas, concepts and models that can support the identification of ATM system concept trade-offs; new technology validation at system level; and defining and consolidating requirements. The ATM research community will be able to share research results.
- Two research areas, as described below.
  - **ATM excellent science and outreach.** This will help develop new concepts for ATM beyond those identified in the European ATM Master Plan, and will help to develop emerging technologies and methods to the level of maturity required to feed the applied research conducted by the SESAR JU. This part of ER will be structured around the four key features and the transversal needs of the programme to ensure there is a flow of ideas and results in a structured manner across the whole programme:
    - automation and autonomy,
    - complexity, data science and information management,
    - environment and meteorology for ATM,
    - performance, economics, legal and regulation,
    - ATM's role in intermodal transport,
    - CNS for ATM.
  - **ATM application-oriented research.** This aims at bridging ATM research with the wider research community and providing the necessary scientific support to ATM change. There will be 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 further funded research areas in other disciplines or sectors.

The abovementioned three areas of the ER are further complemented as of 2020 by the SESAR Digital Academy, described in more detail in point 1.3.3.2 of this section.

ER is fully funded by the EU under the Horizon 2020 framework and has a total funding amount of up to EUR 100 million ([24]), which includes direct funding (Title III – Operational expenditure) through open calls for proposals and a portion of the SESAR JU running costs (Title I – Staff expenditure and Title II – Infrastructure and operating expenditure). The overall funding for strategic area of operation 2 for 2022–2024 is indicated in Annex II.

([24]) The SESAR JU's basic act establishes an amount of 'EUR 85 million for exploratory research … Exploratory research activities should be entirely paid from the Union budget', which was confirmed in the multiannual work programme of the SESAR 2020 programme. With the addition of EUR 15.4 million to the maximum budget of the fourth open call for proposals for ER, the total budget allocated to ER activities has been increased to EUR 100 million, including direct funding and a proportion of SESAR JU running costs.

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

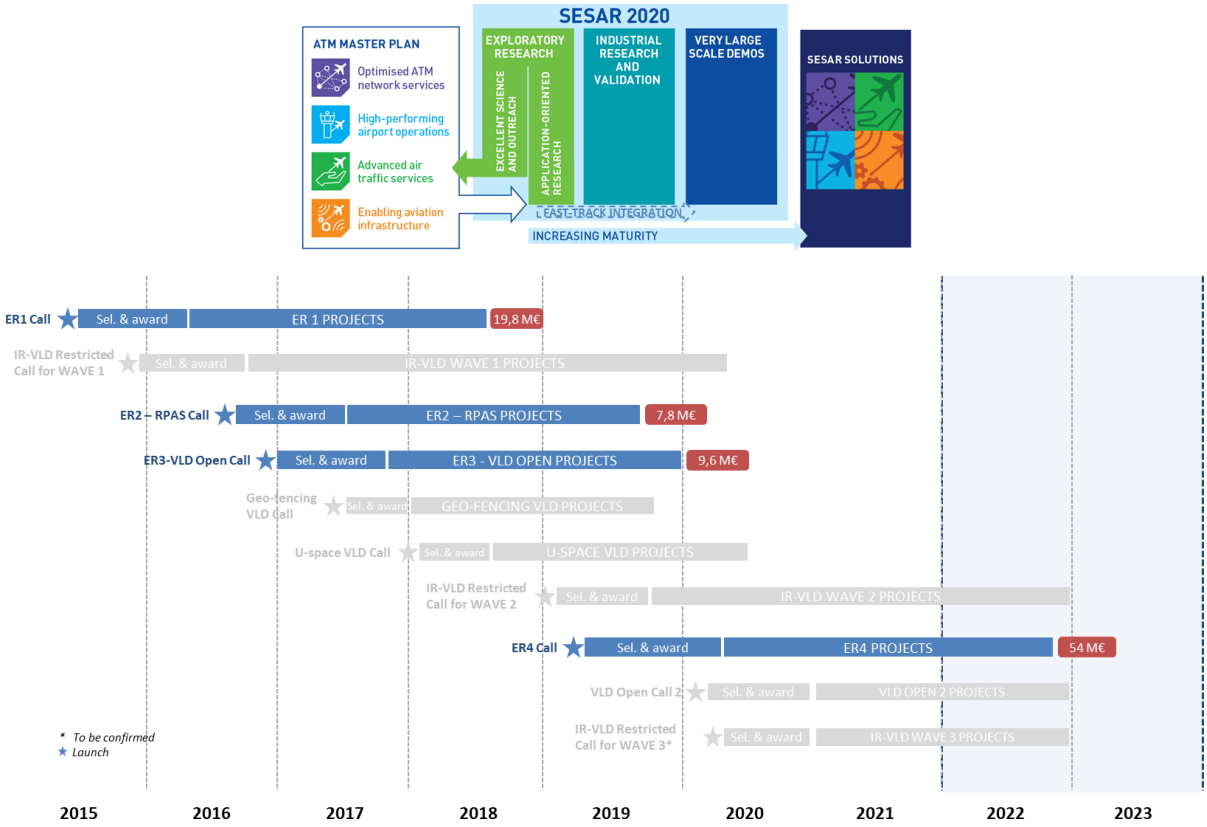

Figure 13: Sequence of ER calls and related funding over the 2015–2022 period

As depicted in this figure, during the 2022–2024 period the SESAR JU will, for ER activities, supervise and ensure the delivery of results by the projects launched under the ER4 call for proposals (with reference H2020-SESAR-2019-2), then ensure the financial and administrative closure of these projects in 2023. It is not expected that operational, financial or administrative activities in relation with ER will take place in 2024.

As outlined in the SESAR 2020 Programme research topics presented in subparagraph 1.1.2 ‘SESAR 2020 Programme research topics to be addressed within the innovation pipeline’, ER activities cover application-oriented research focusing on the four key features of the ATM Master Plan, along with fundamental scientific research activities.

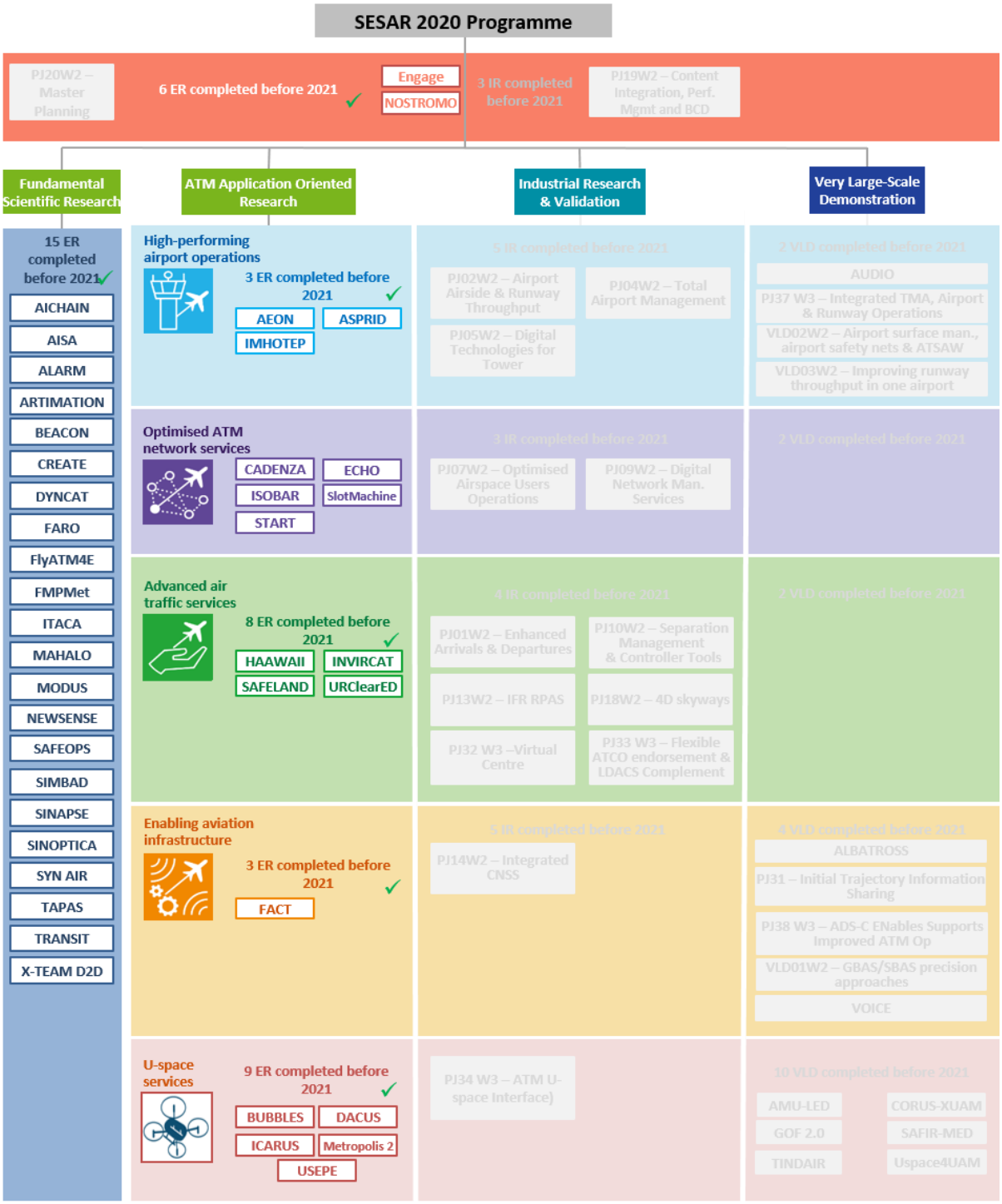

Figure 14: SESAR 2020 Programme portfolio of projects for ER at the beginning of 2021

1.3.1. Calls for proposals launched in previous years and already closed in the beginning of 2022

Two first calls on ER were organised in 2015 and 2016, resulting in a total of 37 projects, which are now complete. Details on these calls and projects can be found in the SESAR JU's SPDs for previous periods and in the SESAR JU's consolidated annual activity reports.

The third call related to ER (under the call for proposals with reference H2020-SESAR-2016-2 with the designation ER3/VLD Open) resulted in eight ER projects.

A summary of the results of ER projects already completed and closed is available in the SESAR JU consolidated annual activity reports.

1.3.2. Calls for proposals in execution: ER4 call for proposals with reference H2020-SESAR-2019-2

A fourth ER call was launched in 2019. After the completion of the call procedure and the successful award of 29 grants, 27 ER projects were launched by the end of May 2020 and two projects ('HAAWAII' and 'FACT' 'HAAWAII') were launched in June 2020 and July 2020 respectively.

During the review of its budget for expenditure conducted in April 2020, the SESAR JU identified available operational appropriations (Title III). Considering the overall very good quality of proposals received in response to the ER4 call, and kept on a reserve list due to the limited budget initially available (EUR 38.6 million at the launch of the call), the SESAR JU decided to take the opportunity of the available operational appropriations to increase the maximum budget of the ER4 call for proposals.. In September 2020, an additional amount of EUR 15.4 million was made available, which allowed the SESAR JU to award 12 additional grants to projects on the reserve list (six in work area 1 and six in work area 2); the grant agreement preparation phase concluded in December 2020 with the signature of all grant agreements and the launching of the projects in execution.

For the ER4 call for proposals, the SESAR JU will comply with all provisions of the 'General Annexes' to the 'Horizon 2020 work programme 2018–2020' ([25]). All related grants will be in compliance with the Horizon 2020 model grant agreement.

All ER4 projects are expected to close by the end of 2022. This call is building on and complementing the research topics already included in the earlier ER calls launched in 2015 and 2016 (see above). By the end of 2021, the SESAR 2020 Programme included the following projects as a result of the ER4 call[26].

Project reference	Project title	Short project description	Max. total funding value (EUR)
AEON	Advanced Engine Off Navigation	AEON aims at defining a concept of operations focusing on engine-off taxiing techniques, and a set of dedicated tools to support the operators. The project defines how to determine, in real time, efficient and conflict-free routing plans for autonomous and non-autonomous aircraft taxiing from gates to the corresponding runways and the other way around	1 444 525
AICHAIN	A platform for privacy-preserving Federated Machine Learning using Blockchain to enable Operational Improvements in ATM	AICHAIN proposes an innovative digital information management concept combining federated machine learning and Blockchain technologies. This enables the cyber-secured exploitation of large private data sets by a privacy-preserving federated learning architecture in which	996 505

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

([26]) One project, 'NOSTROMO', funded through the ER4 call for proposals, supports strategic steering activities. Therefore, it is not included in this list and the relative details are described in paragraph 1.2.3. Transversal and strategic steering activities.

Project reference	Project title	Short project description	Max. total funding value (EUR)
		neither the training data nor the training model needs to be exposed.	
AISA	AI Situational Awareness Foundation for Advancing Automation	To implement advanced automation, artificial intelligence (AI) and humans need to be able to share situational awareness. Therefore, the AISA project is exploring the effect of, and opportunities for, distributed human-machine situational awareness in en-route air traffic control (ATC) operations. The project is developing an intelligent situationally aware system by combining machine learning with a reasoning engine.	990 125
ALARM	multi-hAzard monitoring and earLy wARning systeM	ALARM aims to develop a prototype global multi-hazard monitoring and Early Warning System (EWS). A global multi-hazard monitoring means near-real time and continuous global Earth observations from satellite, with the objective to generate prompt alerts of natural hazards affecting ATM and to provide information for enhancing situational awareness and providing resilience in crisis.	991 269
ARTIMATION	TRANSPARENT ARTIFICIAL INTELLIGENCE AND AUTOMATION TO AIR TRAFFIC MANAGEMENT SYSTEMS	ARTIMATION aims to investigate AI methods in predicting air transportation traffic and optimizing traffic flows based on Explainable Artificial Intelligence (XAI) to address the challenge related to transparency of automated system in the ATM domain. ARTIMATION will provide a proof-of-concept of transparent AI models that includes visualization, explanation and generalization to ensure safe and reliable decision support.	999 375
ASPRID	Airport System Protection from Intruding Drones	ASPRID aims to assess the problem of protecting the airport operations from drone intrusion (careless or malicious) under a holistic and operationally oriented approach. The Project proposes to investigate vulnerability of airport under the different types of threat and possible ways of response as well as to study the interrelations between all those aspects involving different scenarios.	1 235 195
BEACON	Behavioural Economics for ATM Concepts	BEACON aims to study the feasibility of extending user-driven prioritisation process to allow multi-prioritisation processes in the airspace and the exchange of slots between airlines. It will build two models: a strategic model and a	996 594

Project reference	Project title	Short project description	Max. total funding value (EUR)
		detailed tactical simulator. To properly capture the agents' behaviours, BEACON will make use of behavioural economics.	
BUBBLES	Defining the BUilding Basic BLocks for a U-Space SEparation Management Service	BUBBLES aims to formulate and validate the concept of a U-space advanced (U3) 'separation management service'. It will develop algorithms to compute the collision risk of unmanned aerial systems, allowing separation minima and methods to be defined so that a safety level stated in terms of overall probability of collision can be defined and maintained.	1 606 109
CADENZA	Advanced Capacity and Demand Management for European Network Performance Optimization	CADENZA aims to develop a detailed trajectory broker concept for the European network, incorporating advanced demand–capacity balancing mechanisms. The trajectory broker will balance capacity and demand through a coordinated capacity provision process and collaborative trajectory management (including a novel trajectory-charging scheme). Significant improvements in cost-efficiency and delay are expected.	1 158 124
CREATE	Innovative operations and climate and weather models to improve ATM resilience and reduce impacts	Air operations largely use weather information to make the air traffic flow safe, continuous and efficient. As climate changes continue, the information available on the weather at short and longer notice is increasing and technology is being improved. CREATE aims to achieve innovative procedures in ATM to reduce the climate and environmental impact, while becoming more resilient to weather phenomena.	998 165
DACUS	Demand and Capacity Optimisation in U-space	DACUS aims to develop a service-oriented Demand and Capacity Balancing (DCB) process for drone traffic management. This overall objective responds to an operational and technical need in European drone operations for a tangible solution integrating the functionalities of SESAR's U-space services for traffic management to produce timely, efficient and safe decisions.	1 739 618
DYNCAT	Dynamic Configuration Adjustment in the TMA	DYNCAT aims to enable more environmentally friendly and more predictable flight profiles in the TMA, namely on approach, by supporting pilots in configuration management.	989 299

Project reference	Project title	Short project description	Max. total funding value (EUR)
ECHO	European Concept of operations for Higher airspace Operations	ECHO aims to deliver a comprehensive demand analysis and innovative and feasible Concept of Operations enabling near term and future Higher Airspace operations in a safe and orderly manner. The Higher Airspace including the operators forms a new, almost legacy free environment enabling an expeditions uptake of innovations or extrapolated SESAR solutions	1 968 865
FACT	Future All Aviation CNS Technology	FACT aims to increase safety, security, efficiency, and robustness of future air traffic environment through development of integrated CNS functional architecture supporting the use of common performance based approach, addressing needs of large spectrum of airspace users across varied operational environments.	1 850 500
FARO	saFety And Resilience guidelines for aviatiOn	FARO aims to bring new insights into safety and resilience in ATM, with four objectives: to exploit existing safety knowledge; to quantify the impact of increasing automation on ATM safety; to analyse the impact of increasing automation on ATM resilience; and to provide design guidelines and identify future research needs.	999 559
FlyATM4E	Flying Air Traffic Management for the benefit of environment and climate	FlyATM4E aims to expand approved climate-assessment methods and the optimisation of aircraft trajectories to identify promising mitigation options suitable for solving the task of reducing the overall climate impact of aircraft operations. The project will assess the feasibility of a concept for the environmental assessment of ATM operations working towards the environmental optimisation of air traffic operations.	999 765
FMPMet	Meteorological uncertainty management for Flow Management Positions	FMPMet aims to integrate meteorological forecast uncertainty information into the decision-making process for flow management position. FMPMet aims to provide the flow management position with an intuitive and interpretable probabilistic assessment of the impact of convective weather on the operations, up to 8 hours in advance.	849 000
HAAWAII	Highly Automated Air Traffic Controller	HAAWAII aims to research and develop a reliable, error-resilient and adaptable	1 825 000

Project reference	Project title	Short project description	Max. total funding value (EUR)
	Workstations with Artificial Intelligence Integration	solution to automatically transcribe voice commands issued by both air traffic controllers and pilots, and to perform proof-of-concept trials in challenging environments. Also, the objectively estimated controllers' workload utilising digitised voice recordings of the complex London TMA will be assessed.	
ICARUS	Integrated Common Altitude Reference System for U-space	ICARUS aims to propose an innovative solution to the challenge of the common altitude reference inside very low-level airspaces with the definition of a new U-space service and its validation in a real operational environment.	1 144 588
IMHOTEP	Integrated Multimodal Airport Operations for Efficient Passenger Flow Management	IMHOTEP aims to develop a concept of operations and a set of data analysis methods, predictive models and decision-support tools that allow information sharing, common situational awareness and real-time collaborative decision-making between airports and ground transport stakeholders.	1 999 805
INVIRCAT	IFR RPAS Control in Airports and TMA	INVIRCAT aims to create a concept of operations for remotely piloted aircraft systems in the terminal manoeuvring area of airports, assessing it through simulations, and to draft a set of recommendations for rule-makers and standardisation bodies.	1 416 055
ISOBAR	Artificial Intelligence Solutions to Meteo-Based DCB Imbalances for Network Operations Planning	ISOBAR aims at providing a service- and AI-based network operations plan, by integrating enhanced convective weather forecasts for predicting imbalances between capacity and demand and exploiting AI to select mitigation measures at the local and network levels in a collaborative air-traffic-flow and capacity-management operations paradigm.	1 908 798
ITACA	Incentivising Technology Adoption for Accelerating Change in ATM	ITACA aims to accelerate the development, adoption and deployment of new technologies in ATM. ITACA will develop a new set of methodologies and tools enabling the rigorous and comprehensive assessment of policies and regulations aimed at amplifying the uptake of new technologies within ATM.	999 938
MAHALO	Modern ATM via Human/Automation Learning Optimisation	To answer the question of whether automation should match human behaviour or be understandable to humans, MAHALO aims to develop an	997 213

Project reference	Project title	Short project description	Max. total funding value (EUR)
.....		individually tuned machine learning system to solve ATC conflicts and couple this to an enhanced en-route Conflict Detection & Resolution display. Insights will be used to define a framework to guide the design of future AI systems.	
Metropolis 2	Metropolis 2: A unified approach to airspace design and separation management for U-space	Metropolis 2 aims to provide the fundamentals for concrete solutions for U-space U3/U4 services that are needed to enable high density urban aerial operations, with a unified approach to the following U-space services: strategic deconfliction, tactical deconfliction, and dynamic capacity management.	1 692 760
Modus	Modelling and assessing the role of air transport in an integrated, intermodal transport system	Modus analyses the performance of the overall transport system by considering the entire door-to-door journey holistically. The project identifies (future) drivers for passenger demand and supply and assesses the impact on airside and landside processes and capacities. Based on these analyses, potential solutions to meet high-level European transport objectives are proposed.	998 875
NewSense	Combining Simulation Models and Big Data Analytics for ATM Performance Analysis	NewSense aims to improve safety and efficiency of operations primarily in secondary airports with innovative low-cost surface surveillance solutions, based on 5G cellular networks for the long term, and millimeter-wave radar for the medium term, allowing the implementation of affordable Advanced-Surface Movement Guidance and Control Systems (A-SMGCS).	943 960
SAFELAND	SAFE LANDing through enhanced ground support	SAFELAND aims to support the flight and landing of aircraft operated by a single pilot, in case of partial or total incapacitation of the pilot. SAFELAND will focus on the ground side, and specifically on the role ATM could have in managing the transition from a single-pilot-operated flight to a status with reduced or absent contribution of the on-board pilot to landing.	1 978 138
SafeOps	From Prediction to Decision Support - Strengthening Safe and Scalable ATM Services through Automated Risk Analytics based on	Maintaining safety and cost-efficiency of air transport operations while increasing the capacity will push the next generation of ATM systems towards digitalization. In the mid-term, a digitalized system in the human operated ATM environment will be	997 750

Project reference	Project title	Short project description	Max. total funding value (EUR)
	Operational Data from Aviation Stakeholders	capable of delivering reliable predictive analytics based on automated information processing. SafeOPS aims to support these future services by investigating the use of big data analytics together with new risk assessment methodologies	
SIMBAD	Combining Simulation Models and Big Data Analytics for ATM Performance Analysis	SIMBAD aims to develop and evaluate a set of machine learning approaches aimed at providing state of-the-art ATM microsimulation models with the level of reliability, tractability and interpretability required to effectively support performance evaluation at ECAC level. The project will demonstrate and evaluate the newly developed methods and tools through a set of case studies.	999 938
SINAPSE	Software defined networking architecture augmented with Artificial Intelligence to improve aeronautical communications performance, security and efficiency	SINAPSE aims to propose an intelligent and secured aeronautical datalink communications network architecture design, based on the software-defined networking architecture model augmented with AI to predict and prevent safety services outages, to optimise available network resources and to implement cybersecurity functions protecting the network against digital attacks.	853 300
SINOPTICA	Satellite-borne and IN-*situ* Observations to Predict The Initiation of Convection for ATM	SINOPTICA aims to explore the potential of assimilating remote-sensing, global navigation satellite system (GNSS)-derived datasets and in situ weather-station data into very high-resolution, very short-range numerical weather forecasts to provide improved prediction of extreme weather events to the benefit of ATM operations.	999 285
SlotMachine	A Privacy-Preserving Marketplace for Slot Management	Until now, ATFM slots have only been subject to intra-airline swaps, used by airlines to prioritize expensive flights and thus minimize overall costs. Airlines want to keep the cost structure of their flights confidential, as they fear a competitive disadvantage when disclosed. This desire for confidentiality has hampered slot swapping between different airlines. SlotMachine aims to employ blockchain technology and secure multi-party computation to extend the existing UDPP solution with the possibility to keep private the participating airlines'	1 937 739

Project reference	Project title	Short project description	Max. total funding value (EUR)
		confidential information, such as the cost structure of flights.	
START	a Stable and resilient ATM by integrating Robust airline operations into the network	START aims to develop, implement and validate optimisation algorithms for robust airline operations that result in stable and resilient ATM performance even in disturbed scenarios. The main focus of the project is the optimisation of conventional traffic situations while considering disruptive weather events such as thunderstorms.	1 999 411
SYN AIR	Synergies between transport modes and Air transportation	SYN+AIR aims to generate common goals for Transport Service Providers, that will justify data sharing while facilitating the user to execute a seamless D2D journey. SYN+AIR will generate customer door-to-door journeys and will analyse how those journeys can be facilitated through improved planning and operations activities (following the ATFCM phases: strategic, pre-tactical, tactical) powered by data sharing.	997 250
TAPAS	Towards an Automated and exPlainable ATM System	TAPAS aims to explore highly automated AI-based scenarios through analysis and experimental activities applying explainable artificial intelligence and visual analytics, in order to derive general principles of transparency that pave the way for the application of AI technologies in ATM environments, enabling higher levels of automation.	997 410
TRANSIT	Travel Information management for Seamless Intermodal Transport	TRANSIT aims to develop a set of multimodal key performance indicators, mobility data analysis methods and transport simulation tools, allowing the evaluation of the impact of innovative intermodal transport solutions on the quality, efficiency and resilience of the door-to-door passenger journey.	999 950
URClearED	A Unified Integrated Remain Well Clear Concept in Airspace D-G Class	URClearED aims to support current study activities on the RWC functionalities by defining and analysing operational scenarios, which allow to assess requirements and assumptions made in current standards and applicable documents, and then paving the way to future industrial level activities on such system.	1 631 793
USEPE	U-space Separation in Europe	USEPE aims to research on drones' separation methods in high demanding	1 999 309

Project reference	Project title	Short project description	Max. total funding value (EUR)
		environments such as cities, and on the use of machine learning algorithms to automate the safe separation and de-confliction of drones, while maintaining airspace capacity in different environments. The research approach will take into account both the strategic and tactical flight phases.	
X-TEAM D2D	eXTEnded AtM for Door2Door travel	X-TEAM D2D aims to define, develop and initially validate a concept of operations for the seamless integration of ATM and Air Transport into an overall intermodal network, including other available transportation means (surface, water), to enable the door-to-door connectivity, in up to 4 hours, between any location in Europe.	997 375

Table 5: Ongoing ER4 projects in 2022 (under the call for proposals with reference H2020-SESAR-2019-2)

1.3.3. Other activities related to exploratory research

1.3.3.1. SESAR Innovation Days

The SESAR Innovation Days are an annual event representing the main vehicle for SESAR Joint Undertaking to share progress and disseminate exploratory research results, where researchers, industry and stakeholders meet to exchange information on new and innovative research activities and relevant results coming from the SESAR Programme managed by the SJU; they are the main vehicle for SESAR Joint Undertaking to share progress and disseminate exploratory research results

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

As in previous years, the 2021 event will be shaped by scientific papers and presentations, selected based on an open call for contributions. The event will also feature a poster exhibition and a networking event, which will provide participants with the opportunity to learn about other interesting projects and to meet like-minded researchers and key industry, airport and airline players (see Table 23 in Section III, point 2.5.1.1 'Communication and promotion activities'). Given the current situation with Covid-19 and the associated impact on travel and gatherings, the 2021 edition of the SESAR Innovation Days will take place online from 7-9 December.

The SESAR Young Scientist Award, which aims to recognise young scientists with great potential who contribute to the scientific research in the field of ATM and aviation, is also presented during the SESAR Innovation Days.

1.3.3.2. SESAR Digital Academy

The SESAR Digital Academy responds to a request from the previous Commissioner for transport to skill and inspire the next generation aviation workforce in anticipation of the digital economy.

The vision of the SESAR Digital Academy is to become a recognised learning initiative supporting Europe's future aviation and ATM workforce. The mission is to nurture Europe's brightest minds and advance learning, scientific excellence and innovation in aviation and ATM, to promote student mobility and a whole spectrum of learning opportunities, from fundamental research to industry-focussed applied research, and to enhance the knowledge, skills and employability of aviation professionals.

The SESAR Digital Academy seeks to bring together under one umbrella SESAR exploratory research activities and outreach, relating to education and training, as well as professional learning opportunities offered by research centres, universities, industry partners and other entities within the ATM/aviation domain.

Linked with the Knowledge Transfer Network (addressed by the ER3 project 'Engage'), and making use of a dedicated portal on the SESAR JU's website, in 2022 and 2023 the initiative will increase the accessibility and visibility of existing SESAR outreach and will continue to highlight relevant events, such as the SESAR Innovation Days, along with other activities targeting students and the academic community, such as the Young Scientist Award.

It is expected that the Digital Academy will complete its activities by the end of 2022 and will not be carried out in 2023 and 2024.

1.4. Strategic area of operation 3: Deliver industrial research and validation

During the reporting period, SESAR 2020 IR activities will facilitate the migration of ideas from ER and have them further extended in the applied research and finally in the pre-industrial development stage, 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 that are derived from the ATM Master Plan and identified in the SESAR 2020 multiannual work programme.

This is done through projects funded under a maximum of three calls for proposals restricted to the 19 SESAR JU Members other than the EU and EUROCONTROL. The total EU funding available for these calls under Horizon 2020 is EUR 398 million in direct costs (Title III – Operational expenditure), including EUR 319.7 million for IR and EUR 18.8 million for strategic steering activities – see paragraph 1.2 'Strategic area of operation 1: Provide strategic steering to the SESAR programme' above; the remaining part is for VLDs – see paragraph 1.5 'Strategic area of operation 4: Deliver very large-scale demonstration activities', as depicted in the figure below.

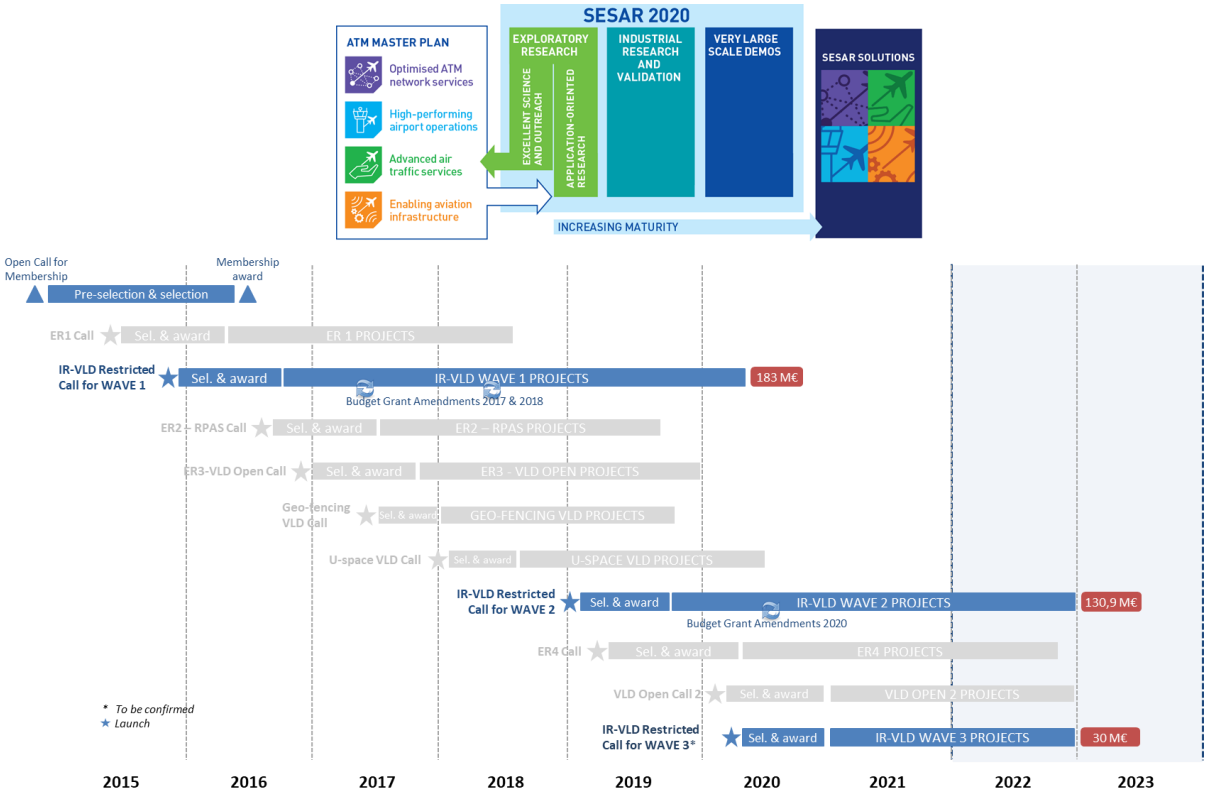

Figure 15: Sequence of IR calls and related funding over the 2015–2022 period

The exact amount of each call is to be confirmed, especially taking into account the results of the calls for proposals with reference H2020-SESAR-2019-1 (IR-VLD Wave 2 call) and H2020-SESAR-2020-2 (IR-VLD Wave 3). All projects will be completed by the end of 2022.

In addition, a portion of the SESAR JU's running costs (Title I – Staff expenditure and Title II – Infrastructure and operating expenditure) is used to carry out the IR activities. The overall funding for strategic area of operation 3 (IR) for 2022–2024 period is indicated in Annex II.

As outlined in the SESAR 2020 Programme research topics presented in subparagraph 1.1.2 'SESAR 2020 Programme research topics to be addressed within the innovation pipeline', IR is structured around the four key features of the ATM Master Plan, as shown in the following figure.

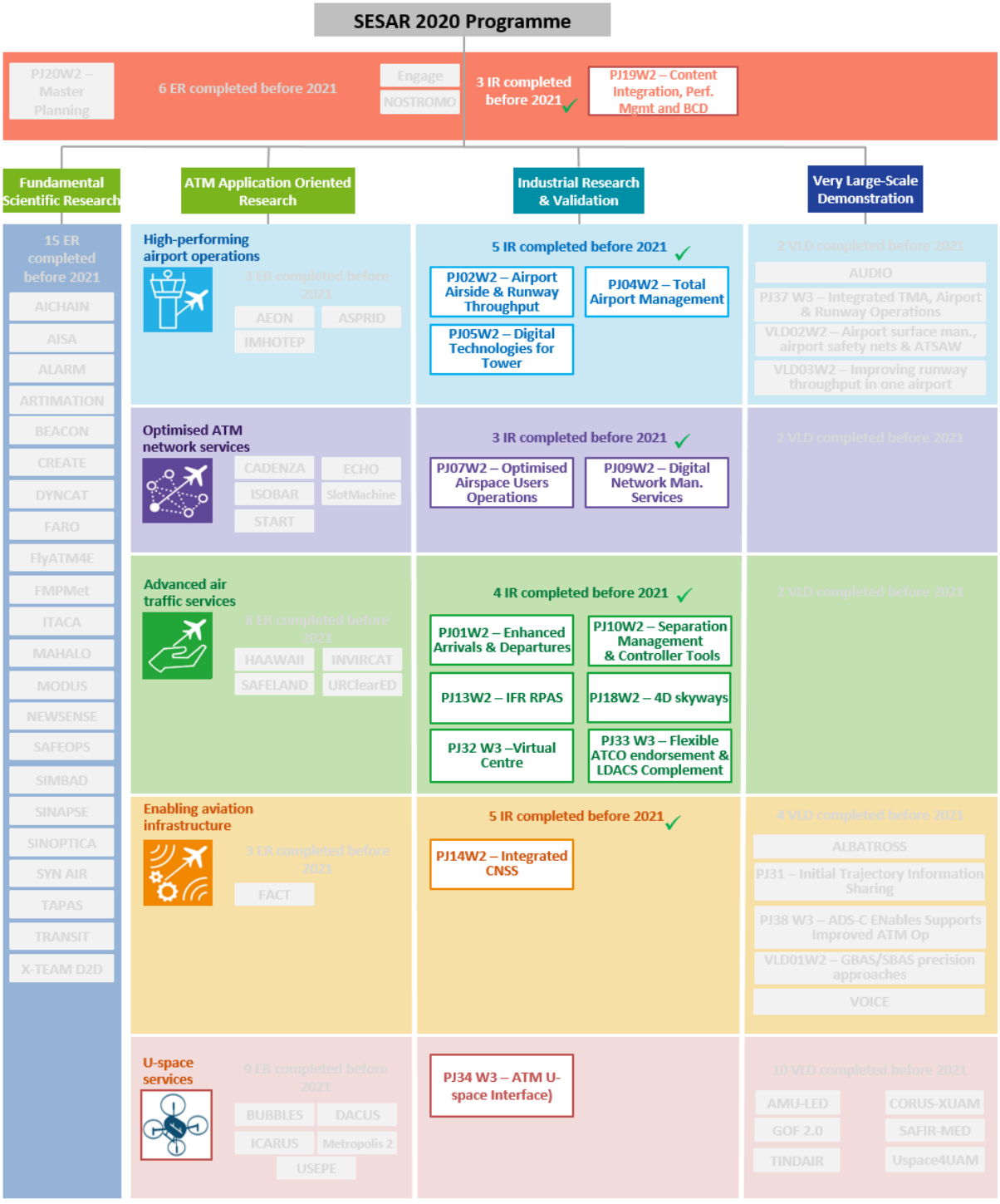

Figure 16: SESAR 2020 Programme portfolio of projects for IR at the beginning of 2021

All projects under Wave 1 have completed. In 2022, the SESAR JU will, in the context of IR activities, supervise and ensure the delivery of (candidate) SESAR solutions by the IR Wave 2 and IR Wave 3 projects (end result: the SESAR solution packs), then close the grant agreements by the end of 2022.

The SESAR JU will then ensure the financial and administrative closure of the grant agreements by the end of 2023. It is not expected that operational, financial or administrative activities in relation with IR will take place in 2024. The following paragraphs indicate the remaining candidate SESAR solutions that will be delivered by the above-listed projects through the SESAR release process. Each entry represents the targeted achievement of a European operational concept validation methodology maturity level (V1, V2, or V3); an 'S' representing the target availability date of the SESAR solution. The mapping of these candidate SESAR solutions with the nine essential operational changes is provided in Annex A of the 2020 edition of the European ATM Master Plan.

Complementing the results from Wave 1, the results from Wave 2 and Wave 3 will cover the objectives set for the development phase of the SESAR programme in the ATM Master Plan. Considering that the Wave 3 call is complementing some Wave 2 activities, the option on the complementarity of grants has been activated for the Wave 3 call for proposals (with reference H2020-SESAR-2010-2).

1.4.1. Building on SESAR success toward engaging into the European environmental commitment and the Green Deal

Innovation in ATM has progressed over the past decade thanks to the SESAR programme. More in detail, en-route solutions detailed in the second wave of ongoing projects might offer a potential benefit of 200.3 kg/ CO2 per ECAC flight, if deployed at large scale in the European airspace.

As example, the major SESAR 1 solutions contributing to the CO2 reduction per flight are the following:

- PJ.10-02b: Advanced Separation Management where the savings can reach -114.0 kg/ CO2 per flight in the departure or arrival phase as well as en-route.
- PJ.01-02: Use of Arrival and Departure Management Information for Traffic Optimisation within the TMA offering up to -54.2 kg/ CO2 per flight, in the arrival phase of the flight

Around airport, SESAR Solutions for airport and terminal airspace, such as continuous climb and descent operations (CCO/CDO), or noise preferential routes are being considered for deployment to address noise reduction. Interestingly, this is done taking into consideration the problematic of interdependencies and trade-off between strategic environmental objectives. The concept of continuous descent/climb approach offer a potential savings of 340 000 t. fuel/year, equivalent to 1.1 million t/CO2.

At airport, for ground operations, the use of emission free taxiing, without compromising punctuality, could make a fuel saving of around 2 %, and as such should be further studied and generalised. Additionally, Improved airport operations (advanced collaborative decision making) & optimised taxi and runway usage in order to avoid unnecessary fuel burn are reflected in 13 of the 17 A-CDM airports that target to bring improvements of 108 072 t of CO2 emissions.

At the end of 2020, looking at the ambition from SESAR to deliver an improvement between 250 and 500 kg of kerosene per flight, the state of play of the program indicates that only a low effort is required to achieve the expected performance ambition lower levels of the Master Plan. The continuation of the program beyond 2020 under the new JU setting and its strengthening in developing solutions targeting environmental impact, will allow reaching the ATM Master Plan objectives.

1.4.2. Wave 2 projects (from 2019 to 2022)

The IR Wave 2 call for proposals (within the restricted call with reference H2020-SESAR-2019-1, also covering VLD activities) was launched in Q1 2019. The evaluation of the proposals was performed, the beneficiaries were selected and the grants were awarded by the end of 2019. The grant agreement signature procedure was finalised by the end of 2019 for grants related to industrial research. This enabled the launch into execution of all Wave 2 IR projects during Q4 2019. The delivery of the Wave 2 SESAR solutions is expected during the 2020–2022 period.

The IR Wave 2 call aims to enable the flexibility needed to align future research with the results of Wave 1, reassess 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 that were not planned to be delivered to V3 maturity level within Wave 1. Finally, it will allow for strategic input to scope new projects from the Master Plan update and to build on the results of the outcome of ER projects from the ER1 call to increase the maturity of the research towards future solutions.

Furthermore, the results from the IR-VLD Wave 2 call for proposals will provide the basis for setting up a changed ecosystem for aviation, and more specifically to modernise the underlying ATM infrastructure. This ecosystem will mainly be built upon ATM solutions characterised by:

- higher levels of autonomy and connectivity of all air vehicles, coupled with more automated traffic management;
- 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 devices 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 target vision provided in the European ATM Master Plan, updated and refined in the 2018–2019 campaign to develop the 'Digital European Sky' vision, and its performance ambition. This approach relied on the use of the following prioritisation criteria.

- **ATM performance improvement potential.** Demonstrating performance gains in capacity (at the 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 2020 Programme complies with all of the provisions of the '*Horizon 2020 work programme 2018–2020*' for IR Wave 2 and Wave 3 projects. However, it should be noted that the SESAR 2020 Programme delivers results through the SESAR solutions and not project by project. Therefore, it is not necessary for all IR projects (receiving co-financing following restricted calls for proposals, as defined in Section III, subpoint 2.6.1.1.3 of the SPD for 2020–2022) to provide open access to all research data, and they may decide to opt out of the provisions of Annex L 'Conditions related to open access to

research data' contained in the 'General Annexes' to a related Horizon 2020 work programme ([27]). This opt-out, if used, would aim to protect results that are expected to be commercially or industrially exploited and/or to protect the project's main aim ([28]) of contributing to a programme comprising two or more projects that jointly contribute to the delivery of one or more SESAR solutions.

A summary of closed IR projects and their results is available in the latest SESAR JU consolidated annual activity report.

All solutions referred to in the following tables are being developed through IR Wave 2 projects launched in Q4 2019.

1.4.2.1. IR Wave 2 projects delivering candidate SESAR solutions within the 'High-performing airport operations' key feature

The 'High-performing airport operations' IR projects will deliver the following results (candidate SESAR solutions) in 2022.

Candidate SESAR solution ref.	Candidate SESAR solution title	Expected maturity level in 2022	ATM system upgrade phase	ATM Master Plan KPAs contributed to
PJ.02-W2-04 (Wave 2)	Advanced geometric GNSS-based procedures in the TMA	V2	Phase C – Regional, trajectory-based, flight- and flow-centric operations	Capacity Operational efficiency (fuel & CO^2 reduction) Predictability Safety Cost-efficiency Flexibility
PJ.02-W2-14 (Wave 2)	Evolution of separation minima for increased runway throughput	V3-S	Phase C – Regional, trajectory-based, flight- and flow-centric operations	Capacity Operational efficiency (fuel & CO^2 reduction) Resilience Safety Human performance
PJ.02-W2-21 (Wave 2)	Digital evolution of integrated surface management	V3-S	Phase C – Regional, trajectory-based, flight- and flow-centric operations	Capacity Predictability Safety Human performance
PJ.02-W2-17 (Wave 2)	Improved access to secondary airports	V3-S	Phase C – Regional, trajectory-based,	Capacity Predictability

([27]) Part 20 'General Annexes' to the 'Horizon 2020 work programme 2016–2017' (European Commission Decision C(2016) 4614 of 25 July 2016); or Part 19 'General Annexes' to the 'Horizon 2020 work programme 2018–2020' (European Commission Decision C(2019) 4575 of 2 July 2019).

([28]) In line with 'General Annexes', Annex L, second paragraph, points (a) and (d) of the 'Horizon 2020 work programme 2016–2017'.

Candidate SESAR solution ref.	Candidate SESAR solution title	Expected maturity level in 2022	ATM system upgrade phase	ATM Master Plan KPAs contributed to
			flight- and flow-centric operations	Safety
PJ.02-W2-25 (Wave 2)	Safety support tools for avoiding runway excursions	V3-S	Phase B – Efficient services and infrastructure delivery	Safety Human performance Interoperability Cost-efficiency Capacity
PJ.04-W2-28 (Wave 2)	Enhanced collaborative airport performance planning and monitoring	V3-S	Phase C – Regional, trajectory-based, flight- and flow-centric operations	Predictability Punctuality Operational efficiency (fuel & CO^2 reduction) Resilience
PJ.04-W2-29 (Wave 2)	Digital collaborative airport performance management	V3-S	Phase C – Regional, trajectory-based, flight- and flow-centric operations	Capacity Predictability Punctuality Operational efficiency (fuel & CO^2 reduction)
PJ.05-W2-35 (Wave 2)	Multiple remote tower and remote tower centre	V3-S	Phase C – Regional, trajectory-based, flight- and flow-centric operations	Cost-efficiency Access and equity Human performance
PJ.05-W2-97 (Wave 2)	HMI interaction modes for airport tower	TRL4	Phase C – Regional, trajectory-based, flight- and flow-centric operations	Capacity Cost efficiency Safety

Table 6: Delivery of candidate SESAR solutions within the 'High-performing airport operations' key feature in 2022

1.4.2.2. IR Wave 2 projects delivering candidate SESAR solutions within the 'Optimised ATM network services' key feature

The 'Optimised ATM network services' IR projects will deliver the following results (candidate SESAR solutions) in 2022.

Candidate SESAR solution ref.	Candidate SESAR solution title	Expected maturity level in 2022	ATM system upgrade phase	ATM Master Plan KPAs contributed to
PJ.07-W2-38 (Wave 2)	Enhanced integration of AU trajectory definition and network management processes	V3-S	Phase C – Regional, trajectory-based, flight- and flow-centric operations	Operational efficiency (fuel & CO^2 reduction) Predictability Flexibility Access and equity

Candidate SESAR solution ref.	Candidate SESAR solution title	Expected maturity level in 2022	ATM system upgrade phase	ATM Master Plan KPAs contributed to
PJ.07-W2-40 (Wave 2)	Mission trajectories management with integrated dynamic mobile areas type 1 and type 2	V3-S	Phase C – Regional, trajectory-based, flight- and flow-centric operations	Cost-efficiency Safety Operational efficiency (fuel & CO^2 reduction) Capacity Predictability Human performance Cost-efficiency Flexibility Civil/military cooperation and coordination Access and equity
PJ.07-W2-39 (Wave 2)	Collaborative framework managing delay constraints on arrivals	V3-S	Phase C – Regional, trajectory-based, flight- and flow-centric operations	Predictability Flexibility Access and equity
PJ.09-W2-44 (Wave 2)	Dynamic airspace configurations	V3 ongoing	Phase C – Regional, trajectory-based, flight- and flow-centric operations	Cost-efficiency Safety Operational efficiency (fuel & CO^2 reduction) Capacity Predictability Human performance Cost-efficiency Flexibility Civil/military cooperation and coordination Access and equity
PJ.09-W2-45 (Wave 2)	Enhanced network traffic prediction and shared complexity representation	V3-S	Phase C – Regional, trajectory-based, flight- and flow-centric operations	Safety Operational efficiency (fuel & CO^2 reduction) Capacity Cost-efficiency Predictability Flexibility Access and equity
PJ.09-W2-49 (Wave 2)	Collaborative network performance management	V3-S	Phase C – Regional, trajectory-based, flight- and flow-centric operations	Safety Operational efficiency (fuel & CO^2 reduction) Predictability Cost-efficiency

Candidate SESAR solution ref.	Candidate SESAR solution title	Expected maturity level in 2022	ATM system upgrade phase	ATM Master Plan KPAs contributed to
				Capacity Flexibility Security Access and equity

Table 7: Delivery of candidate SESAR solutions within the 'Optimised ATM network services' key feature in 2022

1.4.2.3. IR Wave 2 projects delivering candidate SESAR solutions within the 'Advanced air traffic services' key feature

The 'Advanced air traffic services' IR projects will deliver the following results (candidate SESAR solutions) in 2022.

Candidate SESAR solution ref.	Candidate SESAR solution title	Expected maturity level in 2022	ATM system upgrade phase	ATM Master Plan KPAs contributed to
PJ.01-W2-08 (Wave 2)	Dynamic E-TMA for advanced continuous climb and descent operations and improved arrival and departure operations	V3-S	Phase B – Efficient services and infrastructure delivery	Capacity Predictability Safety Cost-efficiency Operational efficiency (fuel & CO^2 reduction) Flexibility
PJ.01-W2-06 (Wave 2)	Advanced rotorcraft operations in the TMA	V2	Phase B – Efficient services and infrastructure delivery	Capacity Predictability Safety Operational efficiency
PJ.10-W2-73 (Wave 2)	Flight-centric ATC and improved distribution of separation responsibility in ATC	V3-S	Phase C – Regional, trajectory-based, flight- and flow-centric operations	Capacity Flexibility Cost-efficiency Human performance Operational efficiency Predictability
PJ.10-W2-93 (Wave 2)	Delegation of airspace amongst ATSUs	V3-S	Phase C – Regional, trajectory-based, flight- and flow-centric operations	Capacity Operational efficiency Safety Human performance Cost-efficiency
PJ.10-W2-96 (Wave 2)	HMI interaction modes for ATC centre	TRL6	Phase C – Regional, trajectory-based,	Capacity Safety

Candidate SESAR solution ref.	Candidate SESAR solution title	Expected maturity level in 2022	ATM system upgrade phase	ATM Master Plan KPAs contributed to
			flight- and flow-centric operations	Human performance Cost-efficiency
PJ.13-W2-111 (Wave 2)	Collision avoidance for IFR RPAS	V3-S	Phase B – Efficient services and infrastructure delivery	Safety Interoperability
PJ.13-W2-115 (Wave 2)	IFR RPAS accommodation in airspace class A to C	V3-S	Phase C – Regional, trajectory-based, flight- and flow-centric operations	Safety Interoperability
PJ.13-W2-117 (Wave 2)	IFR RPAS integration in airspace class A to C	V2	Phase C – Regional, trajectory-based, flight- and flow-centric operations	Safety Interoperability
PJ.18-W2-53 (Wave 2)	Improved ground trajectory predictions enabling future automation tools	V3-S	Phase C – Regional, trajectory-based, flight- and flow-centric operations	Capacity Operational efficiency Predictability Safety Human performance Cost-efficiency
PJ.18-W2-56 (Wave 2)	Improved vertical profiles through enhanced vertical clearances	V2	Phase C – Regional, trajectory-based, flight- and flow-centric operations	Capacity Operational efficiency Predictability Safety Human performance
PJ.18-W2-57 (Wave 2)	RBT revision supported by datalink and increased automation	V2	Phase C – Regional, trajectory-based, flight- and flow-centric operations	Capacity Operational efficiency Predictability Safety Human performance
PJ.18-W2-88 (Wave 2)	Trajectory prediction service	TRL4	Phase C – Regional, trajectory-based, flight- and flow-centric operations	Cost efficiency Interoperability

Table 8: Delivery of candidate SESAR solutions within the 'Advanced air traffic services' key feature in 2022

1.4.2.4. IR Wave 2 projects delivering candidate SESAR solutions within the 'Enabling aviation infrastructure' key feature

The 'Enabling aviation infrastructure' IR projects will deliver the following results in 2021 and 2022. 'Enabling aviation infrastructure' projects are not mapped with ATM Master Plan KPAs 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 TRL criteria and not according to the European operational concept validation methodology as for other key features.

Candidate SESAR solution ref.	Candidate SESAR solution title	Expected maturity level in 2022	ATM system upgrade phase
PJ.14-W2-76 (Wave 2)	Integrated CNS and spectrum	TRL4	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.14-W2-77 (Wave 2)	FCI services	TRL6	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.14-W2-60 (Wave 2)	FCI terrestrial data link and A-PNT enabler (L-DACS)	TRL6	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.14-W2-107 (Wave 2)	Future satellite communications data link	TRL6 ongoing	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.14-W2-61 (Wave 2)	Hyper-connected ATM	TRL4	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.14-W2-81 (Wave 2)	Long-term alternative position, navigation and timing (A-PNT)	TRL4	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.14-W2-79 (Wave 2)	Dual frequency / multi constellation DFMC GNSS/SBAS and GBAS	TRL6	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.14-W2-110 (Wave 2)	Aircraft as an AIM/MET sensor and consumer	TRL4	Phase B – Efficient services and infrastructure delivery
PJ.14-W2-83 (Wave 2)	Surveillance performance monitoring	TRL6	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.14-W2-84 (Wave 2)	New use and evolution of cooperative and non-cooperative surveillance	TRL6	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.17-W2-100 (Wave 2)	SWIM TI purple profile for air/ground safety-critical information sharing	TRL4	Phase C – Regional, trajectory-based, flight- and flow-centric operations
PJ.17-W2-101 (Wave 2)	SWIM TI green profile for G/G civil–military information sharing	TRL6	Phase C – Regional, trajectory-based, flight- and flow-centric operations

Table 9: Delivery of candidate SESAR solutions within the 'Enabling aviation infrastructure' key feature in 2022

1.4.3. Wave 3 projects (from 2020 to 2022)

The Wave 3 restricted call for proposals (with reference H2020-SESAR-2020-2, also covering VLD activities) was launched in Q1 2020. The 5 Grants have been signed end of December 2020. Currently the Projects are in their ramp-up phase. Further details on the Solutions they will address will be provided when the projects plans will be baselined. The projects co-financed under this call are expected to deliver the following results (candidate SESAR solutions) in 2022.

Candidate SESAR solution ref.	Candidate SESAR solution title	Expected maturity level in 2021	Expected maturity level in 2022	Expected maturity level in 2023	ATM system upgrade phase	ATM Master Plan KPAs contributed to
PJ.32-W3-01	*ATFCM aspects of Airspace Delegation across ATSU's*	V1	V1	V2	C	Cost-efficiency, Human Performance, Capacity
PJ.33-W3-01a	Increased Flexibility in ATCO Validation supported by advanced controller assistance systems and procedures	V1	V1	V2	C	Cost-efficiency, Human Performance, Capacity
PJ.33-W3-01b	Generic Controller Validations	V1 ongoing	V1 ongoing	V1 ongoing	C	Cost-efficiency, Human Performance, Capacity
PJ.33-W3-02	L-DACS Digital Voice capability	TRL2	TRL2	TRL4	C	Cost-efficiency,
PJ.34-W3-01	Collaborative U-space-ATM interface	V1	V1	V2	C	Cost-efficiency, Human Performance, Safety
PJ.34-W3-02	Highly-automated collaborative U-space-ATM interface	V0	V0	V1	C	Cost-efficiency, Human Performance, Safety
PJ 37. Integrated TMA, Airport and Runway operations (ITARO): This is a VLD that does not develop solution as such, but demonstrate (or complement the validation) of solutions from SESAR 1, Wave 1 or Wave 2.						
PJ 38. ADS-C ENables and Supports Improved ATM Operations (ADSCENSIO). This is a VLD that does not develop solution as such, but demonstrate (or complement the validation) of solutions from SESAR 1, Wave 1 or Wave 2.						

Table 10: Delivery of candidate SESAR solutions in 2022 under the Wave 3 call for proposals (with reference H2020-SESAR-2020-2)

The candidate SESAR solutions would be developed (and, in some cases, delivered) by Wave 3 projects through the SESAR release process.

1.5. Strategic area of operation 4: Deliver very large-scale demonstration activities

VLDs 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 when possible. As such, VLDs will mostly derive from work matured through an earlier phase of IR.

VLDs are conducted either as a result of restricted calls for proposals by the SESAR JU Members other than the EU, or through open calls for proposals by SESAR JU Members other than the EU or other entities. VLD activities are run under up to seven calls and have overall direct funding (Title III – Operational expenditure) of EUR 107.6 million, broken down as depicted in the figure below. In addition, a portion of the SESAR JU's running costs (Title I – Staff expenditure and Title II – Infrastructure and operating expenditure) is used to carry out the VLDs. The overall funding for strategic area of operation 4 for the 2022 - 2024 period is indicated in Annex II.

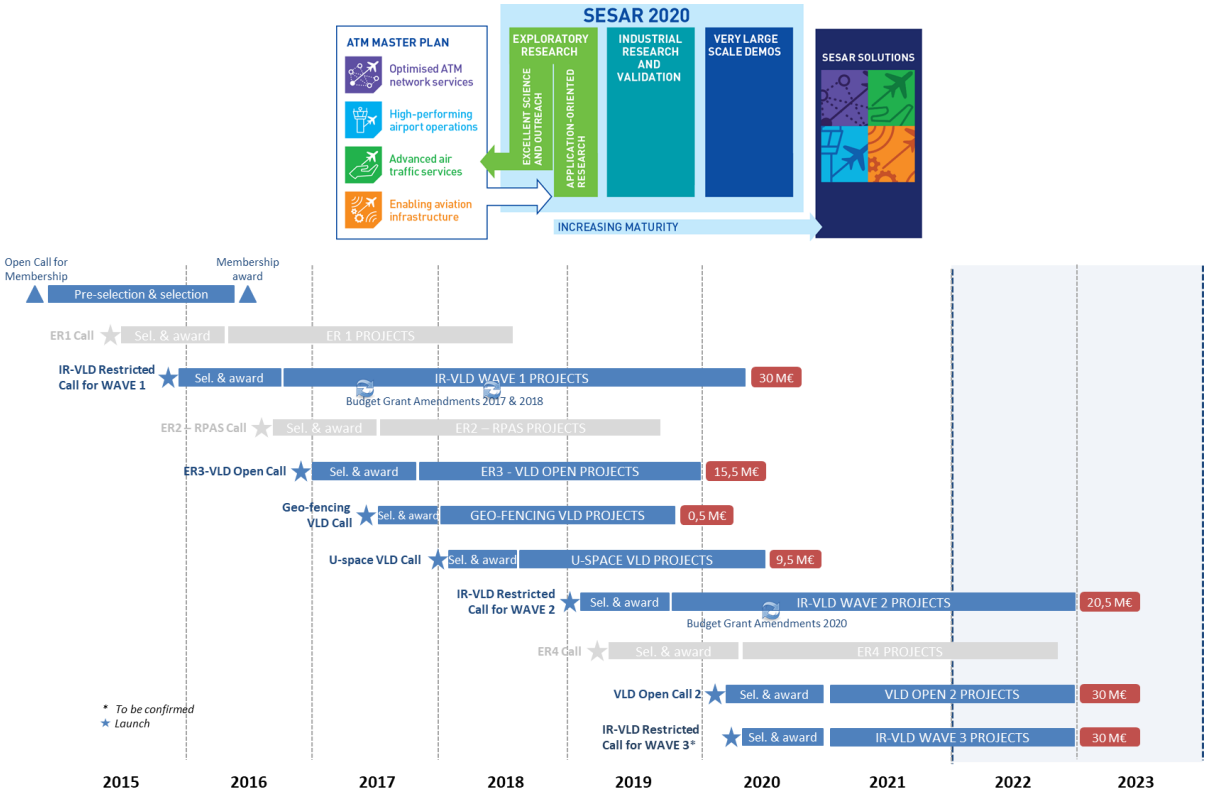

Figure 17: Sequence of VLD calls and related funding over the 2015–2022 period

In 2022, the SESAR JU will, in the context of VLDs, supervise and ensure the final delivery of the only remaining VLD Open project in execution (AUDIO, under the call with reference H2020-SESAR-2016-2), then close the project; and supervise the Wave 2, Wave 3 and VLD Open 2 projects, then close the grant agreements by the end of 2022. The SESAR JU will then ensure the financial and administrative closure of the grant agreements by the end of 2023. It is not expected that operational, financial or administrative activities in relation with VLD will take place in 2024.

As outlined in the SESAR 2020 Programme research topics presented in subparagraph 1.1.2 'SESAR 2020 Programme research topics to be addressed within the innovation pipeline', VLDs cover the four key features of the European ATM Master Plan and U-space, along with other high priority policy areas.

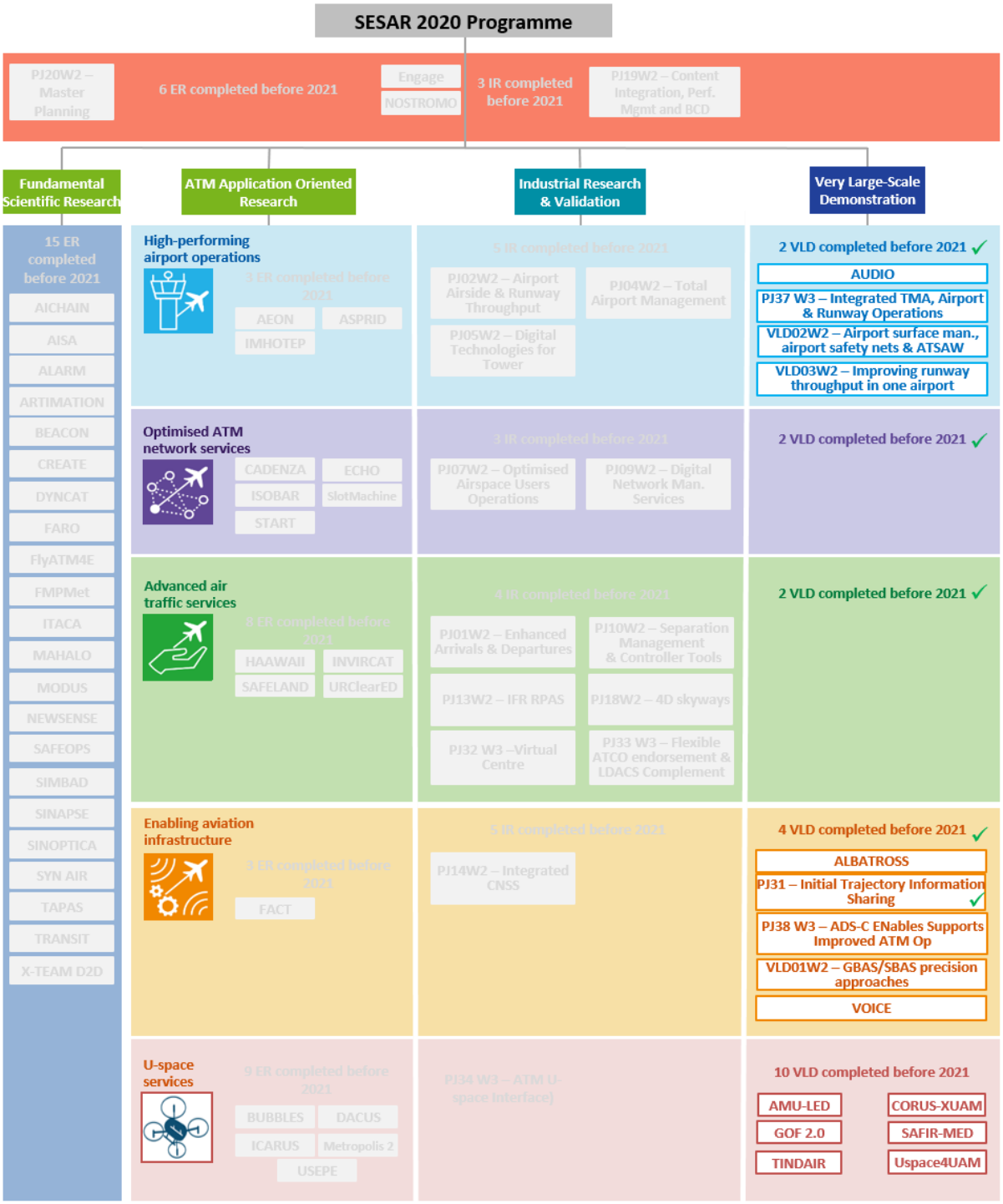

Figure 18: SESAR 2020 Programme portfolio of projects for VLDs at the beginning of 2021

A summary of closed VLD projects and their results is available in the SESAR JU consolidated annual activity reports.

The SESAR 2020 Programme complies with all provisions of the '*Horizon 2020 work programme 2018–2020*' for VLD Wave 2 and Wave 3 projects. However, it should be noted that the SESAR 2020 Programme delivers results through the SESAR solutions and not project by project. Therefore, it is not necessary for all VLD projects (receiving co-financing following restricted calls for proposals, as defined

in Section III, subpoint 2.6.1.1.3 of the SPD for 2020–2022) to provide open access to all research data, and they may decide to opt out of the provisions of Annex L 'Conditions related to open access to research data' contained in the 'General Annexes' to a related Horizon 2020 work programme ([29]). This opt-out, if used, would aim to protect results that are expected to be commercially or industrially exploited and/or to protect the project's main aim ([30]) of contributing to a programme comprising two or more projects that jointly contribute to the delivery of one or more SESAR solutions. For the VLD Open 2 call for proposals, the SESAR JU will comply with all provisions of the 'General Annexes' to the '*Horizon 2020 work programme 2018–2020*', including Annex L 'Conditions related to open access to research data' within Part 19 'General Annexes'. All grants under the VLD Open 2 call for proposals will be in compliance with the Horizon 2020 model grant agreement.

1.5.1. VLD Open call (from 2018 to 2021) under the call for proposals with reference H2020-SESAR-2016-2)

To complement the Wave 1 call for proposals restricted to SESAR JU Members other than the EU, an open call related to VLDs ('VLD Open call' under 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 VLDs, the outcome of the call was an award of EUR 17.8 million and the grant signature of eight VLD activities. The activities were launched into execution during the course of 2018, each delivering a demonstration plan and a demonstration report within the indicative project duration of 2 years, thus delivering the final project results by the end of 2020. The last project resulting from this call for proposals that is still in execution in 2021 is the AUDIO project, expected to close in 2021.

1.5.2. VLD Wave 2 (from 2019 to 2022) under the call for proposals with reference H2020-SESAR-2019-1

In Q1 2019 the SESAR JU launched the restricted call for proposals with reference H2020-SESAR-2019-1 covering IR and VLD. The evaluation of the proposals received was performed, the beneficiaries were selected and the three grants were signed in Q4 2019 and in Q1- Q2 2020. This will enable the delivery of Wave 2 demonstration results in the 2020–2022 period.

A summary of the Wave 2 VLD projects launched into execution by the end of October 2020 is provided in the following table.

Project reference	Project title	Short project description	Max. total co-financing value (EUR)
VLD01-W2 DREAMS	Demonstration Of Runway Enhanced Approaches Made with Satellite Navigation	The project intends to demonstrate how GNSS technology can bring benefits in enhancing arrival procedures developed in the Wave 1. The demonstration will cover business jet and mainline aircraft and will also pioneer flights on GBAS CAT III operations.	5 176 441

([29]) Part 20 'General Annexes' to the 'Horizon 2020 work programme 2016–2017' (European Commission Decision C(2016) 4614 of 25 July 2016); or Part 19 'General Annexes' to the 'Horizon 2020 work programme 2018–2020' (European Commission Decision C(2019) 4575 of 2 July 2019).

([30]) In line with 'General Annexes', Annex L, second paragraph, points (a) and (d) of the 'Horizon 2020 work programme 2016–2017'.

Project reference	Project title	Short project description	Max. total co-financing value (EUR)
VLD02-W2 STAIRS	Airport surface management, airport safety nets and ATSAW	The project intends to demonstrate the use of the specific avionics (validated within the Wave 1) providing traffic alerts for pilots during runway operations to prevent runway incursion and aircraft collision. The demonstration will address both mainline and business aviation solutions during the lifecycle of the demonstration project; the systems will go through a full certification review process to ensure compliance with the applicable certification specification and to be ready for deployment.	2 697 113
VLD03-W2 SORT	Safely Optimized Runway Throughput	The projects aims at demonstrating fundamental changes in wake turbulence separation minima; in safe and efficient runway use tailored at individual aircraft level using new technology and analytics; in reduced radar separation minima on final approach	4 500 000

Table 11: Ongoing Wave 2 VLD projects in 2022 (under the call for proposals with reference H2020-SESAR-2019-1)

1.5.3. VLD Open 2 (from 2020 to 2022) call for proposals with reference H2020-SESAR-2020-1

In 2020, to complement the call for proposals restricted to SESAR JU Members other than the EU, the SESAR JU launched the second VLD open call for proposals (with reference H2020-SESAR-2020-1).

Subject to the successful completion of the grant agreement signature procedure, the launch into execution of related project activities is expected in Q4 2020 or Q1 2021, with grant closure activities in Q3–Q4 2022. This call is intended to be the last open call for VLDs, optimising the usage of funds available to bridge the gap between development and deployment and to secure the achievement of policy priorities such as the implementation of the Airspace Architecture Study transition plan.

A total of 6 projects were launched into execution in the end of 2020 and the beginning of 2021. These are as shown in the following table.

Project reference	Project title	Short project description	Max. total co-financing value (EUR)
ALBATROSS	ALBATROSS: The most energy efficient flying bird	The project will demonstrate a “perfect Zero fuel and CO2 emissions waste flight” in real conditions, through a series of live trials in various European operating environments and adopting the following approach : calculate the optimum flight profile, check ATM constrains and try to relax them, finalize the optimum flight	3 996 381

Project reference	Project title	Short project description	Max. total co-financing value (EUR)
		profile and execute the flight accordingly	
AMU-LED	Air Mobility Urban - Large Experimental Demonstrations	The project proposes to design and deliver a detailed concept of operations and definition of urban air missions followed by a large real flight demonstration campaign to address various Use cases applicable to logistics and urban transport of passengers, to design or integrate UAM environment, to test the UAS ground and airborne platforms and finally, to assess safety, security, sustainability and public acceptance.	3 997 415
CORUS-XUAM	CONCEPT OF OPERATIONS FOR EUROPEAN U-SPACE SERVICES - EXTENSION FOR URBAN AIR MOBILITY	The project will update the U-space ConOps, addressing the integration of UAM/UAS operations into the airspace, also identifying new U3/U4 services. The project will then combine flights by eVTOLs with other traffic and operations in the CTRs of major airports with a focus on different types of mission, such as passenger transport, logistic, delivery, emergency response and surveillance, using different U-space deployment architectures and state-of-the-art technologies.	3 999 389
GOF2.0	GOF2.0 Integrated Urban Airspace VLD	The project will demonstrate operational validity of serving combined UAS, eVTOL and manned operations in a unified, dense urban airspace using current ATM and U-space services and systems. The demonstrations focus on validation of the GOF 2.0 architecture for highly automated real-time separation assurance in dense air space including precision weather and telecom networks for air-ground communication.	3 911 774
SAFIR-Med	SAFE AND FLEXIBLE INTEGRATION OF ADVANCED U-SPACE SERVICES FOCUSING ON MEDICAL AIR MOBILITY	The project will demonstrate the integration of medical air mobility UAV platforms and services within a real urban environment. Technologies of all partners will be leveraged to make use of the maximum number of U-Space services towards the highest possible operational safety level, including advanced Detect And Avoid U-space service.	2 038 609

Project reference	Project title	Short project description	Max. total co-financing value (EUR)
TINDAiR	Tactical Instrumental Deconfliction And in flight Resolution	The project will demonstrate the safe integration of UAM as additional airspace user. The results of the VLD will help to refine the safety, performance, standardisation and regulatory requirements to enable UAM. The VLD will include the execution of flight demonstrations in accordance with the safety conditions.	3 269 884
Uspace4UAM	U-space for UAM	The project will bridge the gap between development and deployment for U-space capabilities and services that will enable a safe introduction of urban air mobility in Europe (UAM). It will study safety cases and their impact on system requirements, and look at how regulation and standardisation can be set up to support innovators to build a sustainable business case while operating safely in a multi-modal transport network.	3 999 966
VLD2-VOICE	Reduced separations and improved efficiency based on Vhf cOmmunICations over LEO satEllites	The project will demonstrate that with the use of Satellite based VHF systems providing Voice and Datalink ATS, traffic in remote airspace can be handled as in a continental, and current separation can be reduced non compromising safety. Demonstration will cover operations in CANARIAS and SAL FIRs where ATCOs communicating in real time with Aircraft at distances bigger than 1500km	3 989 808

Table 12: Ongoing VLD Open 2 projects in 2022
(under the call for proposals with reference H2020-SESAR-2020-1)

1.6. Strategic area of operation 5: Deliver SESAR outreach

As indicated in the SESAR JU basic act, the JU is responsible for securing support and buy-in from 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 in the form of communications and external relations (including international affairs), supported by the core SESAR membership, and cooperative arrangements and contracts with specific stakeholder groups.

Figure 19: SESAR JU's specific stakeholder groups within the ATM value chain

As presented in point 2.3.1.2 'Expenditure' below, in addition to direct funding (from Title II and Title III) the SESAR JU also dedicates a proportion of its running costs (Title I – Staff expenditure and Title II – Infrastructure and operating expenditure) to carrying out SESAR outreach activities. The overall funding for strategic area of operation 5 is indicated in Annex II.

The following paragraphs presents activities that will be carried out in 2022 and 2023 in relation with SESAR Outreach; it is expected that, in 2024, Outreach activities will be limited to the closure of the SESAR JU.

1.6.1. European stakeholder outreach

The SESAR JU's outreach work will target and involve a wide range of SESAR JU member and stakeholder organisations (see Figure 19). This outreach aims to secure the involvement of stakeholders in the SESAR JU's R & I activities, including in support of validating SESAR solutions, as well as to ensure close coordination and, where appropriate, alignment with activities which are outside SESAR but are of strategic importance to the success of the SESAR project, such as standardisation. The SESAR JU also maintains close relations with institutional stakeholders such as the European Commission, the European Parliament, and the European Council, along with

EUROCONTROL (a founding member of the SESAR JU, together with the EU represented by the European Commission), in order to ensure that its activities are aligned with and take into account developments in the EU's policy towards ATM.

During the 2022–2024 period the SESAR JU will continue to foster its strong ties with the following key European stakeholder groups.

- **European Union Aviation Safety Agency (EASA).** The SESAR JU will collaborate under the established memorandum of cooperation (MoC) with EASA([31]) to secure early involvement and inputs for the awareness and readiness of SESAR activities for industrialisation and subsequent deployments. The MoC will, at the same time, cater for the SESAR JU's direct provision of support to EASA in European and international activities that relate to securing the necessary safety, security and regulatory arrangements.
- **European Defence Agency.** The MoC established with the European Defence Agency ([32]) will continue with the aim of securing support and buy-in from the military community (in their roles as ANSPs, airport operators, airspace users and regulators) in relation to SESAR JU activities and the ATM Master Plan. In particular, areas of common interest include the ATM Master Plan, regulations, space-based systems, the integration of unmanned aerial systems, cybersecurity threats to and vulnerabilities of ATM and the development of aviation/ATM standards.
- **European Space Agency.** The established MoC ([33]) 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 communications as an element of importance for the future enabling CNS infrastructure for ATM.
- **National aviation authorities.** The SESAR JU will work under the established MoCs with the European national authorities ([34]) to secure support to the SESAR JU from the various national authorities and to de-risk SESAR solutions' readiness for deployment.
- **Clean Sky 2 Joint Undertaking.** The established MoC ([35]) caters for the sharing of best practices and for identifying gaps and synergies in areas where a joint vision and approach is beneficial for both programmes. The cooperation will also align on performance targets in general and environmental targets in particular.
- **Advisory Council for Aviation Research and Innovation in Europe (ACARE).** The SESAR JU participates in the advisory council to ensure the appropriate representation of ATM

([31]) Memorandum of cooperation between the European Aviation Safety Agency and the SESAR Joint Undertaking signed on 23 November 2016 to establish the general terms of cooperation between the parties.
([32]) Memorandum of cooperation between the European Defence Agency and the Single European Sky ATM Research Joint Undertaking signed on 19 December 2016 to establish the general terms of cooperation between the parties.
([33]) Memorandum of cooperation between the European Space Agency and the Single European Sky ATM Research Joint Undertaking signed on 15 September 2016 to establish a cooperative framework between the parties.
([34]) Six MoCs signed on 9 June 2017 between the Single European Sky ATM Research Joint Undertaking and the Directorate General Civil Aviation of Bulgaria, the Croatian Civil Aviation Agency, the Civil Aviation Authority of the Czech Republic, the German Federal Supervisory Authority for Air Navigation Services, the Irish Aviation Authority and the Swiss Federal Office of Civil Aviation.
([35]) Memorandum of cooperation between the Clean Sky 2 Joint Undertaking and the Single European Sky ATM Research Joint Undertaking signed on 10 December 2015 to establish a cooperative framework between the parties.

in the European strategic innovation and research agenda, and to secure the link with Flightpath 2050.

- **EUROCAE.** The participation of the SESAR JU in the EUROCAE Council and the Technical Advisory Committee will continue in 2022–2023, securing close collaboration between the SESAR JU Members and the availability of SESAR material in support of standardisation. The alignment of priorities will be important in relation to the ATM Master Plan and the ICAO Global Air Navigation Plan (GANP).
- **European ATM Standardisation Coordination Group** — the SESAR JU continue its involvement in this 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.
- **European Strategic Coordination Platform.** The SESAR JU will participate actively in the activities under the EASA-led European Strategic Coordination Platform to coordinate the definition and implementation of the European strategy for cybersecurity in aviation.
- **Professional staff organisations.** The SESAR JU will secure support from the different professional staff associations in the provision of operational expertise in relation to all of 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 organisations in their respective activities as agreed to be relevant and necessary to secure inclusion in developments and commitment to the SESAR solutions.
- **European airports.** The SESAR JU will work closely with European airports and the Airport Council International through the SESAR work programme and on airport activities such as roadshows and conferences, with specific inputs from SESAR for securing awareness, buy-in and commitment.
- **Civil airspace users.** The SESAR JU will continue to reach out to the airspace user categories on activities relevant and necessary to secure awareness of and buy-in and commitment to the SESAR work and activities.
- **New entrants.** New innovative airspace users and organisations in the field of unmanned traffic management / U-space, unmanned aerial systems and high-level operations will be approached based on relevant EU strategies and on a case-by-case basis to find the most efficient mechanism of cooperation for the benefit of SESAR JU tasks and activities.

1.6.2. Cooperation with third countries and international organisations

The SESAR JU's international cooperation activities are conducted in close coordination with the European Commission to ensure consistency and alignment with the EU's broader aviation strategy, in particular its external affairs dimension.

The SESAR JU will continue to conduct outreach activities with international partners pursuant to its strategy for cooperation with third countries and/or international organisations. The principal objectives of this strategy are threefold:

- to secure global leadership for SESAR in the context of ICAO;
- to ensure global interoperability and harmonisation based on SESAR solutions;

- to promote and support the competitiveness of the European aviation and ATM industry.

1.6.2.1. Cooperation with ICAO

ICAO is the global body responsible for developing international civil aviation standards and recommended practices and policies in support of a safe, efficient, secure, economically sustainable and environmentally responsible civil aviation sector. A key objective of the SESAR JU's international engagement is to ensure an alignment between its and Europe's priorities and those established at ICAO level. It is particularly important to ensure that the European ATM Master Plan and industry standardisation initiatives remain aligned with the relevant ICAO provisions and their future evolution. For this reason, the SESAR JU works closely with the European Commission and other European institutions and partners, notably EASA and EUROCONTROL, in support of ICAO. The SESAR JU participates in regular European ICAO coordination meetings, chaired by the European Commission, as a means to define European priorities and plan accompanying actions and inputs to ICAO. The SESAR JU also participates in the broader European Safety and Air Navigation Coordination Group, which ensures coordination with the 44 European Civil Aviation Conference (ECAC) states.

In 2022–2023 the SESAR JU's ICAO-related activities will involve engagement on the future evolution of the GANP and the aviation system block upgrades through participation in relevant groups such as the ICAO GANP Study Group. A particular milestone over the period will be the 41st ICAO Assembly that will take place in 2022. The SESAR JU will also seek to work closely with ICAO as it develops policies in strategically important domains, such as integrated communications, navigation and surveillance, drones, higher airspace operations and environmental targets.

By continuing to engage closely with such activities, the SESAR JU is able to ensure that policies, standards and provisions being established at the global level are interoperable and harmonised with those being developed through the SESAR R & I pipeline, recognising that this is a vital prerequisite for a safe, secure, efficient and sustainable global ATM system. This in turn helps maintain and further strengthen SESAR's position as a global leader in aviation and ATM modernisation, which also serves to promote the competitiveness and global market shares of the European aviation and ATM industry.

1.6.2.2. Cooperation with international partners

In addition to its direct participation and involvement in ICAO activities, the SESAR JU cooperates with a number of key international partners. The SESAR JU has cooperated since 2011 with the US Federal Aviation Administration (FAA) / NextGen programme under the EU–US MoC on ATM modernisation, civil aviation R & I and global interoperability. The FAA's NextGen programme and SESAR are the two largest ATM modernisation initiatives in the world. As such, it is essential that the two programmes be closely aligned to ensure that global interoperability and harmonisation can be maintained, not only for the present but for the future too. Maintaining regular dialogue across a range of topics and domains allows the two sides to identify any risks, issues or opportunities that may arise in relation to global interoperability. A review of the scope of this cooperation during 2020 will allow a renewed focus on priority topics of interest, reflecting the evolution of the programmes on each side of the Atlantic.

The SESAR JU will also maintain cooperation with a number of other key partners through a range of instruments. The SESAR JU has its own bilateral MoCs with Qatar, Singapore and the United Arab Emirates. Singapore is an important partner due to the leading role it plays in ATM in South-East Asia, building on its own ATM research capabilities. Singapore is working to progress rapidly in the development and application of new technologies in ATM, such as automation, machine learning and AI, as well as the integration of drones. The country is therefore working on many of the same themes

and topics as the SESAR JU, so there is ample scope for developing mutually beneficial research in 2021–2023.

Qatar and the United Arab Emirates are two important aviation partners for the EU, and the SESAR JU has developed cooperative arrangements with each of them as part of the broader EU aviation strategy, with the objective of facilitating dialogue and sharing of information in relation to our respective ATM modernisation activities. The rapid growth of air traffic between Europe and the Gulf region in recent years means that there is a mutual interest in ATM modernisation, along with strong interest in the development and application of digital technologies to improve safety, efficiency and sustainability.

The SESAR JU also cooperates with Japan under a MoC between the Commission's Directorate-General for Mobility and Transport and the Japanese Transport Ministry, which aims to support global interoperability. Japan has its own ATM modernisation programme, known as CARATS, and is therefore also an important partner for the SESAR JU. Like Europe, Japan also has ambitious goals to integrate drones into its airspace, and this is a specific area in which the SESAR JU will seek to deepen dialogue and cooperation.

The SESAR JU also works closely in support of EASA on the ATM-related elements of EU technical cooperation projects with third countries and regions. This includes cooperation with China under the EU–China aviation partnership project and regional technical cooperation projects with South-East Asia, South Asia and Latin America. Conducted within the framework of the EU's external aviation policy, these projects cover the sharing of lessons learnt, knowledge and expertise, and cooperation activities related to ATM modernisation towards ICAO.

1.6.3. Communications

The SESAR JU's communications strategy defines the following broad objectives.

- Illustrate and showcase SESAR solutions that are mature and ready for industrialisation and deployment, showing tangible benefits for aviation and society as a whole.
- Extend SESAR awareness and outreach activities directly with stakeholders and at European and global events/conferences to promote SESAR results, thus 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 partnership spirit of the SESAR JU through communications activities with its staff and SESAR experts.

To meet these objectives over the 2022–2024 period, 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.
- Participate in and organise events in Europe and elsewhere in the world.
- Create and publish appropriately targeted printed materials and digital communications in general and as needed based on SESAR 2020 project results, and specifically in relation to key strategic events.
- Provide effective press and media outreach.

1.7. 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. Its main objectives are to facilitate the 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 period from 2022 to 2024, the SESAR JU will continually align operational and strategic planning activities with the capabilities of the organisation to best serve stakeholders' needs and to maintain full regulatory compliance with all the obligations stemming from the Horizon 2020 programme. 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 with strategic priorities through the introduction of 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, where necessary; and plan and implement the changes required to improve performance in a quantifiable or measurable way.

Additionally, bearing in mind Article 1(2) of the amended SESAR JU basic act, which stipulates that the JU shall cease to exist on 31 December 2024, as well as ongoing discussions on the future of the EU public–private partnerships under the new Union Long Term Budget, the SESAR JU will conduct the necessary proceedings over the 2022–2024 period to ensure the effective and timely implementation of one or both scenarios of the future of SESAR set forth in subparagraph 1.1.6 'Future of ATM research' above. These proceedings are planned as follows.

- In 2022:
  - depending on the approved scenario and the progress of the legislative process, the SESAR JU will either be operating as a new ATM partnership or continuing its existing mandate leading to a fully defined termination scenario (which includes finalising the preparation of the detailed planning of the winding-up of SESAR JU corporate and administrative activities and starting the detailed planning of the SESAR JU's final liquidation, as defined in the roadmap updated and finalised in 2020 for this particular scenario).
  - Irrespective of the approved scenario, the SESAR JU will finalise the R & I activities from the main SESAR 2020 Programme (allowing the final payments for the last finalised projects to be made in 2023).
- In 2023: under the repeal and replace scenario, the SESAR 3 JU shall replace and succeed the SESAR JU. Therefore, the new partnership will be responsible for managing all rights and obligations including assets, debts or liabilities of the SESAR JU. In addition, as

provided by the transitional provisions of the draft of the future regulation ([36]), actions initiated under the SESAR JU established by Council Regulation (EC) No 219/2007, as last amended by Council Regulation (EU) No 721/2014 and the financial obligations related to such actions, shall continue to be governed by that Regulation until their completion. Consequently, the SESAR JU will start the implementation of the transfer of corporate and administrative activities under the SESAR 2020 Programme, all based on the detailed implementation plan approved in 2020 and subsequently updated.

- In 2024: if the termination of the SESAR JU has to be carried out under any scenario, and especially under the termination scenario, the SESAR JU will finalise the implementation of the winding-up of the corporate and administrative activities and run the liquidation activities, with a view to completing all winding-up and liquidation activities by the end of 2024.

The roadmap of the approved scenario and the related detailed implementation plan is expected to be fully integrated with SESAR JU's multiannual and annual work programmes as part of all of the SPDs covering the related period. During the whole process the SESAR JU will focus on the timely and complete fulfilment of its overall mission and programme and on meeting the expectations of its stakeholders, while ensuring the appropriate level of its corporate activities to fulfil all its obligations and fully respecting any budgetary and human resource constraints derived from the application of the legislation.

As presented in Section II, point 2.3.1.2 'Expenditure', 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 for strategic area of operation 6 is indicated in Annex II.

([36]) In accordance with the transitional provisions established through the Article 175 of the draft Single Basic Act applying to the SESAR 3 Joint Undertaking.

2. Human and financial resource outlook for years 2022–2024

2.1. Overview of the past and current situation

At the end of 2020 and during 2021, in line with the situation reported in 2020, the staff establishment plan of the SESAR JU contains 39 temporary agent (TA) posts, along with 3 seconded national expert (SNE) posts for which Member State experience is requested (as authorised by the SESAR JU Administrative Board). For detailed data on the different staff categories, please refer to Annex IV, Table 1 and Annex V, sub-annex A.

The last year to request the remaining EU entitlements intended for the SESAR 2020 Programme (EUR 585 million in commitment appropriations, less the appropriations already requested) was 2020. The overall revenue of the SESAR JU in 2022 comes from the contributions of Members other than the Union to running costs only, while the EU contribution will be taken from the amount frontloaded in 2020 to cover the larger part of the running costs during the 2021–2024 period.

(EUR)

Revenue	Commitments received in 2020	Commitments planned in 2021
EU contribution (EFTA included)	123 671 000	0
Other revenue	- 29 807 405	33 147 925
Total	**93 863 595**	**33 147 925**

Table 13: SESAR JU revenue overview for 2020 (received revenue) and 2021 (planned revenue)

The negative revenue appearing in 2020 relates to the reimbursement of SESAR 1 cash received in excess to all SESAR JU members, which is further explained in the SESAR JU 2021-2023 Single Programming Document.

From 2021 to 2022, Title III expenditure will decrease significantly as no new calls for proposals will be organised (since 2020). Title III expenditure will focus on activities such as the Scientific Committee and support from ATM stakeholders (see Section II, sub-paragraph 1.2.5.).

(EUR)

Expenditure	Commitments made in 2020	Commitments planned in 2021
Title I	5 196 248	5 671 228
Title II	2 728 289	3 647 863
Title III	133 837 324	2 521 500
Total	**141 761 861**	**11 840 591**
Title IV	13 383 404 ([37])	21 307 334
Total incl. Title IV	**155 145 265**	**33 147 925**

Table 14: SESAR JU expenditure overview for 2020 and 2021

([37]) The amount frontloaded in 2020 to cover the larger part of the running costs during the 2021–2024 period (EUR 3 345 851 per year).

2.2. Outlook for the years 2022–2024

The SESAR JU does not plan to carry out new activities in the 2022-2024 period in comparison to the previous periods.

As defined in paragraphs 1.2 to 1.6 above, over 2022, the SESAR JU will steer and supervise the execution of the SESAR 2020 Programme and carry out the related outreach activities. The programme will be at its full speed over that period. Corporate and administrative functions will support the operational activities and provide assurance of the sound financial management of the SESAR JU.

Starting from 2023, operational activities will be completed and the SESAR JU will carry out closure activities of the SESAR 2020 Programme from an administrative and financial perspective. Communication activities related to the completion of the programme will also be undertaken.

This multiannual plan for SESAR 2020 requires an adapted level of resources with full staff establishment plan until the end of 2022, and a decrease in the level of human resources from 2023 onwards. The profile of resources, which is described in the following paragraphs, follows this high-level plan.

Since a new partnership for ATM research has been established that impacts the strategic orientations and the work programme of the SESAR JU with new tasks and/or a growth of existing tasks, the level of resources will be reconsidered. The budget and human resources figures in the current version of the SPD do not take into account the new Council Regulation establishing the new SESAR 3 JU. This new entity will require a new work programme and an adapted level of resources. The alignment will take place in the work programme of the new legal entity.

2.3. Resource programming for 2022–2024

No EU financial contribution in commitment is planned to the SESAR JU for the 2022–2024 period. The SESAR JU will continue to receive payment appropriations from the Horizon 2020 Programme over the next three years, allowing it to finalise the SESAR 2020 Programme.

The 2022–2024 staff numbers are indicative, subject to the outcome of the EU's future budgetary procedures ([38]).

2.3.1. Financial resources

2.3.1.1. Revenues

In accordance with Article 4 of the SESAR JU basic 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 SESAR JU basic act extending the mandate of the SESAR JU and setting out the sources of financing over the 2014–2020 period sets the overall amount of EU funding as EUR 585 million under the Horizon 2020 programme. In the 2020 draft budget, the SESAR JU requested only the amount needed for running costs covering the period from 2020 until 2024 (i.e. EUR 3.35 million per year). That budget request leads to a total amount requested for running costs of EUR 16.73 million for the period from 2020 to

([38]) The budget and human resources figures in the current version of the SPD do not take into account the new Commission's proposal for the legal basis 2021-2027 and the work programme. The alignment should take place as the new legal basis is adopted.

2024, and to an amount of EUR 26.71 million in total for the SESAR 2020 Programme, instead of the EUR 29.25 million provided for in the SESAR JU 2020 multiannual work programme ([39]), hence a gap of EUR 2.54 million in the EU's contribution to the running costs. This gap is a direct consequence of the use of SESAR 1 funds instead of SESAR 2020 funds to cover 2016 running costs. The corresponding amount of EUR 2.54 million is thus available through the EU's contribution to operational activities, with the possibility to transfer this amount to the running costs budget (Titles I and II) if needed to ensure the coverage of the running costs until 2024. This ensures that the overall EU funding of EUR 585 million under the Horizon 2020 programme ([40]), as defined in the SESAR JU's basic act, is maintained.

The last year to request the remaining EU entitlements (EUR 585 million in commitment appropriations, less the appropriations already requested) was 2020 ([41]). In the 2022–2024 period the SESAR JU continues to request payment appropriations from the European Commission annually to cover payments to be made on the basis of legal commitments entered into in the aforementioned period or in preceding financial years.

All SESAR JU Members other than the European Commission (representing the EU) contribute to the SESAR JU as follows.

- Financial contributions: 5 % of each Member's contribution shall be in cash in order to finance the running costs of the JU (i.e. staff, infrastructure and operating expenditure).
- In-kind contributions, consisting of the operational activities carried out by the stakeholder Members for developing, both jointly and under the SESAR JU's supervision, the next generation of the ATM system in Europe.
- As a founding member, pursuant to Article 9(2)(b) of the SESAR JU Statutes and the SESAR JU–EUROCONTROL Agreement, EUROCONTROL shall, in particular, contribute to the SESAR JU's work programme ([42]) through a set of activities under the authority of the SESAR JU, which may include the following:
  - through research, development and validation activities under the SESAR 2020 Programme, subject to the award of grants (in-kind contribution);
  - through external coordination and adaptation of the relevant EUROCONTROL consultation mechanisms (in-kind contribution);

([39]) The SESAR 2020 multiannual work programme provides for an allocation of a maximum of 5 % of the overall funding of EUR 585 million to the running costs of the SESAR JU (see paragraph 1.5).

([40]) Not including the additional revenues of EUR 11.3 million granted to the SESAR JU by the European Commission and referred to in point 1.1.3.3.

([41]) Article 4(3) of the amended SESAR JU basic act stipulates that 'All Union financial contributions to the Joint Undertaking shall cease upon expiry of the 2014–2020 financial framework unless otherwise decided by the Council on the basis of a Commission proposal'. The expiry date of the 2014–2020 financial framework is 31 December 2020.

([42]) In accordance with Schedule 2 of the SESAR JU–EUROCONTROL Agreement, the EUROCONTROL financial contribution shall comprise: '(a) An estimated amount of EUR 25 million (corresponding to 5 % of the total contribution of EUROCONTROL), as a contribution for the SJU's running costs. This amount shall consist of: i) an estimated amount of EUR 10 million for IT support provided in accordance with the terms and conditions in Schedule 4, ii) the remaining estimated amount of EUR 15 million cash contribution to be transferred to the SESAR JU according to a time schedule duly justified by the actual needs of the SJU.' Therefore, the level of cash contribution is highly dependent on the level of actual EUROCONTROL gross in-kind contributions, and can fluctuate up or down.

- through detachment of the Programme Management Unit (in-kind contribution) ([43]);
- through the provision of information and communication technology (ICT) support to the SESAR JU in accordance with Schedule 4 of this agreement (in-kind and financial contribution);
- upon request of the SESAR JU, through the execution of other ATM-related studies necessary to support SESAR JU in the achievement of its objectives, complementary to the SESAR 2020 Programme (in-kind contribution).

Before the SESAR JU Administrative Board accepted the accession of 19 stakeholder Members other than the EU, the value and the utility of the in-kind contributions that were offered by each candidate member for carrying out the tasks of the JU were assessed. Following that assessment, the contribution of each Member was contractually established (as estimates) in a unique membership agreement signed by the SESAR JU and all Members (excluding EUROCONTROL which signed a specific SESAR JU-EUROCONTROL Agreement). Article 10.5 of the Membership Agreement foresees an adjustment of the initial overall estimated Contributions in order to take into account the actual in-kind contribution made to and accepted by the SJU. Such an adjustment shall be formalised in accordance with the amendment procedure set forth in article 21.2 of the Membership Agreement. This amendment procedure has been launched and approved by the Administrative Board for 3 Members in 2021 and the overall contributions re-assessed. The overall contributions per Member are as follows:

(EUR)

Members	Estimated total net contribution ([44])	*Of which financial contribution*	*Of which net in-kind contribution*
European Union	**585 000 000**	***585 000 000***	
EUROCONTROL	**492 256 781**	***25 000 000.00***	***467 256 781***
Other Members in total	**297 125 484**	***17 100 534***	***280 024 950***
AIRBUS	26 761 006	*1 667 271*	*25 093 735*
AT-ONE Consortium	12 495 693	*627 887*	*11 867 806*
B4 Consortium	2 382 455	*397 076*	*1 985 379*
COOPANS Consortium	9 275 779	*599 718*	*8 676 061*

([43]) Pursuant to Article 9(2)(b) of the SESAR JU Statutes and the SESAR JU–EUROCONTROL Agreement, in 2008 EUROCONTROL established a unit as a programme support office, hosted by the SESAR JU, to provide the necessary support in the management of the SESAR programme. This support is considered as an in-kind contribution to the SESAR JU. Under the current SESAR JU–EUROCONTROL Agreement (see schedules 2 and 3 of that agreement), this unit is known as the Programme Management Unit (PMU) for the duration of the SESAR 2020 Programme. The PMU provides programme management support to the SESAR JU in strict coordination with the other SESAR JU teams. The number of staff engaged in this function at the end of 2019 was 19. The PMU staff assigned to the SESAR JU for the execution of this agreement shall remain subject to EUROCONTROL's staff regulations and rules.

([44]) In accordance with Article 10.2.2 of the membership agreement: 'Cash Contributions shall correspond to 5 % of each Member's Gross In-Kind Contribution after deduction of the SJU Co-Financing. For the sole purpose of calculating the amount of Cash Contribution due by each Member under this Agreement, the SJU Co-Financing shall be considered as capped to 50 % of each Member Gross In-Kind Contribution'. Therefore, the level of cash contributions is highly dependent on the level of actual gross in-kind contributions from members, and can fluctuate up or down.

Members	Estimated total net contribution ([44])	*Of which financial contribution*	*Of which net in-kind contribution*
DASSAULT Aviation[45]	1 944 203	*137 522*	*1 806 681*
DFS	8 483 712	*672 725*	*7 810 987*
DSNA	9 831 224	*641 023*	*9 190 202*
ENAIRE	16 452 269	*834 917*	*15 617 352*
ENAV	8 143 260	*643 950*	*7 499 310*
FREQUENTIS Consortium	6 885 998	*475 866*	*6 410 132*
Honeywell Aerospace	15 324 183	*777 926*	*14 546 257*
INDRA	21 534 500	*1 656 500*	*19 878 000*
Leonardo	48 127 620	*2 291 791*	*45 835 829*
NATMIG Consortium	10 472 227	*511 804*	*9 960 423*
NATS	9 363 535	*655 208*	*8 708 327*
SEAC2020 Consortium[46]	2 526 810	*174 831*	*2 351 979*
SKYGUIDE	1 637 166	*263 860*	*1 373 305*
THALES AIR SYSTEMS[47]	51 135 000	*2 435 000*	*48 700 000*
THALES AVIONICS	34 348 844	*1 635 659*	*32 713 185*
Total	**1 374 382 265**	***627 100 534***	***747 281 731***

Table 15: SESAR JU financial resources estimate overview for the 2014–2024 period

2.3.1.2. Expenditure

For the 2022–2024 period, once SESAR JU running costs are taken into account, the overall estimated expenditure is EUR 25.6 million in commitment appropriations, broken down as follows ([48]).

(EUR)

	2022 budget	2023 forecast budget	2024 forecast budget
Title I	5 749 700	5 864 694	4 013 675
Title II	3 177 026	3 311 567	2 730 863
Title III	736 000		
Total	**9 662 726**	**9 176 261**	**6 744 538**

Table 16: SESAR JU financial resource outlook (commitment appropriations) for the 2022–2024 period

Title III 'Operational expenditure' is planned as follows.

- For grants, in continuity of the decrease in 2021 compared to 2020 due to the gradual closure of Horizon 2020 actions, there will be no new calls for proposals in the period 2022-2024. The operations should terminate by the end of 2022, and the year 2023 will be devoted to

45 ADB(D)05-2021 (23 April 2021): Adjustment of DASSAULT AVIATION's value of In-Kind Contribution to the SESAR JU.
46 ADB(D)06-2021 (23 April 2021): Adjustment of SEAC 2020 value of In-Kind Contribution to the SESAR JU.
47 ADB(D)07-2021 (23 April 2021): Adjustment of THALES LAS FRANCE SAS' value of In-Kind Contribution to the SESAR JU.
48 The budget and human resources figures in the current version of the SPD do not take into account the new Commission's proposal for the legal basis 2021-2027 and the work programme. The alignment should take place as the new legal basis is adopted.

financial and administrative closure of the SESAR 2020 Programme operations, which translates in no commitments.

- Unused commitment and payment appropriations for the level-2 commitments of 2021 will be carried over into 2022 to cover other operational expenditure.
- Payments in relation to grant agreements signed in 2020 will be executed over the 2020–2023 period.
- The global budgetary envelope for procurement appears in Annex XII (year 2022 only).

The overall planned expenditure of the SESAR JU for 2022-2024, in commitment appropriations, including direct Title III and indirect Title I and Title II figures, is broken down per Strategic Area of Operation in the following table.

Strategic area of operation	Types of procedure	Call and support activities budget			
		Commitment appropriations (EUR)	As a percentage of the total	Payment appropriations (EUR)	As a percentage of the total
Strategic area of operation 1 – Strategic steering	Restricted Horizon 2020 calls for proposals Procurement of support services	2 826 187	11.05%	2 826 784	3.18%
Strategic area of operation 2 – Exploratory research	Open Horizon 2020 calls for proposals	2 271 769	8.88%	29 826 784	32.92%
Strategic area of operation 3 – Industrial research and validation	Restricted Horizon 2020 calls for proposals Procurement of support services	9 757 370	38.14%	27 265 569	30.64%
Strategic area of operation 4 – Very large-scale demonstrations	Open and restricted Horizon 2020 calls for proposals Procurement of support services	3 273 941	12.80%	20 849 749	23.43%
Strategic area of operation 5 – SESAR outreach	Procurement of support services	2 484 752	9.71%	3 768 484	4.24%
Strategic area of operation 6 – Deliver effective financial, administrative and corporate management	Procurement of support services	4 969 505	19.42%	4 969 505	5.59%
Total		**25 583 524**	**100,00%**	**88 966 586**	**100,00%**

Table 17: SESAR 2020 Programme expenditure outlook for the 2022–2024 period

All expenditure planned as of 2022 will be funded from the budget result (outturn) of the previous year (e.g. 2022 budget will be funded from 2021 budget result) which will include pre-2022 unused or

re-inscribed financial EU contributions to SESAR JU's administrative and operational expenditure and new financial contributions of EUROCONTROL and Members other than the EU to SESAR JU's administrative expenditure.

2.3.1.3. Budget outturn and cancellation of appropriations

The 2021 budget surplus that remains unused by the JU will be included at the beginning of 2022 into the 2022 budget of the SESAR JU.

Given the multiannual nature of the SESAR 2020 Programme, 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 3 financial years. Furthermore, according to Commission Decision C(2019) 5447 of 16 July 2019, Article 12(2) of the revised SESAR JU Financial Rules provides that in order to ensure the continuity of the SESAR JU operation until its termination, appropriations related to administrative expenditure ([49]) may, under conditions defined therein, be entered in the estimates of revenue and expenditure up to the 4 financial years following the last payment of the EU financial contributions as per Article 4(3) of SESAR JU basic act. Therefore, the commitment appropriations that are unused by the end of 2021 will be carried over to 2022 and the related unused payment appropriations have to be re-inscribed into the 2022 budget. Any commitment and payment appropriations that are left after the closure of the contractual obligations and considered not to be needed in the following years (if eligible for carry-over) would be cancelled in 2022 (see Annex III, Table 3).

2.3.2. Human resources

For the 2022-2024 period, 37 TA posts and one CA post have been included in the staff establishment plan of the SESAR JU, along with two SNE posts for which experience of Member States is required. For detailed data on the different staff categories, please refer to Annex IV, Table 1 and Annex V sub-annex A. The budget and human resources figures in the current version of the SPD do not take into account the new Commission's proposal for the legal basis 2021-2027 and the work programme. The alignment should take place as the new legal basis is adopted

In absence of an adopted future regulatory framework for the functioning of a new partnership on ATM research and innovation during the EU multiannual financial framework for 2021–2027, the SESAR JU plans to adapt the published vacancies and the renewals of determined duration contracts in the 2022–2024 period to the scenario of a termination of the SESAR JU on the 31 December 2024 (as described in Section II, subparagraph 1.1.6. 'The future of ATM research'). This adaptation is designed with due consideration to the budget availability and to the operational needs of the SESAR JU as its possible termination approaches. As a consequence, in a scenario where that SESAR JU would be terminated at the end of 2024, the SESAR JU plans a gradual reduction of the filled positions during the 2022–2024 period of 62 % in total, with reference to the positions available in the staff establishment plan in 2020, including contract agents and seconded national experts.

The abovementioned staff policy plan will be automatically revised if and when a confirmation on the establishment of the future regulatory framework for the ATM research and innovation partnership is communicated to the SESAR JU (as described in Section II, subparagraph 1.1.6. 'The future of ATM research'). Simultaneously, the SESAR JU would assess and propose appropriate modifications of the

([49]) In addition, Article 6(2) of the revised SESAR JU financial rules (Annex to SESAR JU Administrative Board Decision ADB(D)21-2019 of 9 October 2019) stipulates that the budget of the SESAR JU shall contain (only) differentiated appropriations. Consequently, administrative appropriations (contained in Titles I and II of the SESAR JU's annual budget) are also considered to be differentiated appropriations, allowing the SESAR JU to re-enter such appropriations, if unused, in the estimates of revenue and expenditure of future years.

multiannual staff policy plan for the 2022–2024 period to adapt it to the actual budget availability and to the operational needs of a possible new ATM partnership.

2.4. Strategy for achieving efficiency gains

To cope with the complexity stemming from the management of activities under four legal frameworks, the SESAR JU will continue its efforts towards further efficiency gains. This is in particular required to face a situation where contribution from Members of the SESAR JU other than the Union may be at risk as a consequence of the COVID-19 crisis and its impacts on the aviation sector; the related risk is described in further detail the table 57 in Annex XV. Furthermore, efficiency gains will contribute to the mitigation of a major risk with reference CORP05 'The SESAR JU may not be able to take up new challenges due to limited human resources' (see Annex XV).

In the 2022-2024 period, the SESAR JU will benefit from efficiency measures already implemented in previous years and will evaluate and, in some cases, implement new measures for further efficiency gains:

- **Quality management:** the SESAR JU undertakes regular process improvement initiatives in the context of the SESAR JU quality management system (see Section III, point 2.6.1.5 'Corporate quality management' and Annex X 'Strategy for the organisational management and internal control systems') supervised by the Quality, Information and Communication Technology Committee (QICT Committee), in order to monitor effectiveness and efficiency of business processes and IT tools, and focus on value added activities. This will continue in 2022 with specific attention to policies, procedures, processes and internal control that maintain alignment with evolving obligations and that also enhance support for staff working from home.
- **Information and document management:** the QICT Committee also supervises the implementation and continuous improvement of the SESAR JU's Information and Document Management System (IDMS), which aims at simplifying and streamlining the management of information and documentation within the organisation. The IDMS is based on software implemented in 2017 and has been under constant improvement since then. In that regard, the SESAR JU is also considering the implementation of modules in ARES (the European Commission's document management system) that will streamline communication with Commission services.
- **Electronic workflows:** the managed configuration of electronic systems supporting quality and information processes and key workflows that can be operated either locally or remotely makes teleworking measures possible with limited impact on the SESAR JU's business continuity. This is thanks to the effectiveness of the SESAR JU's ICT system, which includes collaboration platforms and electronic workflows that, in combination with ABAC workflows, support the most critical processes bound with strict deadlines. The aim is to remove this additional inefficiency in 2021 a financial tool (SPEEDWELL) into the ICT configuration to further enhance financial transactions.
- **Reduction in the number of staff missions:** made possible through the increased use of video conferences, the number of missions has been reduced, 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 has

opted for web conferences to coordinate with grant beneficiaries. This represents a significant benefit in terms of environmental footprint, efficiency and work–life balance.

- Use of the **human resources (HR) information system Sysper for Agencies**, developed by the European Commission, will be in full operation at the SESAR JU. This HR system is based on the Commission's HR management rules, in particular on the Staff Regulations and the Conditions of Employment of Other Servants of the European Union ([50]), the General Implementing Provisions thereto and the related business processes. It is expected to streamline the management of HR-related transactions and reporting. Sysper's modules cover the following HR areas:
  - identity management,
  - organisation management (organisation chart, job quotas),
  - employee personal data management,
  - talent management (career management, job descriptions, vacancies),
  - time management (including work patterns, leave rights, absences, flexitime),
  - document management (generation of various certificates, personal files digitalisation),
  - optionally, other areas such as evaluation, reclassification, HR reporting and analytical services.

Finally, ICT opportunities will also be used in the field of procurement as the SESAR JU is finalising the **implementation of the e-procurement suite** provided by the European Commission, which will be in full operation from 2021 onwards.

2.5. Negative priorities/decrease of existing tasks

As described above in paragraph 2.2 'Outlook for the years 2022 to 2024', the SESAR JU is planned to cease to exist at the end of 2024. Therefore, from 2023 onwards, it will be in its winding-up phase starting with the administrative and financial closure of the SESAR 2020 Programme operations and outreach activities over the year 2023, and continuing in 2024 with the closure of the financial, administrative and corporate activities. The allocation of tasks and resources will be carried out accordingly.

([50]) 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).

Section III – Annual work programme for 2022

The content of the SPD's annual work programme section includes the required content as set out in Article 16(1)(b) of the Annex to Council Regulation (EC) No 219/2007 (Statutes of the Joint Undertaking), as amended. The 'work programme' of the SESAR JU corresponds to the term 'work plan' defined in Article 2(1)(22) of Regulation (EU) No 1290/2013 ([51]) which defines the 'work plan' as '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' ([52]).

1. Executive summary

In 2022, the SESAR JU will continue to steer and manage the innovation pipeline delivered through the SESAR 2020 Programme by the SESAR JU Members other than the EU and other organisations involved in ATM-related research and demonstration activities. Furthermore, in continuity of year 2021, no further funding will be provided to the SESAR 2020 Programme under the Horizon 2020 programme.

Therefore, the activities planned for 2022 are as follows.

- The follow-up of activities laid out in the 2020 release of the European ATM Master Plan, and in particular in its levels 2 and 3 (the 'Implementation view');
- The management of the grant agreements for ongoing projects under the ER4 open call for proposals (H2020-SESAR-2019-2); the closure of these grants;
- The assurance of continuous commitment of the scientific community around the SESAR topics through organisation of the SESAR Innovation Days and the Young Scientist Award and through further strengthening of the SESAR Digital Academy;
- The completion of Release 11 in line with the Release 11 plan published in 2020 and the execution of Release 12 based on the Release 12 plan to be published at the end of 2021;
- The management of the grant agreements for ongoing projects under the restricted call for proposals: IR-VLD Wave 2 (H2020-SESAR-2019-1) and IR-VLD Wave 3 (H2020-SESAR-2020-2); the closure of these grants;
- The management of the grant agreements for ongoing projects under the VLD Open 2 open call for proposals (H2020-SESAR-2020-1); the closure of these grants;
- The continuation of showcasing mature SESAR solutions through awareness and outreach activities directly with stakeholders and at European and global events/conferences, promoting SESAR as an integral part of the day-to-day air transport and ATM domain, both in Europe and globally;

([51]) 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)' and repealing Regulation (EC) No 1906/2006 (OJ L 347, 20.12.2013, p. 81).

([52]) 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 (OJ L 347, 20.12.2013, p. 104).

- Depending on the scenario selected for the future ATM partnership, the preparation for the financial and administrative winding-up of the SESAR 2020 Programme to be carried out in 2023. The SESAR JU would draw a particular attention to, if applicable, identifying targets for the transfer of SESAR JU intangible assets, or any other solution that may be considered relevant;
- The assurance of effective and efficient financial, administrative, legal and corporate management supported by diligent implementation of internal control principles and systematic quality assurance activities.

Stakeholder engagement beyond the Members is critical to the successful delivery of the 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 2021. To do this the SESAR JU will continue to engage in partnerships with relevant actors in order to foster operational and policy coherence and have a positive benefit on the execution of the SESAR JU's mandate and those of its main stakeholders. Such partnerships will include, inter alia, EU institutions and decentralised bodies, ICAO, other regional R & I programmes, standardisation bodies and other third-party organisations. The 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 the 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 to ensure the coordination of activities relevant for the EU GNSS (European Geostationary Navigation Overlay Service / Galileo).

During the course of the year the SESAR JU will also continue to align the capabilities of the corporate services elements of its organisation to support the delivery of the SESAR 2020 Programme and activities. The objective for the SESAR JU in 2022 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.

2. Activities in 2022

In this chapter each strategic area of operation is described, with a focus on activities to be conducted in 2022, associated with objectives, indicators and the 2022 targets/metrics.

All of the SESAR JU's activities will be supervised by the Administrative Board (see Section II, point 1.1.5.1. 'Administrative Board' above), which plans to hold three meetings during 2022. The key decisions and documents to be adopted during the course of 2022 are expected to be the following.

Q1	Adopt a decision on the Internal Audit Capability 2022 work plan Adopt a decision on the 2022 voting-rights allocation Adopt the first amended version of the *SPD 2022-2024* to inscribe unused appropriations of 2021 into the annual budget for 2022
Q2	Adopt the *Consolidated Annual Activity Report 2021* and the decision on its assessment
Q4	Adopt a decision on the final accounts for 2021 Adopt the SPD for 2023–2024 (if applicable)

Table 18: Provisional timetable for key Administrative Board activities and decisions in 2022

2.1. Strategic area of operation 1: Provide strategic steering to the SESAR programme (operational activity)

2.1.1. Overview of activities

In the context of the strategic steering activities, in 2022 the SESAR JU will supervise the Wave 2 transversal activities (under the call with reference H2020-SESAR-2019-1) and their operational closure.

The SESAR JU will also organise the meetings of the three advisory boards: Programme Committee and the Delivery Management Sub-Committee, Master Planning Committee and Scientific Committee.

2.1.2. Objectives, indicators, expected outcomes and outputs

Indicators and measurements applicable for strategic area of operation 1 in 2022 are as follows.

Objectives	Indicators	Target for 2022
Supervise and close the transversal activities (PJ.19 W2 and PJ.20 W2)	See paragraph 2.3, objective 'Call with reference H2020-SESAR-2019-1 (IR-VLD Wave 2 call for proposals): Reporting and Payment (REPA)': percentage of Wave 2 transversal activities that have submitted their final project report by the end of 2022	100 %
Ensure effective and efficient SESAR 2020 Programme governance meetings	Meetings of the Programme Committee and the Delivery Management Sub-Committee	Four meetings of the Programme Committee Four meetings of the Delivery Management Sub-Committee
	Meetings of the Master Planning Committee	At least two
	Meetings of the Scientific Committee	At least three

Table 19: Objectives, indicators and targets for strategic steering activities in 2022

2.1.3. Resources

For 2022, resources include a portion of the SESAR JU's human and administrative resources (appearing, from a budgetary perspective, in Title I – Staff expenditure and Title II – Infrastructure and operating expenditure of the SESAR JU budget) and a limited amount of expenditure for experts (appearing, from a budgetary perspective, in Title III – Operational expenditure). Resources also include payment appropriations, which are related to the ongoing projects for which the closure is planned until the end of 2022, or the beginning of 2023.

The overall funding for strategic area of operation 1 for 2022–2024 appears in Annex II and in Table 16 in Section II, point 2.3.1.2 'Expenditure'.

2.1.4. Estimates of quantifiable workload drivers

The main workload drivers stemming from the abovementioned 2022 activities and related objectives are laid out in the following table.

Activity / objective	Workload drivers
Supervision and closure of the Wave 2 transversal activities	Participation in project coordination meetings with grant beneficiaries, Review of final project reports and deliverables
Effective and efficient SESAR 2020 Programme governance meetings	Per meeting: preparation of the meeting presentations and other materials, administrative tasks related to the organisation of meetings, administrative and operational follow-up activities including the drafting and publication of minutes

2.2. Strategic area of operation 2: Deliver exploratory research (operational activity)

2.2.1. Overview of activities

In the context of ER activities, in 2022 the SESAR JU will do the following.

- Supervise the projects launched in 2020-2021 under the ER4 call for proposals (call with reference H2020-SESAR-2019-2), along with the related grant agreements, and eventually close these projects.
- Organise the SESAR Innovation Days (see this section, point 2.5.1.1 'Communication and promotion activities' and Section II, point 1.3.3.1 'SESAR Innovation Days').
- As part of the SESAR Innovation Days and in continuation of activities conducted in previous years, organise the Young Scientist Award, which is the annual prize of EUR 5 000 to be awarded to a successful young scientist applicant or to be split among several successful applicants, following an open call for applications and in line with the evaluation conducted by the appointed evaluation committee.
- Use the SESAR Digital Academy initiative to raise the profile and visibility of existing SESAR outputs, events and activities with the development of new educational and continuing professional development services using existing contractual arrangements and communication channels.

2.2.2. Objectives, indicators, expected outcomes and outputs

Accordingly, the SESAR JU has identified a number of other objectives to be delivered during 2022, as outlined in the table below.

Objectives	Indicators	Target for 2022
Supervise and close ER4 projects (under calls for proposals H2020-SESAR-2019-2)	Execution of the H2020 REPA including the Projects Review	100 %
	Percentage of ER4 projects that have their final project report submitted to the SESAR JU by the end of 2022	100 %
Ensure the commitment of the scientific community around the SESAR topics	Organisation of the SESAR Innovation Days	100 %
	Active coordination with the scientific community through meetings with ASDA, and participation in the Advisory Council for Aviation Research and Innovation in Europe and ART	At least one meeting with each organisation
	Organisation of Young Scientist Award 2021	100 %
Maintain the SESAR Digital Academy and expand its membership	Portal publicly available throughout the year	100 %
	Additional organisations contributing to the academy across academia, industry, standards and regulation	At least four
	Organise relevant events under the framework of the SESAR Digital Academy	At least two

Table 20: Objectives, indicators and targets for ER in 2022

2.2.3. Resources

For 2022, resources include a portion of the SESAR JU's human and administrative resources (appearing, from a budgetary perspective, in Title I – Staff expenditure and Title II – Infrastructure and operating expenditure of the SESAR JU budget) and a limited amount of expenditure for experts (appearing, from a budgetary perspective, in Title III – Operational expenditure). Resources also include payment appropriations, which are related to the ongoing projects for which the closure is planned until the end of 2022, or the beginning of 2023.

The overall funding for strategic area of operation 2 for 2022–2024 appears in Annex II and in Table 16 in Section II, point 2.3.1.2 'Expenditure'.

2.2.4. Estimates of quantifiable workload drivers

The main workload drivers stemming from the abovementioned 2022 activities and related objectives are laid out in the following table.

Activity / objective	Workload drivers
Supervision and closure of ER4 projects (under calls for proposals H2020-SESAR-2019-2)	Participation in project coordination meetings with grant beneficiaries, Review of final project reports and deliverables
Commitment of the scientific community around the SESAR topics	Number of meetings per organisation
Maintenance of the SESAR Digital Academy and expand its membership	Number of events Number of updates to the portal

2.3. Strategic area of operation 3: Deliver industrial research and validation (operational activity)

2.3.1. Overview of activities

In the context of IR activities, in 2022 the SESAR JU will do the following.

- Supervise and close the IR projects launched in 2019 under the IR-VLD Wave 2 restricted call for proposals (with reference H202-SESAR-2019-1), along with the related grant agreements.
- Supervise and close the IR projects launched in 2020 under the IR-VLD Wave 3 restricted call for proposals (with reference H2020-SESAR-2020-2), along with the related grant agreements.
- Close Release 11 and execute Release 12. The close-out report of Release 12 will consider all the results provided by the projects up to their closure and will be available in the middle 2023.

2.3.2. Objectives, indicators, expected outcomes and outputs

In addition to those specific deliverables outlined within the corresponding multiannual section, the SESAR JU has identified a number of other objectives to be delivered during 2021, which are outlined in the table below.

Objectives	Indicators	Target for 2022
Execute validation exercises of Release 11	Percentage of Release 11 solutions validation exercises completed in 2022	100 %
Close Release 11	Delivery of the Release 11 close out report	Release 11 close out report available and approved by the Programme Committee by mid-2022
Execute validation exercises of Release 12	Percentage of Release 12 (candidate) solutions validation exercises completed in 2022	100 %
Call with reference H2020-SESAR-2019-1 (IR-VLD Wave 2 call for proposals): Reporting and Payment (REPA)	Percentage of Wave 2 projects that have submitted their REPA report by February 2022	100 %
Call with reference H2020-SESAR-2019-1 (IR-VLD Wave 2 call for proposals): delivery of results of IR Wave 2 projects and closure of grants	Percentage of Wave 2 projects that have submitted their final project report by the end of 2022	100 %
Call with reference H2020-SESAR-2020-2 (IR-VLD Wave 3 call for proposals): Reporting and Payment (REPA)	Percentage of Wave 3 projects that have submitted their REPA report by February 2022	100 %
Call with reference H2020-SESAR-2020-2 (IR-VLD Wave 3 call for proposals): delivery of results of IR Wave 3 projects and closure of grants	Percentage of Wave 3 projects that have submitted their final project report by the end of 2022	100 %

Table 21: Objectives, indicators and targets for IR in 2022

2.3.3. Resources

For 2022, resources include a portion of the SESAR JU's human and administrative resources (appearing, from a budgetary perspective, in Title I – Staff expenditure and Title II – Infrastructure and operating expenditure of the SESAR JU budget) and a limited amount of expenditure for experts (appearing, from a budgetary perspective, in Title III – Operational expenditure). Resources also include payment appropriations, which are related to the ongoing projects for which the closure is planned until the end of 2022, or the beginning of 2023.

The overall funding for strategic area of operation 3 for 2022–2024 appears in Annex II and in Table 16 in Section II, point 2.3.1.2 'Expenditure'.

2.3.4. Estimates of quantifiable workload drivers

The main workload drivers stemming from the abovementioned 2022 activities and related objectives are laid out in the following table.

Activity / objective	Workload drivers
Release planning and execution	Monitoring of the preparation and execution of the validation activities, assessment of the technical deliverables: number of validation exercises (Release 11 & 12) Review of the maturity of the developed SESAR Solutions Consolidation of the results in the R11 Report
Supervision of IR Wave 2 projects and closure of related grants	Participation in project coordination meetings with grant beneficiaries Review of final project reports and deliverables
Supervision of IR Wave 3 projects and closure of related grants	Participation in project coordination meetings with grant beneficiaries Review of final project reports and deliverables

2.4. Strategic area of operation 4: Deliver very large-scale demonstration activities (operational activity)

2.4.1. Overview of activities

In the context of VLDs, in 2021 the SESAR JU will do the following.

- Supervise and close the VLD projects launched in 2019-2020 under the IR-VLD Wave 2 restricted call for proposals (with reference H202-SESAR-2019-1), along with the related grant agreements.
- Supervise and close the VLD projects launched in 2020 under the IR-VLD Wave 3 restricted call for proposals (with reference H2020-SESAR-2020-2), along with the related grant agreements.
- Supervise and close the VLD Open 2 projects launched in 2020 under the open call for proposals (with reference H2020-SESAR-2020-1), along with the related grant agreements.

2.4.2. Objectives, indicators, expected outcomes and outputs

In addition to the specific deliverables outlined within the corresponding multiannual section, the SESAR JU has identified a number of other objectives to be delivered during 2022, as outlined in the table below.

Objectives	Indicators	Target for 2022
Call with reference H2020-SESAR-2019-1 (IR-VLD Wave 2 call for proposals): Reporting and Payment (REPA)	Percentage of Wave 2 projects that have submitted their REPA report by February 2022	100 %
Call with reference H2020-SESAR-2019-1 (IR-VLD Wave 2 call for proposals): delivery of results of VLD Wave 2 projects and closure of grants	Percentage of Wave 2 projects that have submitted their final project report by the end of 2022	100 %
Call with reference H2020-SESAR-2020-2 (IR-VLD Wave 3 call for proposals): Reporting and Payment (REPA)	Percentage of Wave 3 projects that have submitted their REPA report by February 2022	100 %
Call with reference H2020-SESAR-2020-2 (IR-VLD Wave 3 call for proposals): delivery of results of VLD Wave 3 projects and closure of grants	Percentage of Wave 3 projects that have submitted their final project report by the end of 2022	100 %
Call with reference H2020-SESAR-2020-1 (Open VLD 2 call for proposals): delivery of results of Open VLD 2 call projects and closure of grants	Percentage of Open VLD 2 call projects that have submitted their final project report by the end of 2022	100 %

Table 22: Objectives, indicators and targets for VLDs in 2022

2.4.3. Resources

For 2022, resources include a portion of the SESAR JU's human and administrative resources (appearing, from a budgetary perspective, in Title I – Staff expenditure and Title II – Infrastructure and

operating expenditure of the SESAR JU budget) and a limited amount of expenditure for experts (appearing, from a budgetary perspective, in Title III – Operational expenditure). Resources also include payment appropriations, which are related to the ongoing projects for which the closure is planned until the end of 2022, or the beginning of 2023.

The overall funding for strategic area of operation 4 for 2022–2024 appears in Annex III and in Table 16 in Section II, point 2.3.1.2 'Expenditure'.

2.4.4. Estimates of quantifiable workload drivers

The main workload drivers stemming from the abovementioned 2022 activities and related objectives are laid out in the following table.

Activity / objective	Workload drivers
Supervision of VLD Wave 2 projects and closure of related grants	Participation in project coordination meetings with grant beneficiaries Review of final project reports and deliverables
Supervision of VLD Wave 3 projects and closure of related grants	Participation in project coordination meetings with grant beneficiaries Review of final project reports and deliverables
Supervision of Open VLD 2 projects and closure of related grants	Participation in project coordination meetings with grant beneficiaries Review of final project reports and deliverables

2.5. Strategic area of operation 5: Deliver SESAR outreach (operational activity)

2.5.1. Overview of activities

SESAR outreach plays an integral role in engaging with the wider aviation community and informing them about the SESAR JU's work and results. Outreach also encourages wider international commitment to the SESAR approach to ATM modernisation and contributes to maintaining the momentum around SESAR R & I.

For 2022 the following key messages will be the focus of the SESAR JU's outreach activities.

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

In 2022, the SESAR JU will continue showcasing mature SESAR solutions through awareness and outreach activities directly with stakeholders and at European and global events/conferences, promoting SESAR as an integral part of the day-to-day air transport and ATM domain, both in Europe and globally.

2.5.1.1. Communication and promotion activities

In 2022, the SESAR JU's communication activities will support the activities of SESAR 2020 through the application of the following targeted objectives, in accordance with the SESAR JU's rolling communications strategy.

- Continue to regularly illustrate and showcase SESAR solutions that are mature and ready for industrialisation and deployment, showing tangible benefits for aviation 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 ICAO regions.
- Develop appropriately targeted printed materials and digital communications showcasing specific results, as well as the overall outcome of the programme.
- Conduct effective press and media outreach.

The following table provides an overview of the major events and conferences in 2022 in which SESAR will invest significant resources. However, it should be noted that various other conferences and

events organised by the EU and by European and international stakeholders may require the SESAR JU's participation with speakers, workshops or exhibition stands.

Event name	Location	Date	Organiser	Comments
World ATM Congress	TBD	TBD	CANSO/ATCA	Walking tours and theatre presentations
Berlin Air Show	Berlin	TBD	BDLI	Brings together the most important decision-makers from government, military, industry, science and research
Events in collaboration with institutional and stakeholder partners (up to 4)	TBD	TBD	SESAR JU and partners	Exhibition and/or workshops to promote the value of the public–private partnership approach and the results from SESAR to target stakeholder and institutional audiences
SESAR Innovation Days	(to be confirmed)	TBD (Q4 2022)	SESAR JU	A week-long conference with exhibition, networking and other activities (e.g. poster pitches, industry site visits, etc.) See paragraph 2.2. above
Digital events (webinars/vodcasts)	virtual	Q1 – Q4	SESAR JU	Virtual events with presentations and discussion about SESAR projects, solutions and results, as well as the SESAR vision
SESAR Showcase (to be confirmed)	(to be confirmed)	TBD	SESAR JU	A showcase of the results of SESAR 2020

Table 23: Key events and conferences for SESAR JU in 2022

The following table represents the publications / digital communications / online communications and communications coordination currently planned for 2022:

Publications	When
Application of SESAR 2020 visual identity (print material: posters, visual graphics, etc.)	Q1–Q4 2022
2021 SESAR Innovation Pipeline – R & I highlights	Q1 2022
SESAR Solutions Catalogue – 5th edition	Q1 2022
Various brochures/factsheets on SESAR JU R & I (e.g. performance, environment, solutions, results)	Q1-Q4 2022
Digital communication	**When**
2022 highlights	Q4 2022
Digital tools (incl. virtual reality, augmented reality and gaming)	Q1-Q4 2022
Videos and animations, including animated gifs	Q1-Q4 2022
Online communication	**When**
E-news (interviews and project news)	10 e-news per annum

Contributions to external magazines	12-16 articles per annum
Press relations	Q1-Q4 2022
Social media campaigns	Q1-Q4 2022
Communications coordination	**When**
Organise WebEx and face-to-face meetings with the Communications Coordination Group	Q1-Q4 2022

Table 24: Main publications and communication activities in 2022

2.5.1.2. Cooperation with third countries and international organisations

The SESAR JU will continue to engage actively with key international partners in support of global interoperability and harmonisation. At the global level, in relation to ICAO, the SESAR JU will maintain its active participation and collaboration under the leadership of the European Commission, in particular through participation in the ICAO GANP Study Group, which oversees the future evolution of the GANP. The alignment between the ICAO GANP, the ATM Master Plan and the SESAR 2020 Programme is essential to de-risk development towards deployment. The SESAR JU will, in this respect, continue to participate in the European ICAO Coordination Group chaired by the European Commission, in particular in support of the preparation of Europe's inputs to the 41st ICAO Assembly in 2022.

The close collaboration with the FAA and its NextGen programme will continue, subject to the outcome of the review of priority topics being conducted by the European Commission and the FAA to take into account changing priorities and emerging issues, in particular with a view to future ATM research needs. The priorities for the collaboration will be set by the Executive Committee on the basis of the EU–US MoC, chaired on the European side by the Commission. The focus will nevertheless remain on identifying and mitigating international harmonisation and global interoperability risks.

The existing cooperative arrangements with other international partners covering the ATM domain, whether of the SESAR JU or at the level of the European Commission or the EU, will be further enhanced during 2022 as the SESAR solutions evolve and are being deployed. This includes arrangements with Georgia, Japan, Qatar, Singapore and the United Arab Emirates. 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, Latin America, South Asia and South-East Asia. 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.

2.5.2. Objectives, indicators, expected outcomes and outputs

The outcome of these activities will be measured according to the metrics indicated in the SESAR JU's rolling communications strategy (e.g. level of participation of stakeholders, website analytics, social media analytics, etc.).

Objectives	Indicators	Target for 2022
Strengthen global interoperability activities aligned with the European Commission's expectations, especially towards ICAO, in	Coverage of ICAO GANP aviation system block upgrade modules aligned and agreed with NextGen. Transparent progress towards	Securing inputs to and outcomes from the 41st ICAO Assembly in 2022 that are aligned with SESAR JU's priorities and requirements

Objectives	Indicators	Target for 2022
close collaboration with FAA/NextGen and other ATM modernisation initiatives	interoperability and harmonisation between SESAR and NextGen	Active participation in the ICAO GANP Study Group Prioritised work plan agreed with FAA under EU-US MoC
Strengthen links towards standards-making organisations such as EUROCAE and the Radio Technical Commission for Aeronautics with the involvement of SESAR JU Members and the availability of SESAR material in support of standardisation	Alignment of priorities in standards development with the ATM Master Plan and SESAR 2020 needs	Well-aligned and supporting roadmaps relevant for standards among SESAR, standards-making organisations, international bodies and ICAO
		SESAR JU active participation in the European ATM Standards Coordination Group, the EUROCAE Council and the Council and Technical Advisory Committee to ensure alignment of the work programmes
		SESAR member/project contribution to standards-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 24
	SESAR participation in relevant ATM events	
	SESAR publications	See Table 25 above
Active cooperative arrangements with all EU Member States and stakeholders, international actors and other modernisation initiatives in aviation relating to the SESAR definition and development phases	Active cooperative arrangements or agreements with European (EU Member States and stakeholders) actors	Actors and initiatives to be addressed as a priority: — national aviation authorities — Airport Council International — Clean Sky 2 Joint Undertaking — EASA — European Defence Agency — European Space Agency — EUROCAE — PSOs
	Active cooperative arrangements or agreements with international actors and other ATM modernisation initiatives	Actors and initiatives to be addressed as priority: — ICAO (see also the abovementioned objective for 2022 in relation to GANP) — China — Qatar — Singapore — United States (FAA)

Table 25: Objectives, indicators and targets for SESAR outreach in 2022

2.5.3. Resources

For 2022, resources include a portion of the SESAR JU's human and administrative resources (appearing, from a budgetary perspective, in Title I – Staff expenditure and Title II – Infrastructure and operating expenditure of the SESAR JU budget).

The overall funding for strategic area of operation 5 for 2022–2024 appears in Annex III and in Table 16 in Section II, point 2.3.1.2 'Expenditure'.

2.5.4. Estimates of quantifiable workload drivers

The main workload drivers stemming from the abovementioned 2022 activities and related objectives are laid out in the following table.

Activity / objective	Workload drivers
Strengthened global interoperability activities	Number of meetings and participation in coordination / cooperation events
Strengthened links towards standards-making organisations	Number of meetings and participation in coordination / cooperation events
Promotion of SESAR JU activities and results	Number of publications, workshops, events organised or participated to
Active cooperative arrangements with all EU Member States and stakeholders, international actors and other modernisation initiatives in aviation relating to SESAR	Number of meetings and participation in coordination / cooperation events

2.6. Strategic area of operation 6: Deliver effective financial, administrative and corporate management (transversal activity)

2.6.1. Overview of activities

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 subparagraph 2.6.2 below and are associated with relevant indicators and 2022 targets.

2.6.1.1. Calls for proposals and grant management

No new calls for proposals are planned to be launched in 2022 under the SESAR 2020 Programme.

In 2022, the SESAR JU will manage grant agreements and the execution of payments in accordance with the financial circuit for the grant agreements within the Horizon 2020 set of rules where reporting periods become due or projects close their work and final payment is due. This will be carried out in relation to the calls for proposals mentioned earlier in this document ([53]), namely:

- the execution and closure of the ER4 grants resulting from the open call for proposals with reference H2020-SESAR-2019-2;
- the execution and closure of the IR and VLD Wave 2 grants resulting from the restricted call for proposals with reference H2020-SESAR-2019-1;
- the execution and closure of the IR and VLD Wave 3 grants resulting from the restricted call for proposals with reference H2020-SESAR-2020-2;
- the execution and closure of the VLD Open 2 grants resulting from the open call for proposals with reference H2020-SESAR-2020-1.

2.6.1.2. Financial management

The SESAR JU will continue to work with a proactive approach to ensure the transparent and effective management of financial resources and a high level of budget implementation (in terms of both commitments and payments).

During 2022, the SESAR JU will continue to streamline workflows within the SESAR JU's finance-related IT systems (ABAC/SAP and the SESAR JU's own information and document management system IDMS, complemented with SPEEDWELL for some financial transactions) and with regard to the Horizon 2020 IT tools (SYGMA/Compass), and to maintain a high level of accuracy in budgetary forecasting.

The procedures and tools at the SESAR JU related to services contracted to European Commission's Directorate-General for Budget will continue to be implemented in accordance with the service agreements. These services are: treasury, accounting, central budgetary framework, recovery actions, validation of local systems and financial reporting.

2.6.1.3. 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 2022 the SESAR JU will carry out the following actions.

([53]) In accordance with 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).

For legal affairs:

- Develop legal analysis on various matters requiring it. This analysis aims to ensure:
  - the regularity and legality of all SESAR JU's binding agreements, contracts, grants, decisions, processes and measures;
  - compliance with the agreements concluded with SESAR JU's Members (Membership Agreement);
  - compliance with the agreements concluded with SESAR JU's founding members (delegation agreements with the European Commission, agreement with EUROCONTROL);
  - appropriate support for activities aiming at defining the future of SESAR.
- Such analysis could take the form of:
  - legal advice, opinions, legal risk assessments and related mitigation actions,
  - participation in the SESAR JU's technical and administrative projects,
  - drafting, reviewing or updating SESAR JU staff training activities, guidelines or other material on legal matters including SESAR JU's internal rules and procedures.
- Coordinate with the European Commission and relevant SESAR JU external stakeholders with regard to legal aspects of:
  - the implementation of the SESAR 2020 Programme activities;
  - any measure related to the transition towards the new multiannual financial framework;
  - the development and implementation of the programme and administrative closure/transition scenarios, including the potential liquidation of the SESAR JU in its current form, the transfer of tangible and intangible assets and any other topics requiring legal expertise;
  - Brexit-related decision-making.
- Participate in interagency legal and procurement networks (Inter Agencies' Legal Network (IALN) and Network of Agencies' Procurement Officers (NAPO)) as well as in Horizon 2020 legal networks (Legal Mechanism Issue Group (LMIG), and Common Implementation Centre (CIC) ad hoc meetings) in order to contribute to the implementation and development of these networks' annual work programmes, concerted guidance, processes and templates.

For procurement:

- Provide legal and procedural support and advice for the effective implementation of the procurement plan for 2022 (Annex XII of this document): preparation, launch and administration of procurement procedure files and contracts.
- Develop legal and procedural analysis on various matters requiring it in the field of procurement in view of the rules and regulatory framework applicable to SESAR JU procurement and contract management. Such analysis could take the form of legal advice, legal risk assessments and related mitigation actions, SESAR JU staff training

activities, guidelines or other material on procurement matters as well as drafting, review and/or update of the SESAR JU's internal rules and procedures related to procurement activities.

- Promote automation in the management of procurement and contracts (i.e. e-procurement).
- Liaise with other JUs and EU agencies in relation to inter-institutional and joint procurement.

2.6.1.4. Corporate planning and reporting activities

2.6.1.4.1. Preparation and adoption of corporate planning and reporting documents

By 31 January 2022, the SESAR JU will prepare and submit to the Budgetary Authority its SPD for 2023–2024. This document will be further developed and submitted to the Administrative Board by the end of November 2022 for adoption in December.

In February 2022, the SESAR JU will prepare the first amended version of the SPD for 2022–2024, aiming for the adoption of the budget outturn and the transfer of unused 2021 appropriations to the 2022 budget by the Administrative Board mostly.

In addition, the SESAR JU will prepare its Consolidated Annual Activity Report for 2021 and submit it to the Budgetary Authority by 30 June 2022.

2.6.1.4.2. Future scenario definition and preparation

The outline of activities to be carried out in 2022 in relation to the definition and preparation of the future scenario appears in Section II, paragraph 1.7 'Strategic area of operation 6: Deliver effective financial, administrative and corporate management'. These activities will be further developed and elaborated upon in accordance with upcoming developments as regards the future of ATM research.

2.6.1.5. Corporate quality and ICT management

In 2022, in accordance with its strategy for the organisational management and internal control systems presented in Annex X, the SESAR JU will maintain its Quality Management System and will continue performing extensive quality monitoring. Specific continuous improvement actions will be defined and followed up within the QICT Committee.

The SESAR JU will also run its Information and Document Management System and the supporting platform (referred to as IDMS) in relation with other tools and platforms it uses where information or documents are managed, be they owned by the SESAR JU itself or by the European Commission (ABAC for financial processes, Horizon 2020 tools for grant management etc.) or by another provider. Continuous improvement actions will be planned and undertaken, and will be followed up within the QICT Committee.

The ICT coordination will continue to support SESAR JU corporate governance and staff by:

- providing expert advice and input in the fields of ICT, unified communications and business continuity management;
- providing a stable and continuously accessible teleworking infrastructure;
- ensuring seamless transition of ICT service suppliers (EUROCONTROL subcontractors) with minimised interruptions to service and continuity of support arrangements.

During the reporting period, continuous care will be taken to ensure that the ICT infrastructure and the operating environment are suitable to meet the needs and budget of the SESAR JU. The configuration is controlled through internal governance (QICT Committee), with deviations described through change requests or in transformation projects. Service-level measurement and performance improvement activities will be safeguarded by service improvement requests and problem management.

Ensuring the continuity and interoperability of the ICT services provided will require particular attention when renewing contractual elements of the infrastructure environment, of the centralised licensing portfolio (in particular due to new European Commission framework contracts, which are planned to be used as of 2020) and of the ICT coordination services.

2.6.1.6. Human resources management

In 2022, the SESAR JU will implement the learning and development policy through a set of trainings tailored to the type of position of its employees, with a dedicated monitoring tool for both compliance with the policy and budget execution.

Efficiency gains in the area of HR are presented in Section II, paragraph 2.4 'Strategy for achieving efficiency gains', and will be monitored in 2022.

During the year the SESAR JU will continue to implement all guidance material and procedures deriving from implementing rules and model decisions which are mandatory for the SESAR JU.

The SESAR JU will pay special attention to staff retention, although it is acknowledged that the uncertainty inherent in the future of SESAR is a challenge to this objective.

Besides the above, HR activities will focus on the following specific objectives during 2022:

- If the termination of the SESAR JU has to be carried out by 2024, reduce the number of filled posts by 12 % (comprising of TAs, CAs and SNEs) while maintaining the operational capability of the SESAR JU fit for achieving its objectives in 2022.
- Complete the staff selection processes following the two vacancies considered essential for the operation of the SESAR JU.
- Present to the Administrative Board members, for their adoption, the relevant model decisions, implementing rules or requests for opt-outs relating to the Staff Regulations developed by the European Commission, where appropriate.

2.6.1.7. Facility and support services

Facility and support services activities are related to the following administrative tasks and services.

- Facilities management coordination, supporting all persons working and/or providing services within the SESAR JU premises, by providing facility coordination support in the buildings and logistics services.
- Mission coordination, supporting SESAR JU staff by providing core support for their travel bookings and the execution of missions, and for the reimbursement of travel expenses towards the travel agency's expenses and the traveller's claims.
- Insurance coordination, ensuring necessary coverage against recognised operational risks and the follow-up of new insurance claims.

In 2022, in terms of facilities management, work will continue on a number of initiatives at the SESAR JU's premises in Brussels to sustain or improve the productivity, safety and efficiency of the working environment and facilities offered to SESAR JU staff. In particular, the SESAR JU will:

- publish a public procurement call for tenders in relation to security services, split into two lots: lot 1 'Guarding services' and lot 2 'Alarm monitoring, badging and video surveillance systems';
- start the preparation of a new public procurement call for tenders in relation to cleaning services;
- depending on the evolution of the COVID-19 crisis, extend or implement measures to monitor the occupancy levels and the presence of the staff at the SESAR JU's premises, based on the rules and recommendations of the European Commission and the Belgian authorities.

Mission support will also continue during 2021, consisting of mission process management and support for all staff across the SESAR JU while contributing to continuous improvement initiatives relating to the mission system or the electronic workflow.

2.6.1.8. Internal control, risk management and audits

2.6.1.8.1. Ex ante and ex post controls

Ex ante controls

Ex ante controls remain important tools to help the SESAR JU prevent errors and to 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 2021, the following *ex ante* activities will take place.

- Generate and check grant agreement,
- Initiate, check and verify invoices for administrative expenditure,
- Assess periodic reports from grants, and verify and pay cost claims.

Ex post controls

One of the other major pillars of assurance for SESAR JU is its *ex post* audit activity. Its main objectives are as follows.

- 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 and 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 of assessing the value for money of the SESAR JU's operations.
- Identify systemic errors through the analysis and synthesis of the results obtained and formulate recommendations to address the issues.
- Provide the SESAR JU auditees with recommendations to improve the financial management, processes, procedures and practices applied to the activities related to the SESAR JU's contracts, with the main purpose being to ensure that recurring errors are avoided by the SESAR JU beneficiaries.

In 2022, the audit activity is expected to encompass (according to the Horizon 2020 Audit Strategy) audits in a number of participations, performed by the Common Audit Service of DG Research and Innovation (CAS), as well as follow-up and closure of any pending audits previously launched, regular meetings and exchange of information. For all these activities, the SESAR JU has an active participation in the CAS coordination mechanisms.

The SESAR JU will also contribute to the Implementation Strategy for Horizon Europe, in particular by participating in discussions, making proposals for a common audit approach on common financial rules.

The enhanced communication campaign provided by the CAS will support external stakeholders when needed.

2.6.1.8.2. Corporate risk management

The SESAR JU risk management policy addresses four threads of risks: corporate risks, master plan risks, SESAR JU internal risks and SESAR 2020 Programme risks. The policy focuses on the management of critical risks, defined as risks that:

- endanger the realisation of objectives outlined in the European ATM Master Plan,
- cause serious damage to the SESAR partners (SESAR JU Members, the broader stakeholder community involved in the execution of the European ATM Master Plan);
- result in critical intervention at political level (European Parliament / Council of the European Union / European Commission) regarding the 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;
- in any way seriously impact the SESAR JU's image and reputation.

The list of critical risks that may affect the achievement of the SESAR JU's objectives for 2021 as per the above definition, extracted from the SESAR JU's corporate risk register, appears in Annex XV.

Strategic risk assessment

In November 2018, the IAS conducted a strategic risk assessment of the SESAR JU. This entailed the IAS analysing all of the operational, administrative, financial and IT processes of the SESAR JU with the aim of identifying areas of risk and future audit topics. This strategic risk assessment was performed in coordination with the SESAR JU IAC, and led to the 2019–2021 Strategic Internal Audit Plan (SIAP) which was published in May 2019.

The next in-depth risk assessment by the IAS is planned for 2022.

2.6.1.8.3. Audits

Internal Audit Capability

The SESAR JU's Internal Audit Capability (IAC) will perform audit and consulting engagements based on risks identified in 2020 and will coordinate activities with the Internal Audit Service (IAS) of the European Commission and the European Court of Auditors as described below. The 2021 annual audit plan of the IAC will be presented to the Administrative Board in December 2020.

Internal Audit Service 2022 audits

Internal audits are carried out by the IAS in liaison with the IAC.

In 2021, the IAS plans, in accordance with the '2019–2021 Strategic Internal Audit Plan', an audit on the in-kind contribution validation process. (cf. subpoint 2.6.1.8.2).

European Court of Auditors 2022 audits

At this stage the SESAR JU is not aware of any external audits to be conducted by the European Court of Auditors in 2021, with the exception of the recurring annual audit of the accounts.

2.6.1.9. Data protection

Since the entry into force of Regulation (EU) 2018/1725 ([54]), the long-term commitment to a privacy practice and culture has been strengthened at the SESAR JU.

The SJU will continue adapting its processes and ICT tools when used for processing personal data. This will enable to demonstrate accountability in line with Regulation 2018/1725.

Whereas most of the novelties and requirements of Regulation (EU) 2018/1725 have been tackled by the SESAR JU through the implementation and monitoring of the action plan, a number of ongoing actions are to be performed in the upcoming years in line with the main principles of:

- accountability and shift of responsibilities from the Data Protection Officer to the controller responsible for compliance at three levels (insurance, demonstration and verification);
- documentation and consultation obligations closely tied to the risks;
- transparency and provision of clear information to data subjects allowing for the effective exercise of data subjects' rights';
- obligation on the part of the SESAR JU to notify personal data breaches to the supervisory authority;
- strict data protection measures for procurement and contract management.
- For this purpose, the SESAR JU will continue to implement the following recurring activities.
    - Plan, provide advice and report to the controller on accountability at three levels: (1) participation in the QICT Committee meetings; (2) constant monitoring of the SESAR JU

([54]) Regulation (EU) 2018/1725 of the European Parliament and of the Council of 23 October 2018 on the protection of natural persons 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 (OJ L 295, 21.11.2018, p. 39).

action plan on data protection; and (3) regular reporting obligations to the European Data Protection Supervisor (EDPS).

- Provide advice on ad hoc requests from data subjects and process access requests in due time.
- Record and map all transfers of personal data through the update and population of the electronic records system (GDPR central system) and privacy notices.
- Implement data protection by design and by default in the definition of new services and tasks by introducing data protection requirements for procurement procedures at three different levels (definition, evaluation and reporting) and in the resulting contracts.
- Draft SESAR JU policies and internal rules on data protection. Notably on data breaches, impact assessment, access requests.
- Review of the SESAR JU decision on Restrictions every two years, and assess every 6 months each restriction in place and report to the Governing Board.
- Provide advice and coordination in data protection impact assessments (DPIAs) and consult the EDPS when necessary.
- Report and document any identified data breach and prepare when necessary notifications to the EDPS and affected data subjects.
- Internal rules of the SESAR JU on data protection drafting exercise will continue through 2022.
- Contribute to and follow up on developments in joint controllership.
- Cooperate with EUROCONTROL's data protection officer and advance in the drafting of SESAR JU-EUROCONTROL joint controllership agreement.
- Dissemination and info sessions across the SESAR JU.

The following specific actions are planned during 2022.

- Readiness for closer cooperation with EUROCONTROL in terms of:
  - Final drafting of the Joint Controllership agreement as a schedule of the SESAR JU-EUROCONTROL agreement for S3JU.
  - Mapping the processing of personal data for the new tasks of EUROCONTROL as per the SBA.
- Internal publication and application of specific SESAR JU specific procedures for data breaches and impact assessments.
- Publication in the Official Journal of the Governing Board Decision on Restrictions of data subjects rights.
- Introduction of Data Processing Agreements as annexes to procurement contracts, with an impact on data protection, in application of the Standard Contractual Clauses published by the European Commission.

- Preparation and coordination of the DPIA in Microsoft Office 365 in close cooperation with SESAR JU LISO, IT services and EUROCONTROL.
- Dissemination activities and info sessions on data breaches and restrictions to all staff.

2.6.2. Objectives, indicators, expected outcomes and outputs

The SESAR JU has the following objectives to be delivered during 2022, which will be tracked according to the indicators mentioned in the following table.

Objectives	Indicators	Target for 2022
Ensure full compliance with programming and reporting requirements	Full compliance with programming obligations for JUs:	Full compliance
	• first amended version of the SPD for 2022–2024 submitted to the Administrative Board for adoption by 28 February 2022 (transfer of unused 2021 appropriations to the 2022 budget and inscription of budget result)	100 %
	• draft SPD for 2023–2024 submitted to the budgetary authority by 31 January 2022	100 %
	• SPD for 2023–2024 submitted to Administrative Board by the end of November 2022 for adoption in mid-December 2022	100 %
	Full compliance with reporting obligations for JUs:	Full compliance
	• Corporate Annual Activity Report 2021 adopted by the Administrative Board and sent to the budgetary authority by 30 June 2022	100 %
	Number of critical observations from auditors	0
	Number of files sent to OLAF for investigation	0
Monitor exception and non-compliance events register	Register the exceptions and non-compliance events per SESAR JU area which are identified and notified	100 %
Monitor efficiency and effectiveness of legal and procurement activities	Percentage of completed legal and procurement aspects of the contract action planning within deadlines (see Annex XII)	95 %
	Provision of legal advice to the SESAR JU on: • Horizon 2020 grants • non-Horizon 2020 grants • other matters in relation to the European network with agencies and the Common Support Centre	In accordance with the plan agreed with the requestor
Monitor efficiency and effectiveness of project audit activities	Horizon 2020 project audits: provision of necessary inputs to the CAS to execute audits in 2021	100 %

Objectives	Indicators	Target for 2022
Monitor efficiency and effectiveness of human resources management	Effective staffing management: • maximum turnover rate • minimum occupancy rate	 10 % ([55]) 90 % ([56])
	Implementation of career development review and promotion exercise	100 %
	Implementation of or opt-out from Commission implementing decisions and models	100 %
Monitor efficiency and effectiveness of SESAR JU's corporate and management activities	Full compliance with the internal control framework during 2022 (to be documented in the Corporate Annual Activity Report 2022)	100 %
	Discrepancies against processes, and their translation into quality management system improvement actions Continuous registration of improvement actions as part of the SESAR JU Quality Management System	All process improvement actions taken in accordance with the action plan, defined if discrepancies are found
	An acceptable level of corporate risks as per the risk management plan, allowing for the leveraging of opportunities	All risk-related actions implemented in accordance with the mitigation plan
Monitor efficiency and effectiveness of budget and finance activities	Budget request for 2023 submitted to the European Commission by 31 January 2022	100 %
	Percentage of SESAR 2020 balancing payments executed in a timely manner	100 % of requested payments made
	Budget execution: commitment and payment appropriations are executed as planned in the 2022 budget	90 % for commitment appropriations 80 % for payment appropriations
	Completion of 2021 annual accounts within regulatory deadlines	100 %
	Support for the European Court of Auditors' audit and provision of relevant documentation leading to an unqualified opinion on the 2021 accounts	100 %
Deliver infrastructure services to enable teams and 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 and disaster planning
Prepare the SESAR 2020 Programme closure	Carry out the relevant aspects of the closure process over the 2022–2023 period	100 %

([55]) This figure is subject to a major review following the evolution of staffing levels in accordance with the staff policy plan depending on the scenario which will be in place at the SJU in 2021.

([56]) This figure is subject to a major review following the evolution of staffing levels in accordance with the staff policy plan depending on the scenario which will be in place at the SJU in 2021.

Objectives	Indicators	Target for 2022
Prepare the transition towards the new legal entity 'SESAR 3 JU'	Develop a transition plan towards the new 'SESAR 3 JU'	SESAR JU -SESAR 3 JU transition plan adopted by the Governing Board of the new ATM partnership, or equivalent body
	Start the execution of the transition as established in the transition plan	TBD as per transition plan

Table 26: Objectives, indicators and targets for financial, administrative and corporate management in 2022

2.6.3. Resources

For 2022, resources include a portion of the SESAR JU's human and administrative resources (appearing, from a budgetary perspective, in Title I – Staff expenditure and Title II – Infrastructure and operating expenditure of the SESAR JU budget).

The overall funding for strategic area of operation 6 for 2022–2024 appears in Annex III and in Table 16 in Section II, point 2.3.1.2 'Expenditure'.

2.6.4. Estimates of quantifiable workload drivers

The main workload drivers stemming from the abovementioned 2021 activities and related objectives are laid out in the following table.

Activity / objective	Workload drivers
Full compliance with programming and reporting requirements	Preparation for adoption of up to three amendments to the SPD 2022-2024 Preparation for adoption of the SPD 2023-2024 including three major draft versions
	Preparation for adoption of the CAAR 2020 including two major draft versions
Monitoring of exception and non-compliance events	Number of exceptions and/or non-compliance events identified, analysed, notified and registered
Monitoring of efficiency and effectiveness of legal and procurement activities	Number and criticality of legal analyses Number and complexity of procurement actions (see Annex XII 'Procurement Plan for 2022')
Monitoring of efficiency and effectiveness of project audit activities	Number of participations subject of CAS audit activities coordinated with the SESAR JU
Monitoring of efficiency and effectiveness of human resources management	Number of vacancies and applications CDR and reclassification cycle Number of Commission implementing decisions and models decisions
Monitoring of efficiency and effectiveness of budget and finance activities	Preparation of budget and budget requests, meeting with the European Commission Number of financial transactions (commitments, payments) Preparation of 2020 annual accounts and meetings with the European Court of Auditors

Activity / objective	Workload drivers
Monitoring of efficiency and effectiveness of corporate and management activities	Internal meetings and workshops related to the follow-up of the internal control indicators Analysis of discrepancies against processes, definition and implementation of related improvement actions through meetings with process actors, revision of process assets etc. Risk management workshops preparation and follow-up
Infrastructure services delivered to enable teams and SESAR JU to operate smoothly	Ongoing monitoring of IT, infrastructure and facilities, including meetings with service providers and maintenance of related procedures Contractual management of IT service providers Maintenance of business continuity and disaster recovery plans
SESAR 2020 Programme closure preparation	Drafting of the SESAR 2020 Programme closure plan with internal stakeholders

Annexes

Annex I: SESAR JU organisation chart

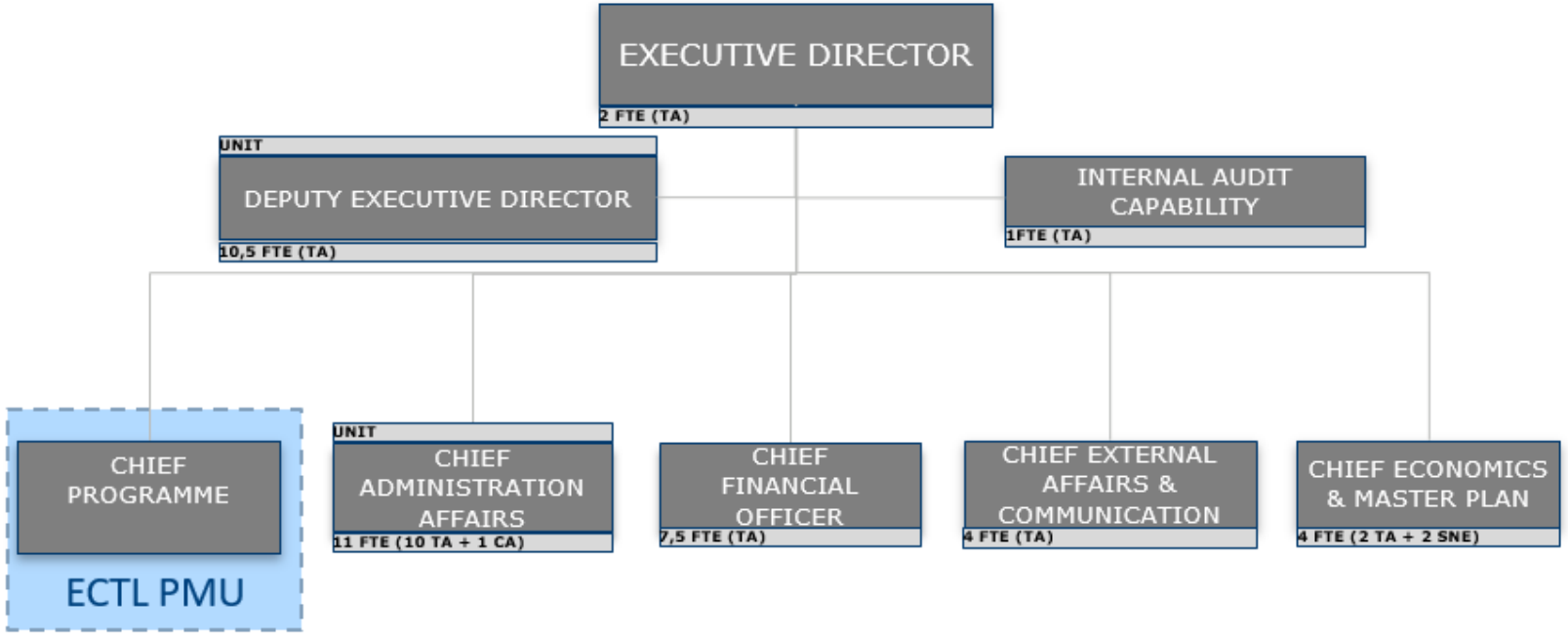

Figure 20: SESAR JU Organisation chart as of February 2021 ([57])

([57]) In accordance with the SESAR JU's Administrative Board decision with reference ADB(D)04-2021.

Annex II: Resource allocation per strategic area of operation – 2022–2024

The following table provides information relating to human and financial resources, broken down per strategic area of operation, in accordance with Chapter 2 of Sections II and III.

Activity / Area of operation	Year N+1 (2022)			Year N+2 (2023)			Year N+3 (2024)		
	TA (posts)	CA & SNE (FTE)	Budget allocated (million EUR)	TA (posts)	CA & SNE (FTE)	Budget allocated (million EUR)	TA (posts)	CA & SNE (FTE)	Budget allocated (million EUR)
Strategic area of operation 1: Provide strategic steering to the SESAR programme	3	1.5	1.04	3	1.5	1.03	3	1.5	0.76
Strategic area of operation 2: Deliver exploratory research	3	0.5	0.88	3	0.5	0.80	3	0.5	0.59
Strategic area of operation 3: Deliver industrial research and validation	15		3.78	15		3.44	15		2.53
Strategic area of operation 4: Deliver very large-scale demonstration activities	5		1.28	5		1.15	5		0.84
Strategic area of operation 5: Deliver SESAR outreach	4		0.89	4		0.92	4		0.67
Strategic area of operation 6: Deliver effective financial, administrative and corporate management	7	1	1.79	7	1	1.84	7	1	1.35
TOTAL	**37**	**3**	**9.66**	**37**	**3**	**9.18**	**37**	**3**	**6.74**

Table 27: Resource allocation per strategic area of operation from 2022 (year N+1) until 2024 (year N+3)

Annex III: Financial resources (tables) – 2021–2024

In this annex the financial resources are presented for the whole of the SESAR JU.

Table 1 – Revenue

The EU's contribution post-2020 is indicative, subject to the outcome of future EU budgetary procedures.

General revenues (financial contributions)

SESAR JU revenues in 2021 (year N) and 2022 (year N+1)

(EUR)

REVENUES	N (2021)	N+1 (2022)
	Revenues estimated	Budget forecast
EU contribution (EFTA included)	-	-
Other revenue	33.147.925	9.662.726
TOTAL REVENUES	33.147.925	9.662.726

Table 28: SESAR JU revenues in 2021 (year N) and 2022 (year N+1) – commitment appropriations

Detailed revenue

Detailed SESAR JU revenue over the 2020-2024 period (N-1 to N+3)

(EUR)

REVENUES	General revenues						
	N-1 (2020)	N (2021)	N+1 (2022)		VAR N+1 / N (%)	N+2 (2023)	N+3 (2024)
	Executed budget	Estimated budget	Requested budget	Budget forecast		Envisaged budget	Envisaged budget
1 Revenue from fees and charges	-	-	-	-	-	-	-
2 EU contribution	115.083.059,02	-	-	-	-	-	-
— of which administrative (Title I and Title II) (budget line 1100)	*3.268.071,48*	-	-	-	-	-	-
— of which operational (Title III) (budget line 1200 – EU)	*105.814.987,54*	-	-	-	-	-	-
— of which assigned revenues deriving from additional budget (budget line 1300)	*6.000.000,00*	-	-	-	-	-	-
3 Third countries' contribution (incl. EFTA and candidate countries)	2.628.901,72	-	-	-	-	-	-
— of which EFTA (budget line 1200 – EFTA)	*2.628.901,72*	-	-	-	-	-	-
— of which candidate countries				-	-	-	-
4 Other contributions (budget lines 2100 and 3100)	6.950.055,17	4.287.011,00	4.158.551,91	4.158.551,91	*-3,0%*	4.073.142,00	1.086.839,82
— of which delegation agreement, ad hoc grants	-	-	-	-	-	-	-
5 Administrative operations	-	-	-	-	-	-	-
6 Revenues from services rendered against payment	-	-	-	-	-	-	-
7 Correction of budgetary imbalances	-	-	-	-	-	-	-
8 Interest generated	-	-	-	-	-	-	-
9 Budget out-turn and unused appropriations from previous years (budget line 5100)	- 30.798.421,04	25.515.063,38	5.504.174,09	5.504.174,09	*-78,4%*	5.103.118,52	5.657.697,71
TOTAL REVENUES	**93.863.594,87**	**29.802.074,38**	**9.662.726,00**	**9.662.726,00**		**9.176.260,52**	**6.744.537,53**
UNUSED APPROPRIATIONS NOT REQUIRED IN CURRENT YEAR	-	3.345.850,75	-	-	*-100,0%*	-	-
TOTAL REVENUES incl. UNUSED APPROPRIATIONS NOT REQUIRED IN CURRENT YEAR	**93.863.594,87**	**33.147.925,13**	**9.662.726,00**	**9.662.726,00**	***-70,8%***	**9.176.260,52**	**6.744.537,53**

Table 29: Detailed SESAR JU revenue budget (financial contribution) over the 2020–2024 period (N – 1 to N + 3) – commitment appropriations

In-kind revenue

TITLE/CHAPTER	Revenue entitlements estimated by the agency			
	N (2020)	N+1 (2021)	N+2 (2022)	N+3 (2023)
1. In-kind contribution from founding members	**60.579.894,68**	**51.103.478,10**	**59.600.000,00**	**60.000.000,00**
1.1 European Union	-	-	-	-
1.2 EUROCONTROL	*60.579.894,68*	*51.103.478,10*	*59.600.000,00*	*60.000.000,00*
2. In-kind contribution from other members	**45.974.388,44**	**31.390.911,08**	**48.004.359,43**	**43.834.965,11**
2.1 Other members	*45.974.388,44*	*31.390.911,08*	*48.004.359,43*	*43.834.965,11*
TOTAL in-kind revenue	**106.554.283,13**	**82.494.389,18**	**107.604.359,43**	**103.834.965,11**

Table 30: In-kind revenue budget over the 2020–2023 period (N to N + 3)

Table 2 – Expenditure

Expenditure per budget title

SESAR JU expenditure per budget title in 2021 (year N) and 2022 (year N+1) – commitment and payment appropriations

(EUR)

EXPENDITURE	N (2021)		N+1 (2022)	
	Commitment appropriations	Payment appropriations	Commitment appropriations	Payment appropriations
Title I	5.671.227	5.671.227	5.749.700	5.749.700
Title II	3.647.863	3.647.863	3.177.026	3.177.026
Title III	2.521.500	58.862.308	736.000	51.047.975
Title IV	21.307.334	-	-	-
TOTAL EXPENDITURE	33.147.925	68.181.399	9.662.726	59.974.701

Table 31: SESAR JU expenditure per budget title in 2021 (year N) and 2022 (year N + 1) – commitment and payment appropriations

Detailed expenditure

Detailed SESAR JU expenditure over the 2020-2024 period (N-1 to N+3) – commitment appropriations

(EUR)

EXPENDITURE	Commitment appropriations						
	Executed budget N-1 (2020)	Adopted budget N (2021)	Budget N+1 (2022)		VAR N+1 / N (%)	Budget N+2 (2023)	Budget N+3 (2024)
			Agency request	Budget forecast			
Title I – Staff expenditure	**5.196.248**	**5.671.227,35**	**5.749.700,00**	**5.749.700,00**		**5.864.694,00**	**4.013.674,98**
11 Salaries and allowances	5.034.119,08	5.286.687,35	5.364.700,00	5.364.700	*1,5%*	5.471.994	3.856.674,98
— of which establishment plan posts	*4.366.068,32*	*4.798.730,00*	*4.700.000,00*	*4.700.000*	*-2,1%*	*4.794.000*	*3.768.032,00*
— of which external personnel	*668.050,76*	*487.957,35*	*664.700,00*	*664.700*	*36,2%*	*677.994*	*88.642,98*
12 Expenditure relating to staff recruitment	-	5.000,00	5.000,00	5.000	-	5.100	-
13 Mission expenses	58.661,03	200.000,00	200.000,00	200.000	-	204.000	50.000,00
14 Socio-medical infrastructure	-	-	-	-	-	-	-
15 Training	28.196,32	50.000,00	40.000,00	40.000	*-20,0%*	40.800	5.000,00
16 External services	72.522,05	93.840,00	90.000,00	90.000	*-4,1%*	91.800	92.000,00
17 Receptions and events	-	-	-	-	-	-	-
19 Other staff-related expenditure	2.749,20	35.700,00	50.000,00	50.000	*40,1%*	51.000	10.000,00
Title II – Infrastructure and operating expenditure	**2.728.289**	**3.647.863,46**	**3.177.026,00**	**3.177.026,00**		**3.311.566,52**	**2.730.862,55**
20 Rental of buildings and associated costs (*)	798.162	908.181,45	935.960,00	935.960	*3,1%*	954.679	927.734,88
21 Information and communication technology	1.466.771	1.687.152,00	1.568.619,00	1.568.619	*-7,0%*	1.670.991	1.412.839,82
22 Movable property and associated costs	847	2.562,24	5.000,00	5.000	*95,1%*	5.100	2.719,07
23 Current administrative expenditure	231.204	639.767,77	273.043,00	273.043	*-57,3%*	278.504	276.744,45
24 Postage/telecommunications	-	-	-	-	-	-	-
25 Meeting expenses	235	10.200,00	10.404,00	10.404	*2,0%*	10.612	10.824,32
26 Running costs in connection with operational activities	-	-	-	-	-	-	-
27 Information and publishing	231.070	400.000,00	384.000,00	384.000	*-4,0%*	391.680	100.000,00
28 Studies	-	-	-	-	-	-	-

Continued on next page

Title III – Operational expenditure	**133.837.324**	**2.521.500,00**	**736.000,00**	**736.000,00**		**-**	**-**
SESAR 1 – 3.1 Studies/development conducted by the SJU	-	-	-	-	-	-	-
SESAR 1 – 3.2 Studies/development conducted by EUROCONTROL	-	-	-	-	-	-	-
SESAR 1 – 3.3 Studies/development conducted by other members	-	-	-	-	-	-	-
SESAR 2020 3.1 – Providing strategic steering to the SESAR programme	2.910.594	1.100.000,00	736.000,00	736.000,00	*-33,1%*	-	-
SESAR 2020 3.2 – Deliver exploratory research	15.335.627	110.000,00	-	-	*-100,0%*	-	-
SESAR 2020 3.3 – Deliver industrial research and validation	82.417.424	-	-	-	-	-	-
SESAR 2020 3.4 – Deliver very large-scale demonstration activities	31.571.645	-	-	-	-	-	-
SESAR 2020 3.5 – Deliver SESAR outreach	1.602.035	1.311.500,00	-	-	*-100,0%*	-	-
Title IV – Unused appropriations not required in the current year	**13.383.404**	**21.307.334,32**	**-**	**-**		**-**	**-**
TOTAL EXPENDITURE	**155.145.265**	**33.147.925,13**	**9.662.726,00**	**9.662.726,00**		**9.176.260,52**	**6.744.537,53**

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

Table 32: Detailed SESAR JU expenditure budget over the 2020–2024 period (N – 1 to N + 3) – commitment appropriations

Detailed SESAR JU expenditure over the 2020-2024 period (N-1 to N+3) – payment appropriations

(EUR)

EXPENDITURE	Payment appropriations						
	Executed budget N-1 (2020)	Adoped budget N (2021)	Budget N+1 (2022)		VAR N+1 / N (%)	Budget N+2 (2023)	Budget N+3 (2024)
			Agency request	Budget forecast			
Title I - Staff Expenditure	**5.192.405,38**	**5.671.227,35**	**5.749.700,00**	**5.749.700,00**		**5.864.694,00**	**4.013.674,98**
11 Salaries and allowances	5.016.317	5.286.687	5.364.700	5.364.700	*1,5%*	5.471.994,00	3.856.674,98
— of which establishment plan posts	*4.366.068*	*4.798.730*	*4.700.000*	*4.700.000*	*(2,1)%*	*4.794.000,00*	*3.768.032,00*
— of which external personnel	*650.249*	*487.957*	*664.700*	*664.700*	*36,2%*	*677.994,00*	*88.642,98*
12 Expenditure relating to staff recruitment	664	5.000	5.000	5.000	-	5.100,00	-
13 Mission expenses	71.676	200.000	200.000	200.000	-	204.000,00	50.000,00
14 Socio-medical infrastructure	-	-	-	-	-	-	-
15 Training	14.706	50.000	40.000	40.000	*(20,0)%*	40.800,00	5.000,00
16 External services	72.777	93.840	90.000	90.000	*(4,1)%*	91.800,00	92.000,00
17 Receptions and events	-	-	-	-	-	-	-
19 Other staff-related expenditure	16.265	35.700	50.000	50.000	*40,1%*	51.000,00	10.000,00
Title II - Infrastructure and operating expenditure	**2.945.854**	**3.647.863**	**3.177.026**	**3.177.026**		**3.311.566,52**	**2.730.862,55**
20 Rental of buildings and associated costs (*)	795.302	908.181	935.960	935.960	*3,1%*	954.679,20	927.734,88
21 Information and communication technology	1.552.779	1.687.152	1.568.619	1.568.619	*(7,0)%*	1.670.991,38	1.412.839,82
22 Movable property and associated costs	2.012	2.562	5.000	5.000	*95,1%*	5.100,00	2.719,07
23 Current administrative expenditure	201.320	639.768	273.043	273.043	*-57,3%*	278.503,86	276.744,45
24 Postage/telecommunications	-	-	-	-	-	-	-
25 Meeting expenses	1.145	10.200	10.404	10.404	*2,0%*	10.612,08	10.824,32
26 Running costs in connection with operational activities	-	-	-	-	-	-	-
27 Information and publishing	393.295	400.000	384.000	384.000	*(4,0)%*	391.680,00	100.000,00
28 Studies	-	-	-	-	-	-	-

Continued on next page

Title III - Operational expenditure	**113.068.863**	**58.862.308**	**51.047.975**	**51.047.975**		**13.071.087,55**	**-**
SESAR 1 – 3.1 Studies/development conducted by the SJU	4.128	-	-	-	-	-	-
SESAR 1 – 3.2 Studies/development conducted by EUROCONTROL	-	-	-	-	-	-	-
SESAR 1 – 3.3 Studies/development conducted by other members	-	-	-	-	-	-	-
SESAR 2020 3.1 – Providing strategic steering to the SESAR programme	3.414.723	1.448.507	936.000	936.000	*-35,4%*	-	-
SESAR 2020 3.2 – Deliver exploratory research	15.999.664	14.579.959	16.865.711	16.865.711	*15,7%*	10.102.362,19	-
SESAR 2020 3.3 – Deliver industrial research and validation	65.671.633	36.148.643	16.666.662	16.666.662	*-53,9%*	742.659,33	-
SESAR 2020 3.4 – Deliver very large-scale demonstration activities	26.813.452	5.362.106	15.295.870	15.295.870	*185,3%*	2.226.066,03	-
SESAR 2020 3.5 – Deliver SESAR outreach	1.165.263	1.323.093	1.283.732	1.283.732	*-3,0%*	-	-
Title IV – Unused appropriations not required in the current year	**-**	**-**	**-**	**-**		**-**	**-**
TOTAL EXPENDITURE	**121.207.122**	**68.181.398,68**	**59.974.700,84**	**59.974.700,84**		**22.247.348,07**	**6.744.537,53**

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

Table 33: Detailed SESAR JU expenditure budget over the 2020–2024 period (N – 1 to N + 3) – payment appropriations

Table 3 – Budget outturn and cancellation of appropriations

(EUR)

Budget outturn	N – 3(2019)	N – 2 (2020)	N – 1 (2021)
Revenue actually received (+)	201 745 069	143 292 614	
Payments made (–)	– 151 504 679	– 121 207 122	
Carry-over of appropriations (–)			
Cancellation of appropriations carried over (+)			
Adjustment for carry-over of assigned revenue appropriations from previous year (+)			
Exchange rate differences (+/–)		-3 990	
Adjustment for negative balance from previous year (–)			
TOTAL	**50 240 390**	**22 081 501**	

Table 34: Budget outturn and cancellation of appropriations over the 2019–2021 period (N – 3 to N – 1)

Annex IV: Human resources (quantitative)

The 2021–2023 staff numbers are indicative, subject to the outcome of the EU's future budgetary procedures.

Table 1 – Staff population and its evolution; overview of all categories of staff

A. Statutory staff and SNEs

The complete Staff Establishment Plan of the SESAR JU is composed of Temporary Agents and Contract Agents. The Staff population of the SESAR JU also includes Seconded National Experts, as follows[58] :

STAFF	Year N – 1 (2020)			Year N (2021)	Year N + 1 (2022)	Year N + 2 (2023)	Year N + 3 (2024)
ESTABLISHMENT PLAN POSTS	Authorised budget	Actually filled as of 31.12.N – 1	Occupancy rate (%)	Authorised staff	Envisaged staff	Envisaged staff	Envisaged staff
Administrators (AD)	33	30	91 %	32	31	31	31
Assistants (AST)	6	4	67 %	6	6	6	6
Assistants/secretaries (AST/SC)							
TOTAL ESTABLISHMENT PLAN POSTS	39	34	87 %	38	37	37	37
EXTERNAL STAFF	FTE corresponding to authorised budget	Executed FTE as of 31.12.N – 1	Execution rate (%)	Headcount as of 31.12.N – 1	FTE corresponding to authorised budget	Envisaged FTE	Envisaged FTE
Contract Agents (CA)	0	1		1	1	1	1
Seconded National Experts (SNE)	3	3	100 %	3	2	2	2
TOTAL EXTERNAL STAFF	3	4	100%	4	3	3	3
TOTAL STAFF	42	38	90 %	42	40	40	40

Table 35: Staff population and its evolution over the 2020–2024 period (N – 1 to N + 3)

[58] In relation with the SESAR 3 Joint Undertaking referred to in subparagraph 1.1.6 of Section II above, 'The future of ATM research', the staff numbers are aligned as from 2022 with the Legislative and Financial Statement i.e. 37 TA and 2 SNE.

B. Additional external staff expected to be financed from grant, contribution or service-level agreements

The SESAR JU will not have additional external staff expected to be financed from grant, contribution or service-level agreements in the period from 2022 to 2024.

C. Other human resources

TYPE OF OTHER HUMAN RESOURCES ([59])	Actually in place as of 31.12.2020)
INTERIM WORKERS	3
BLUE BOOK TRAINEES	2
ATYPICAL TRAINEES	1
STRUCTURAL SERVICE PROVIDERS	3
of which for security services	0
of which for IT services	1
of which for reception services	2
OTHER PERSONNEL ENGAGED THROUGH OPERATIONAL EXPENDITURE UNDER SPECIFIC AGREEMENTS APPROVED BY THE ADMINISTRATIVE BOARD	2
TOTAL OTHER HUMAN RESOURCES	11

Table 36: Structural service providers and interim workers as at 31.12.2020 (N – 1)

([59]) Structural service providers are contracted by a private company and carry out specialised outsourced tasks of a horizontal/support nature for the SESAR JU. The following general criteria must be fulfilled: (1) no individual contract with the SESAR JU on the part of the provider; (2) the provider works on the SESAR JU premises, usually with a PC and a desk; (3) the provider is administratively monitored by the SESAR JU (badge, etc.); and (4) the provider contributes to the added value of the SESAR JU.

Table 2 – Multiannual staff policy plan for years 2022-2024 (posts)

FUNCTION GROUP AND GRADE	Year N – 1 (2020)				Year N (2021)		Year N + 1 (2022)		Year N + 2 (2023)		Year N + 3 (2024)	
	Authorised budget		Actually filled as of 31.12.N – 1		Authorised budget		Envisaged		Envisaged (to be confirmed)		Envisaged (to be confirmed)	
	Perm. posts	Temp. posts	Perm. posts	Temp. posts	Perm. posts	Temp. posts	Perm. posts	Temp. posts	Perm. posts	Temp. posts	Perm. posts	Temp. posts
AD 16												
AD 15		1		1		1		1		1		1
AD 14												
AD 13						1		2		2		2
AD 12		5		3		4		3		3		4
AD 11		3		2		3		4		5		5
AD 10		2		3		2		2		2		3
AD 9		5		4		6		7		8		8
AD 8		7		6		7		7		7		7
AD 7		6		6		4		4		3		1
AD 6		4		5		3		1				
AD 5												
Total AD		33		30		31		31		31		31
AST 11												
AST 10												
AST 9		1		1		1		1		1		1
AST 8												
AST 7		1				1		1		1		1
AST 6												
AST 5		1				2		3		3		4
AST 4		2		2		1				1		
AST 3		1		1		1		1				
AST 2												
AST 1												
Total AST		6		4		6		6		6		6
AST/SC 6												

FUNCTION GROUP AND GRADE	Year N – 1 (2020)				Year N (2021)		Year N + 1 (2022)		Year N + 2 (2023)		Year N + 3 (2024)	
	Authorised budget		Actually filled as of 31.12.N – 1		Authorised budget		Envisaged		Envisaged (to be confirmed)		Envisaged (to be confirmed)	
	Perm. posts	Temp. posts	Perm. posts	Temp. posts	Perm. posts	Temp. posts	Perm. posts	Temp. posts	Perm. posts	Temp. posts	Perm. posts	Temp. posts
AST/SC 5												
AST/SC 4												
AST/SC 3												
AST/SC 2												
AST/SC 1												
Total AST/SC												
GRAND TOTAL		39		34		37		37		37		37

Table 37: Multiannual staff policy plan for years 2022-2024 (N + 1 to N +3 1)

CONTRACT AGENTS	Year N – 1 (2020)			Year N (2021)	Year N + 1 (2022)	Year N + 2 (2023)	Year N + 3 (2024)
	FTE corresponding to authorised budget	Executed FTE as of 31.12.N – 1	Headcount as of 31.12.N – 1	FTE corresponding to authorised budget	Envisaged FTE	Envisaged FTE	Envisaged FTE
Function group IV	0	1	1	1	1	1	1
Function group III							
Function group II							
Function group I							
TOTAL	0	1	1	1	1	1	1

Table 38: Evolution of CAs per function group over the 2020–2024 period (N – 1 to N + 3)

SECONDED NATIONAL EXPERTS	Year N – 1 (2020)			Year N (2021)	Year N + 1 (2022)	Year N + 2 (2023)	Year N + 3 (2024)
	FTE corresponding to authorised budget	Executed FTE as of 31.12.N – 1	Headcount as of 31.12.N – 1	FTE corresponding to authorised budget	Envisaged FTE	FTE corresponding to authorised budget	Executed FTE as of 31.12.N – 1
TOTAL	3	3	3	3	2	2	2

Table 39: Evolution of SNEs per function group over the 2020–2024 period (N – 1 to N + 3)

Table 3 – Recruitment forecasts for 2022 following retirement/mobility or new requested posts

Job title in the SESAR JU	Type of contract (official, TA or CA)		TA / official function group / grade of recruitment planned for publication		CA recruitment function group (I, II, III or IV)
	Due to planned retirement or mobility	New post requested due to additional tasks	Internal (brackets)	External (single grade)	
Programme Officer	TA		AD6-AD8	AD7	
Head of Corporate Quality & Planning	TA		AD7-AD9	AD8	
Executive Director	TA		N/A	AD14	

Table 40: Recruitment forecasts for 2022 (N + 1)

Interagency mobility in 2021

- Number of SESAR JU staff recruited by other EU agencies: 0
- Number of staff recruited by the SESAR JU from other EU agencies: 1

Annex V: Human resources (qualitative)

The SESAR JU staff establishment plan is the document adopted by the Administrative Board defining the total number of posts by grade authorised by the EC to execute the JU's work programme. These posts are filled by personnel recruited under the following types of contract.

- TA/CA contracts, for duties requiring a long-term contract during the period of existence of the SESAR JU.
- SNE contracts, for which experience within Member States' organisations is desirable.

A. Recruitment and management of human resources

Following Council Regulation (EU) No 721/2014 amending Council Regulation (EC) No 1361/2008, the staff of the JU consists of TAs and CAs recruited for a fixed period that may be renewed once for a fixed period of up to 5 years. Any other renewal shall be for an indefinite period in accordance with the EU's Staff Regulations. The total period of engagement shall not in any case exceed the duration of the JU.

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 staff to ensure the functioning of the SESAR JU. In establishing the different job descriptions and the organisation chart of the SESAR JU, particular attention is paid to preserving the separation of functions, to managing the risk of conflicts of interest and to ensuring the efficient and cost-effective operation of the organisation.

It has to be recognised that it is difficult to attract highly skilled persons on TA contracts for a limited duration, given the time frame indicated in the SESAR JU founding act.

1. Statutory staff recruitment policy

The SESAR JU launches recruitment procedures for TAs through the announcement of vacant posts on its website and that of the European Personnel Selection Office. The SESAR JU may also recruit CAs from the European Personnel Selection Office's reserve lists, for the specific needs identified above.

Generally, vacancies are online for 1 month, during which time candidates can submit their applications. Exceptionally, this period may be extended. The exact deadline for applying for a job is indicated in the vacancy notice of the selection procedure, which also provides 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 eligibility of candidates is assessed according to compliance with all formal requirements by the closing date for the submission of applications. Eligible candidates whose applications show evidence of all of the 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 the signature of the contract, selected candidates are requested to provide the 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 of 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.

The 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, Appointing Authority of the SESAR JU, takes the final decision to offer the job to a selected candidate from the reserve list established by the selection panel.

1.1. Officials

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 basic act, most of its existing workforce is assigned to long-term posts, within the limits of the existence of the SESAR JU, both in the operational areas and in the transversal areas.

All TA posts have been identified as posts of long duration, and selected candidates are offered limited duration contracts (except for staff who were under Belgian contracts as at 1 January 2009, in accordance with the transition provisions of Council Regulation (EC) No 1361/2008, who are under indefinite duration contracts still subject to the end of functioning of the SESAR JU on 31 December 2024 at the latest).

The recruitment process followed complies with the European Commission's rules on the engagement and use of temporary staff. The entry grades are determined with regard to the complexity and level of responsibility of the tasks to be performed by the new staff member. These grades are compatible with the provisions of Article 53 of the Conditions of Employment of Other Servants of the European Union, with the corresponding implementing rules on the engagement of TAs 2(f) and with the grades authorised by the European Commission in the SESAR JU's staff establishment plan.

1.3. Contract agents

The SESAR JU's staff establishment plan contains one CA position.

If needed, CAs will be recruited on a fixed-term contract, usually with a duration of 1 year, renewable once for a fixed period. Any further renewal shall be for an indefinite period in accordance with the Staff Regulations. In exceptional cases, the appointing authority may decide on a different contract duration. The total period of engagement shall not in any case exceed the duration of the SESAR JU (Article 2(a) of Council Regulation (EC) No 219/2007 as amended by Council Regulation (EU) No 721/2014).

1.4. Seconded national experts

In relation to requirements for specific expertise, the SESAR JU recruits SNEs from competent national organisations in the EU Member States, especially where expertise within regulators, public authorities or other public bodies is desirable.

1.5. European Commission implementing rules relating to the recruitment of staff

The table below provides an overview of the relevant European Commission implementing rules relating to the recruitment of staff, as applied by the SESAR JU.

Subject matter	Decision number	Applied by SESAR JU		If no, which other implementing rules are in place
		Yes	No	
Engagement of CAs	Model Decision C(2019) 3016	X		
Engagement of TAs	Model Decision C(2015) 1509	X		
Middle management	Model Decision C(2018) 2542	X		
Type of post	Model Decision C(2018) 8800		X	C(2013) 8979

Table 41: Implementing rules relating to the recruitment of staff applied by the SESAR JU

2. Other human resources managed by the SESAR JU

2.1. Interim services acquisition

The SESAR JU has the capacity to engage interim staff on a temporary basis and on short-term contracts through temping agencies in the case of:

- necessary replacement of TAs or CAs in a situation of their long-term absence, and for the duration of such absence
- or
- unforeseen additional tasks implying a level of additional workload that cannot be carried out by the existing TAs and CAs.

For these cases, the SESAR JU is using a framework contract (ref. HR/R1/PR/2019/023), for the period 1 July 2020 to 30 June 2024. The budget available for this procurement is equivalent to 6 FTEs per year during a 4 year period.

2.2. Blue book trainees

The SESAR JU has the capacity to offer traineeships to Blue Book trainees through the SLA signed with the European Commission. The maximum capacity of the SESAR JU to host Blue Book trainees, in accordance with the SLA, is six trainees per traineeship period.

2.3. Atypical trainees

The SESAR JU engages occasionally atypical trainees for short-term traineeships, without a financial impact for the SESAR JU. In 2021, the template and rules to engage atypical trainees, harmonised with those used by the European Commission, will be available.

3. External personnel working for the SESAR JU in-house

3.1. Structural service providers

For the purposes of managing, planning and controlling reception services, in 2011 the SESAR JU signed a 1-year renewable contract with a service provider. This service provider provides one to two FTEs as

receptionists / back-office reception staff. It is not always the same person providing the services. In terms of ICT coordination, one person is provided by an external service provider. There is no contractual relation at all between the persons appointed by the service providers to provide these services and the SESAR JU, for what these persons have no link with SESAR JU HR matters.

3.2. Seconded staff from SESAR JU selected members

At its meeting on 31 May 2017 the Administrative Board of the SESAR JU, having regard to Article 5(1)(p) and Article 8 of the Annex to the SESAR JU basic act and the SESAR Joint Undertaking Membership Agreement, which entered into force on 6 July and was signed by the SESAR JU, EUROCONTROL 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 Decision ADB(D)07-2017;
- to delegate the power to the Executive Director to establish the necessary agreements in line with the aforementioned conditions.

When the experts with specific expertise requested for a certain post are not available for direct recruitment by the SESAR JU and this expertise is retained by personnel working for one of SESAR JU Members, the SESAR JU fills these highly specialised posts with secondments from its Members, ensuring that proper measures to manage potential conflicts of interest are in place (segregation of duties, annual declarations on conflicts of interest, etc.).

In compliance with the Administrative Board's decision, the SESAR JU launches a call for expression of interest to its selected members to establish a list of potential candidates for specific posts.

Secondment to the SESAR JU is subject to the signature of a secondment agreement.

B. Appraisal of performance and reclassification/promotions

Implementing rules in place.

Subject matter	Decision number	Applied by SESAR JU		If no, which other implementing rules are in place
		Yes	No	
Reclassification of TAs	Model Decision C(2015) 9560	X		
Reclassification of CAs	Model Decision C(2015) 9561	X		
Appraisal of TAs	Model Decision C(2013) 8985	X		
Appraisal of CAs	Model Decision C(2014) 2226	X		

Table 42: Implementing rules related to reclassification/promotions applied by the SESAR JU

GRADE	Average seniority in the grade among reclassified staff						
	Year N – 4 (2016)	Year N – 3 (2017)	Year N – 2 (2018)	Year N – 1 (2019)	Year N (2020)	Actual average over 5 years (N – 4 to N)	Average over 5 years (according to decision C(2015) 9563)
AD 5	2.2	2				2.2	2.8
AD 6		2	3	2.5	3.6	2.8	2.8
AD 7	2	2	3	4	3	2.8	2.8
AD 8	2		4	2.6	3	2.8	3.0
AD 9					3.7	3.7	4.0
AD 10					7.5	7.5	4.0
AD 11							4.0
AD 12							6.7
AD 13							6.7
AST 1							3.0
AST 2	2					2.0	3.0
AST 3			2	9.5		5.8	3.0
AST 4							3.0
AST 5							4.0
AST 6		3				3.0	4.0
AST 7							4.0
AST 8			4			4.0	4.0
AST 9							N/A
AST 10							5.0
AST/SC 1							4.0
AST/SC 2							5.0
AST/SC 3							5.9
AST/SC 4							6.7
AST/SC 5							8.3

Table 43: Reclassification of temporary staff/promotion of officials

FUNCTION GROUP	GRADE	Staff in activity at 1.01.N – 2 (2018)	Staff reclassified in year *n* – 1 (2019)	Average number of years in grade of reclassified staff members	Average number of years in grade of reclassified staff members (according to Decision C(2015) 9561)
CA IV	17	-	-	-	6 to 10 years
	16	1	-	-	5 to 7 years
	15	-	-	-	4 to 6 years
	14	1	-	-	3 to 5 years
	13	-	-	-	3 to 5 years
CA III	11	-	-	-	6 to 10 years
	10	-	-	-	5 to 7 years
	9	-	-	-	4 to 6 years
	8	-	-	-	3 to 5 years
CA II	6	-	-	-	6 to 10 years
	5	-	-	-	5 to 7 years
	4	-	-	-	3 to 5 years
	3	-	-	-	6 to 10 years
CA I	2	-	-	-	3 to 5 years
	1	-	-	-	6 to 10 years

Table 44: Reclassification of contract staff

No contract staff members were reclassified during 2018 and 2019.

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 between EU bodies

Until 2016 the SESAR JU's statutory staff were excluded from the possibility of benefiting from mobility between the EU agencies, substantially limiting one of the key elements of the career development of its staff. This situation has changed with the adoption of new implementing rules on the selection of TAs 2(f) in April 2016 under the new Staff Regulations.

3. Mobility between the SESAR JU and the institutions

The SESAR JU has currently no posts occupied by an official from an institution ([60]); nevertheless, where appropriate the SESAR JU can consider favouring mobility with the institutions.

D. Gender representation

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 a gender and geographical balance in a domain of operations that appears to be highly unbalanced.

GENDER	FUNCTION GROUP	Officials		TAs		CAs		GRAND TOTAL	
		Staff	%	Staff	%	Staff	%	Staff	%
Female	AD			15	41			15	41
	AST & AST/SC			3	8			3	8
	TOTAL			***18***	***49***			***18***	***49***
Male	AD			17	46			17	46
	AST & AST/SC			2	5			2	5
	TOTAL			***19***	***51***			***19***	***51***
GRAND TOTAL				**37**	**100**			**37**	**100**

Table 45: Gender representation of statutory staff (officials, TAs and CAs) as at 31.12.2019

GENDER	N – 5 (2015)		N – 1 (2019)	
	Number	%	Number	%
Female managers	0	0	0	0
Male managers	1	100	2	100
TOTAL	**1**	**100**	**2**	**100**

Table 46: Gender evolution of middle and senior management over 5 years

([60]) There is one TA who is on secondment from the European Commission in its own interest.

E. Geographical balance

NATIONALITY	AD and CA FG IV		AST/SC, AST, CA FG I-III		TOTAL	
	Number	% of total AD and CA FG IV staff	Number	% of total AST/SC, AST, CA FG I-III staff	Number	% of total staff
Belgium	3	9 %	2	40 %	5	14 %
Bulgaria	1	3 %	1	20 %	2	5 %
Germany	1	3 %			1	3 %
Ireland	3	9 %			3	8 %
Greece	2	6 %			2	5 %
Spain	4	13 %			4	11 %
France	4	13 %	1	20 %	5	14 %
Croatia			1	20 %	1	3 %
Italy	4	13 %			4	11 %
Cyprus	1	3 %			1	3 %
Lithuania	1	3 %			1	3 %
Netherlands	2	6 %			2	5 %
Portugal	1	3 %			1	3 %
Sweden	1	3 %			1	3 %
United Kingdom	4	13 %			4	11 %
TOTAL	32	100 %	5	100 %	37	100 %

Table 47: Geographical representation of statutory staff (officials, TAs and CAs) as at 31 December 2019

MOST REPRESENTED NATIONALITY	N – 5 (2015)		N – 1 (2019)	
	Number	%	Number	%
United Kingdom	7/38	18 %	4/37	11 %

Table 48: Evolution of the most-represented nationality in the SESAR JU over 5 years

F. Schooling

The European Schools in Brussels should cover the schooling needs of children of SESAR JU staff, for those members of staff currently eligible.

Agreement in place with the European School(s) of:	
Contribution agreements signed with the European Commission on type I European schools (yes/no)	No. SESAR staff with a contract with a minimum duration of 1 year and who receive family allowances from the SESAR JU can have their children enrolled in the European Schools (type I) in Brussels as category I pupils, meaning that they are accepted as a priority and no school fees have to be paid by the parents. A contribution agreement was not concluded at that time due to the low number of children of SESAR JU staff in the European Schools.
Contribution agreements signed with the European Commission on type II European schools (yes/no)	No
Number of service contracts in place with international schools	0
Description of any other solutions or actions in place	N/A

Table 49: Schooling arrangements implemented by the SESAR JU

Annex VI: Environmental management

The SESAR JU is dedicated to reducing the impact of its overall activities on the environment.

Given that the SESAR JU is one of the tenants of the building referred to in the Annex VII, environmental management at the SESAR JU is limited to implementing environmentally friendly practices at its premises and strongly encouraging its staff to abide with these. Staff are provided with the appropriate instructions and means to ensure the continuous and diligent application of the following environmentally friendly practices.

- Waste management, more particularly sorting of glass, cardboard and PMD waste.
- Use of environmentally friendly paper for all printers, compliant with ISO 14020 standard and the International Chamber of Commerce framework for environmental claims.
- Inclusion of provisions encouraging environmentally friendly performance in public calls for tender for cleaning services. Products used by the cleaning company must meet the following relevant core criteria.

  - No ingredients (substances) shall be listed on the product label, in the safety data sheet or in other relevant technical data sheets that have been identified as substances of very high concern ([61]) and have been included in the list in Article 59 of Regulation (EC) No 1907/2006 (the REACH regulation) ([62]). In order to comply with this condition, the tenderer shall take the following into account:
    - products carrying a relevant Type I Ecolabel are deemed to comply;
    - other appropriate means of proof are possible, such as the provision of the ingredients listed on the product label, the safety data sheet, the manufacturer's website and any other relevant technical data sheets, along with their CAS number (where available).
  - **Packaging requirements.** All products must be delivered with clear dosing instructions. Sprays containing propellants should not be used. Products packaged as trigger sprays should be sold as part of a refillable system. The contractor should also be able to justify the range of products used.

    If certain products to be used do not comply with this requirement, the contractor shall provide in advance a written justification for such an exception. The SESAR JU reserves the right to request that the contractor refrain from using any products identified as exceptions to the rule above.
  - **Staff and organisation.** All cleaning staff employed in carrying out the service should be correctly trained for their various tasks. This training should cover cleaning agents, methods, equipment and machines used; waste management; and aspects of health,

([61]) The list of substances referred to (the candidate list) can be found at: https://echa.europa.eu/web/guest/candidate-list-table

([62]) Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the registration, evaluation, authorisation and restriction of chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC (OJ L 396, 30.12.2006, p. 1).

safety and the environment. A record of these training measures (introductory/vocational training) should be kept at the disposal of the SESAR JU.

- The SESAR JU also encourages use of bicycles by providing secure storage, and has a scheme to contribute to the cost of public transport season tickets if the applicant agrees to not use the car park unless under exceptional circumstances.

Furthermore, amongst the efficiency measures described above in Section II paragraph 2.4, the reduction is the number of missions and the preference for web conferences, when possible, has a positive impact on the environmental footprint of the SESAR JU.

Annex VII: 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) are as follows.

		Building 1	Comment
Building name and type		Office Building	
Location		Avenue de Cortenbergh 100 1000 Brussels	Joint-occupancy building with non-EU bodies
Surface area (in m^2)	**Office space**	1 765	
	Non-space	63	There are an additional 28 car parking spaces (not included in the surface area)
	Total	1 828	
Rental contract	**Rent (EUR/year)**	427 925	Excluding gratuities and other reductions
	Duration of the contract	9-year lease from 2016	
	Type	Fixed-term lease	
	Breakout clause (yes/no)	Yes	
	Conditions attached to the breakout clause (if applicable)	Diplomatic clause for rupture of rental contract with 6 months' notice.	
Host country (grant or support)		N/A	

Table 50: Buildings

- Building projects in planning phase: N/A.
- Building projects submitted to the European Parliament and the Council: N/A.

Annex VIII: Privileges and immunities

Privileges	Privileges granted to staff	
	Protocol of privileges and immunities / diplomatic status	Education/daycare
VAT exemption as of 16.10.2008, administrative agreement with the Belgian authorities since 30.3.2009	Protocol of privileges and immunities applicable to staff with regard to VAT	N/A

Table 51: Privileges and immunities

Annex IX: Evaluations

In 2017 the SESAR JU was subject to two evaluations ([63]). The first 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 led to five recommendations in total. SESAR JU management considers that the action plan has been fully implemented, except for recommendation 5. The implementation of this recommendation is currently subject to validation at policy level on the future of the SESAR JU. Therefore, in agreement with the European Commission, the action is currently on hold. No further actions are planned for 2021.

No new evaluations of the SESAR programme have been announced to the SESAR JU for 2022.

([63]) Both reports 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 Horizon 2020 evaluation can be found here: http://ec.europa.eu/research/evaluations/index_en.cfm?pg=h2020evaluation

Annex X: Strategy for the organisational management and internal control systems

The SESAR JU implements the Commission's internal control framework (ICF) through its Quality Management System (QMS), which has been in place since 2015 ([64]) and is accessed via a portal on the SESAR JU's IT system. The QMS is implemented to help the SESAR JU in achieving its objectives and optimising its value to stakeholders. The SESAR JU's Quality Manual describes the approach, which is represented in the figure below.

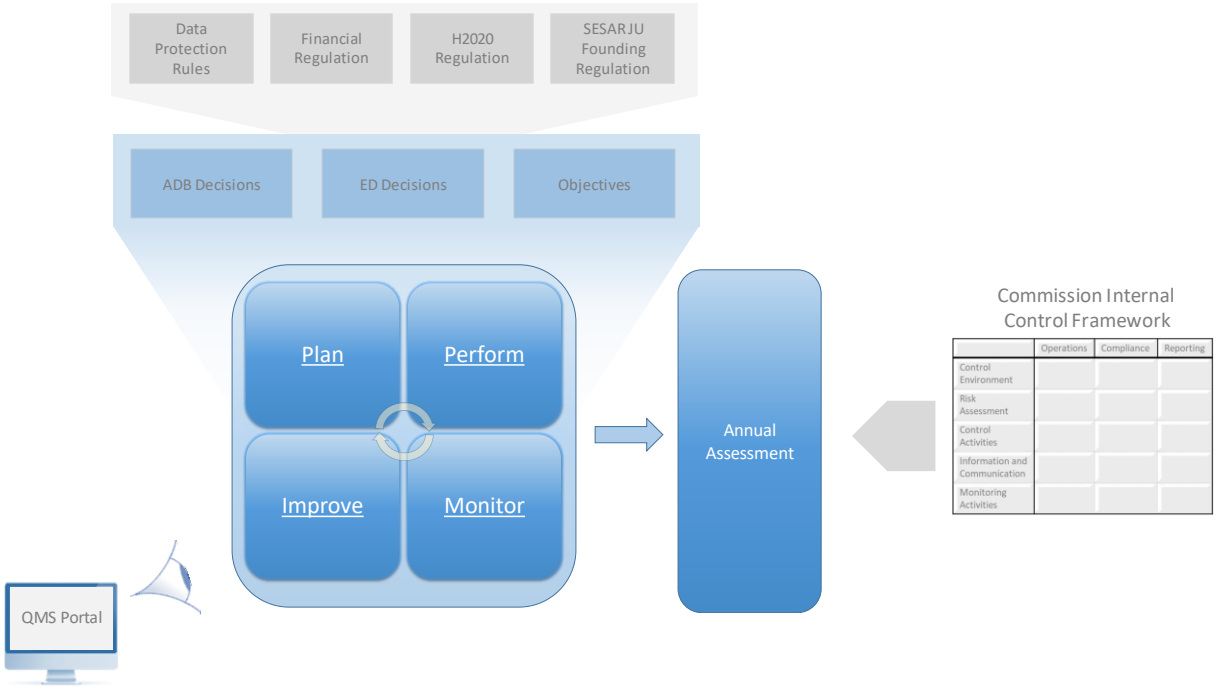

Figure 21: The SESAR JU implementation of the Internal Control Framework

The achievement of SESAR JU objectives (including the performance of the QMS) is assessed annually for its suitability and effectiveness and reported through an implementation of metrics to be presented in the CAAR. The QMS allows for the management of these metrics.

The SESAR JU's Quality Management System

The SESAR JU Quality Manual includes a defined strategy to deploy a Quality Management System (QMS) and applies continual improvement through a PDCA cycle (Plan, Do, Check and Act or Improve). This continual improvement cycle applies to all the processes used at the SESAR JU to comply with its obligations and to deliver its expected results. It involves also the tools related to these processes, and the people that use these tools and processes. The SESAR JU application of the PDCA cycle is summarised below.

Plan

The Single Programming Document (SPD) is the primary planning tool for the SESAR JU and is complemented by lower level objective setting established by the Executive Director with the Corporate Management Team.

([64]) The quality management approach at the SJU has been defined and adopted through SJU/ED/395.

Do

The SESAR JU meets its objectives through the execution of its processes and the adequacy of these processes to the objectives. Ensuring the stability of the processes and their alignment with the strategic goals and objectives is key to the SJU performance and to ensure that stakeholder requirements can be met, which will in turn help building stakeholder confidence.

Roles and responsibilities with regard to process management are established. Process definitions together with a comprehensive process map are published through the QMS Portal. By monitoring the adherence to these processes the QMS helps the SJU to achieve these results.

Check

Several structures have been put in place, either by Regulation or by Decision of the Executive Director, to monitor the SESAR JU's activities. They benefit from the inputs of the QMS regarding the adherence of the SESAR JU to its processes, and the adequacy of such processes. These structures include:

- Administrative Board (ADB),
- Corporate Management Team (CMT),
- Budget Control Committee (BCC),
- Quality and ICT Committee (QICT),
- Project Audit,
- Internal Audit Capability (IAC),
- Annual Reporting through the Consolidated Annual Activity Report (CAAR).

Act (Improve)

As a result of monitoring activities, the SESAR JU routinely initiates change and improvement initiatives.

Annual Assessment

In continuity of 2021, in 2022 the SESAR JU will carry out CMT annual reviews to assess and monitor the performance of the SJU, using the inputs from the QMS according to the Internal Control Framework introduced by the European Commission in 2017, by assessing each of the 50 characteristics of the 17 principles across the five components of the Internal Control Framework.

The CAAR will report on the consolidated ratings for the 17 principles.

Annex XI: Plan for grant, contribution or service-level agreements

Annex XII: Procurement plan for 2022

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 actions involving expenditure from the budget for procurement and prizes.

NB: In accordance with Article 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 or timing identified above for a given procurement procedure if this allows for improved adherence to the SESAR JU's objectives. A change of more than 20 % in the volume of appropriations, the introduction of a new action or other changes affecting the political choices in the SPD are to be considered substantial.

Operational expenditure

The maximum global budgetary envelope reserved for procurements covered by operational appropriations is estimated to be a minimum of ***[to be defined]*** in 2022.

Strategic area of operation 1 – Provide strategic steering to the SESAR programme

Reference	Budget line	Procurement area	Procurement description	Target signature date	Total estimated budget (EUR)	Type of contract/ procedure	Comments
Op.1.1.							
Op.1.2.							
Op.1.3.							
Total for strategic area of operation 1 – Provide strategic steering to the SESAR programme							

Strategic area of operation 2 – Deliver exploratory research

Reference	Budget line	Procurement area	Procurement description	Target signature date	Total estimated budget (EUR)	Type of contract/ procedure	Comments
Op.2.1.							

Reference	Budget line	Procurement area	Procurement description	Target signature date	Total estimated budget (EUR)	Type of contract/ procedure	Comments
Total for strategic area of operation 2 – Deliver exploratory research							

Strategic area of operation 3 – Deliver industrial research and validation

Reference	Budget line	Procurement area	Procurement description	Target signature date	Total estimated budget (EUR)	Type of contract/ procedure	Comments
Op.3.1.							
Total for strategic area of operation 3 – Deliver industrial research and validation							

Strategic area of operation 5 – Deliver SESAR outreach

Reference	Budget line	Procurement area	Procurement description	Target signature date	Total estimated budget (EUR)	Type of contract/ procedure	Comments
Op. 5.1							
Op.5.2							
Op.5.3							
Op.5.4							
Op.5.5							
Op.5.6							
Op.5.7							

Reference	Budget line	Procurement area	Procurement description	Target signature date	Total estimated budget (EUR)	Type of contract/ procedure	Comments
Op.5.8							
Total for strategic area of operation 5 – Deliver SESAR outreach							

Table 52: Main procurement activities to be conducted in 2022 covered by operational appropriations

Administrative expenditure

Although not necessary in the case of administrative appropriations, the SESAR JU decided to identify its main administrative support expenditures for transparency purposes, as shown in the following tables. 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 estimated budget (EUR)	Type of contract/ procedure	Comments
Ad.5.1.						
Ad.5.2.						
Ad.5.3.						
Ad.5.4.						
Ad.5.5.						
Ad.5.6.						
Total for strategic area of operation 5 – Deliver SESAR outreach						

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.	Facility Coordination	Security: Guarding	Q1 2021			
Ad.6.2.	Facility Coordination	Security: Alarm	Q1 2021			
Ad.6.3.	Facility Coordination	Cleaning	Q4 2021			
Ad.6.4.						
Total for strategic area of operation 6 – Deliver effective financial, administrative and corporate management						

Table 55: Main procurement activities to be conducted in 2022 covered by administrative appropriations

Annex XIII: Strategy for cooperation with third countries and/or international organisations

This strategy is defined in Section II, subparagraph 1.6.2 ‘Cooperation with third countries and international organisations’.

Annex XIV: 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
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	France
AT-One Consortium	Deutsches Zentrum für Luft-und Raumfahrt e. V. (German Aerospace Center, DLR)	Germany
	Stichting Nationaal Lucht- en Ruimtevaartlaboratorium (National Aerospace Centre, NLR)	Netherlands
B4 Consortium	Polska Agencja Żeglugi Powietrznej, the Polish Air Navigation Services Agency: (PANSA)	Poland
	Rizeni Letoveho Provozu Ceske Republiky Statni Podnik, the Air Navigation Services of the Czech Republic: (ANS CR)	Czechia
	Letové prevádzkové služby Slovenskej republiky, štátny podnik: (LPS SR s.p.) – state-owned ANSP of Slovakia	Slovakia
	Valstybes imone 'Oro navigacija', the State Enterprise 'Oro Navigacija' (ON) – state-owned ANSP of Lithuania	Lithuania
COOPANS Consortium	Naviair	Denmark
	Irish Aviation Authority: (IAA)	Ireland
	Croatia Control, Croatian Air Navigation Services Ltd: (CCL)	Croatia
	Austro Control Österreichische Gesellschaft für Zivilluftfahrt mbH: (ACG)	Austria
	Luftfartsverket: (LFV)	Sweden
Dassault Aviation SA	Single entity	France
DFS Deutsche Flugsicherung GmbH: (DFS)	Single entity	Germany
République Française, Ministère de L'écologie, du Développement Durable, et de L'Energie, acting via Direction Générale de L'Aviation civile, represented by Direction des Services de la Navigation Aérienne: (DSNA)	Single entity	France
ENAV S.p.A	Single entity	Italy

	Entidad Pública Empresarial ENAIRE	Single entity	Spain
	Leonardo	Single entity	Italy
	Frequentis SESAR Partners (Consortium)	Frequentis AG	Austria
		Hungarocontrol Zrt (HC)	Hungary
		Atos Belgium SA/NV	Belgium
	Honeywell Aerospace SAS	Single entity	France
	INDRA Sistemas, S.A.	Single entity	Spain
	NATS (En Route) Plc	Single entity	United Kingdom
	North European ATM Industry Group NATMIG Consortium	Stiftelsen SINTEF	Norway
		Saab AB	Sweden
		Airtel ATN Ltd.	Ireland
	SESAR European Airports Consortium (SEAC 2020)	Heathrow Airport Limited	United Kingdom
		Aéroports de Paris S.A.	France
		Flughafen München GmbH	Germany
		Flughafen Zürich AG	Switzerland
		Schiphol Nederland B.V.	Netherlands
		Swedavia AB	Sweden
		Avinor AS	Norway
	Skyguide, Swiss civil and military Air Navigation Services Ltd	Single entity	Switzerland
	Thales Air Systems SAS	Single entity	France
	Thales Avionics SAS	Single entity	France

Table 53: List of SESAR JU Members

Annex XV: SESAR JU's critical risks for 2022

The information on the SESAR JU's critical risks is not public and may be made available on request in case of justified need.