

# CONSOLIDATED ANNUAL ACTIVITY REPORT 2017



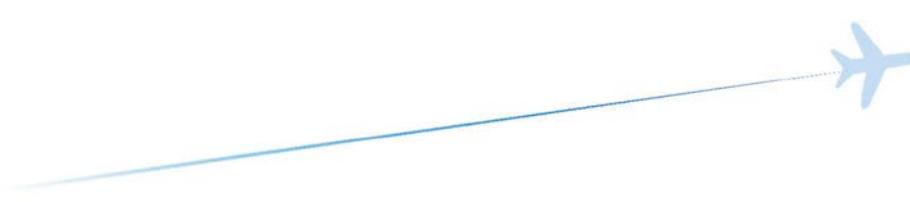
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# SESAR JU Consolidated Annual Activity Report for 2017

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## **Abstract**

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This Consolidated Annual Activity Report, established on the guidelines set forth in Communication from the Commission ref.2014/9641, provides comprehensive information on the implementation of the agency work programme, budget, staff policy plan, and management and internal control systems in 2017.

This report presents the SESAR Solutions delivered in 2017 with maturity “available for industrialisation”.

Founding Members



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## Foreword

### *Delivering the digital revolution in air traffic management*



Modernisation is synonymous with digitalisation, in particular for a highly technology-dependant and service provision oriented sector such as air traffic management (ATM). Only by digitalising the sector can we achieve important results such as improving efficiency in the air, expanding airport capacity, increasing connectivity, and reducing CO2 emissions. Moreover, the digitalisation of air transport services will improve mobility, upgrade passenger experience and reduce costs.

SESAR has a decisive role to play as the technological pillar of the Single European Sky (SES), which is naturally also its digital pillar, and is a key enabler for the EU's Aviation Strategy. The research and development (R&D) and resulting technology solutions delivered by the SESAR Joint Undertaking will help us move towards a future with a highly efficient ATM system, in particular in terms of greater capacity and flight efficiency. SESAR is a regarded brand of quality whose solutions are sought after worldwide – this is enabling Europe's aviation industry to compete internationally, meaning both people and businesses can benefit from more options and new routes with affordable prices.

I am very proud of what the SESAR JU has delivered not just in 2017, but since its establishment. It is a testament to how the public and private sector can work together. I look forward to seeing the work detailed in this report come to full fruition in the coming years.

***Henrik Hololei, Director General of the European Commission's Directorate General of Transport and Mobility (DG MOVE) and Chairman of the SESAR JU Administrative Board***



Digital technologies are radically changing the way we live our lives and the way we do business in every way. The EU Aviation Strategy recognises the potential of digitalisation and emerging innovations to offer smarter, cleaner, and more efficient air transport systems, as well as tailor-made services for end-users. The strategy rightly sees the Single European Sky and more specifically SESAR as catalysts for transforming this vision into a reality.

2017 exemplifies how effective the SESAR JU and its members have been in embedding this digital transformation in ATM, a key element of the aviation value chain. In this period, more than 70 projects continued to develop new solutions in order to improve airport operations, air services and network operations, as well as to address the underpinning technology infrastructure. At the same time, the SESAR JU prepared several calls for future R&D activities, thereby ensuring a continuous flow of solutions. Both the solutions delivered in the SESAR 1 and those in the pipeline in the SESAR 2020 programme are now captured in the second edition of the SESAR Solutions Catalogue. These solutions are real game-changers for increasing the capacity of Europe's airports and airspace, enabling greater connectivity and mobility between regions, all the while ensuring better value for money and reducing the environmental impact of aviation.

2017 also showed that there is a real appetite to go much further in SESAR's transformation work. Adding to the exploration of disruptive technologies, including virtual centres, remote towers and

satellite-based solutions, the SESAR JU received new mandates from the European Commission on the integration of drones alongside more conventional air traffic and the future architecture of European airspace.

ATM is clearly on the cusp of change. The SESAR JU is leading the way in this endeavour and remains committed to delivering high performing aviation in Europe.

***Florian Guillermet, Executive Director, SESAR Joint Undertaking***

## Administrative Board's analysis and assessment

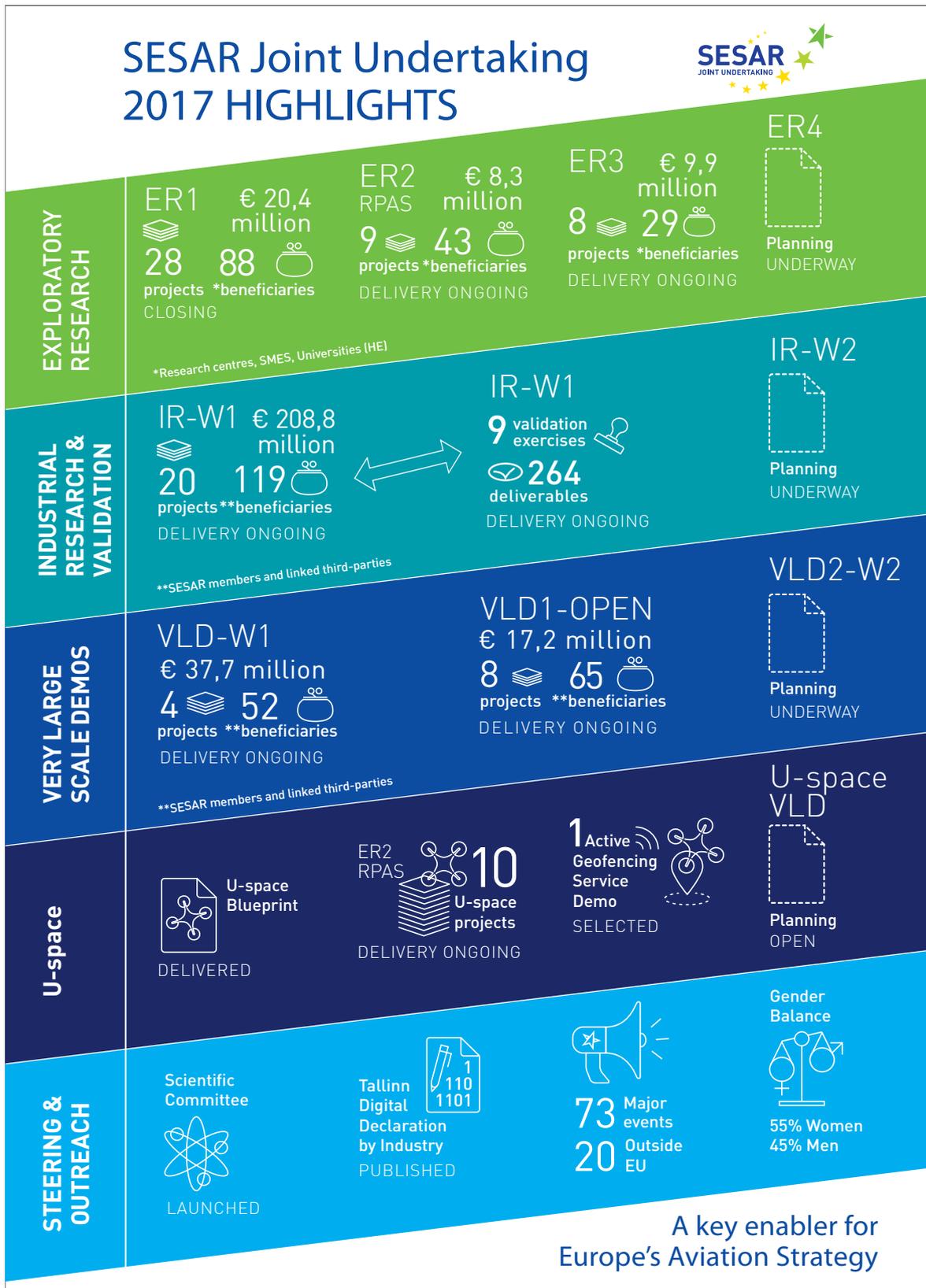
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The Administrative Board has assessed the SESAR Joint Undertaking's Consolidated Annual Activity Report for 2017 (CAAR 2017) and, having reviewed the document, notes that:

- The SESAR JU met its key policy and operational objectives as outlined in the Single Programming Document for the period 2017-2019;
- The SESAR JU's key achievements in 2017 were the following:
  - Delivery of results in the field of Exploratory Research through 28 active projects and the signature of 17 additional grant agreements;
  - Delivery of results in the field of Industrial Research & Validation through 20 active projects and in particular the realisation of the SESAR Release #7 covering 11 SESAR Solutions that were brought to the next level of maturity;
  - Delivery of results in the field of Very Large-Scale Demonstration Activities through 5 active projects, the signature of 8 additional grant agreements, the launch of an additional call for proposals under assigned revenue and the preparation of an additional call for proposals responding to a new mandate from the Commission;
  - Delivery of Transversal Steering & SESAR Outreach;
  - Delivery of effective financial, administrative and corporate management.
- The SESAR JU used its resources in line with the activities as described in the work plan;
- The performance indicators show that overall the targets were met;
- Internal control and management systems were in place and working adequately;
- The required building blocks of assurance (management assessment, exception register, audits etc.) have been in place all along the year 2017;
- The main risks for the delivery of the SESAR JU's key objectives were identified and the relevant mitigating measures taken, keeping overall risks under control and at an acceptable level of criticality.

**Consequently, the Administrative Board concludes that the CAAR 2017 accurately and adequately describes the work performed by the SESAR JU in 2017.**

## Executive summary



In 2017, SESAR JU members and partners actively contributed to the governance, coordination, management and delivery of the SESAR 2020 programme (see list of acronyms in annex IX.1). The results generated so far by the programme aim to contribute to the goals of SES and the EU Aviation Strategy, namely to decarbonise aviation and reduce its environmental footprint, encourage investment and jobs creation, and foster the competitiveness of the European aviation sector. Moreover, the solutions in the pipeline in SESAR 2020 programme aim to lay the ground work for the digital transformation of Europe's aviation sector, enabling a more connected and intermodal approach to mobility supported by higher levels of automation, while addressing the challenge of cyber-security.

The Single Programming Document 2017 focussed on delivering five core objectives:

- Deliver Exploratory Research,
- Deliver Industrial Research and Validation,
- Deliver Very Large-Scale Demonstration Activities,
- Deliver Transversal Steering and SESAR Outreach,
- Deliver effective financial, administrative and corporate management.

This section summarises the key achievements and deliverables of the SESAR JU towards these objectives.

### **Deliver Exploratory Research (ER)**

Encouraging new ideas and fresh thinking is critical for innovation in aviation in order to respond to the growing demand for air travel and the increasing number of air vehicles, such as drones, taking to the skies. That is why the SESAR JU supports Exploratory Research and has created an innovation pipeline in the research programme that transforms innovative ideas into solutions to increase the performance of ATM. In this respect, in 2017 the SESAR JU managed 28 Exploratory Research projects (ER1) within the scope of ATM Excellent Science and Outreach, providing scientific results in:

- Automation, Robotics and Autonomy;
- Complexity, Data Science and Information Management;
- Environment and Meteorology for ATM;
- Economics, Legal and Regulation.

Furthermore, 2017 saw the conclusion of two open calls for proposals:

- ER2-RPAS call for proposals, focusing on remotely-piloted aircraft systems (RPAS), resulted in the signature of nine grant agreements representing a total value of EUR 8,3 million, and the launch of all awarded projects. The nine new projects involve a total of 52 beneficiaries across Europe;
- ER3 call for proposals, focusing on Transversal Exploratory Research and Application-Oriented Research, resulted in the signature of eight grant agreements representing a total value of EUR 9,9 million. The eight projects involve 41 beneficiaries across Europe, with one project reaching out further and engaging many more organisations in its role as a Knowledge Transfer Network and with its catalyst initiative to promote scientific innovation.

In total, at the end of 2017, there were 45 Exploratory Research projects within the SESAR 2020 programme, representing a total effort of EUR 38,6 million and with 134 beneficiaries (26 (20%) SMEs and 62 (50%) research centres or higher-education organisations.

To underpin this work, the SESAR JU renewed its scientific committee with the signature of expert contracts, following an open call for expression of interests, with five independent and highly regarded academics from across Europe. The committee provides scientific advice and recommendations to the SESAR JU, with a particular focus on exploratory research, long-term planning activities and on the transfer of knowledge and outcomes to industrial research activities. In terms of outreach, the SESAR JU organised another edition of the SESAR Innovation Days (SIDs) to share progress and disseminate results of its Exploratory Research programme with the wider ATM/aviation academic community. In 2017, this was again Europe's largest ATM research focused event with over 250 active attendees. The SESAR ER1 projects actively participated to the event through workshop sessions and presentations or demonstrations.

### **Deliver Industrial Research and Validation (IR)**

The SESAR JU members and partners have built a Release process, through which they progressively research and then validate solutions in real operational environments. With validation sites across Europe, the SESAR JU has taken R&D out of the lab and connected it with the real world.

In 2017, 17 Industrial Research and Validation projects (IR Wave 1) were carried out covering the four Key Features of the ATM Master Plan, namely Optimised ATM Network Services, High-Performing Airport Operations, Advanced Air Traffic Services and Enabling Aviation Infrastructure. Work also continued in a further three projects focussing on transversal steering activities. In addition, the SESAR JU conducted 9 out of the 12 validation exercises foreseen in Release 7, as well as a maturity assessment of the related solutions and the planning for Release 8.

These projects represent a total effort of EUR 208,8 million and with 119 beneficiaries and linked third-parties (39 beneficiaries are classified as being within the 20 SESAR JU members<sup>1</sup>, 80 are linked third-parties, 9 being SMEs).

It should be noted that the SESAR JU cannot make use of multi-annual budgeting, despite having multi-annual grants, due to the regulatory framework which governs it. Mindful of this, the SESAR JU implemented the grant budget amendment procedure, which allowed it to adjust the grant agreements, thereby complementing the first instalment of the EU contribution made in 2016. In 2017, the SESAR JU made a second instalment for a total value of EUR 79,7 million.

The planning for the next wave of activities, otherwise known as IR Wave 2, also got underway. The aim is to build on the results of ER1 and IR Wave 1, and ensure alignment with future research as indicated in the European ATM Master Plan, an update of which will be conducted in 2018.

### **Deliver Very Large-Scale Demonstration Activities (VLD)**

Through very-large scale demonstrations, the SESAR JU can assess its solutions in wider, more complex real-life environments involving a broad range of ATM stakeholders. In doing so, these activities enable the acceleration of operational acceptance and uptake of SESAR Solutions. In 2017, the SESAR JU members and partners continued to bridge R&D to deployment, through the delivery of the 4 Very Large-Scale Demonstrations (VLD Wave 1), covering the four Key Features of the ATM Master Plan.

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<sup>1</sup> The 20 stakeholders Members of the SJU count EUROCONTROL (Founding Member) and 19 additional stakeholder organisations, some of them being consortia

As for IR projects, the SESAR JU had to adjust the grant agreements complementing the first instalment of the EU contribution of 2016 with a second instalment in 2017 for the four grants for a total value of EUR 15,3 million using the already established grant budget amendment procedure.

In addition, the SESAR JU evaluated proposals received in response to the VLD Open Call (launched at the end of 2016), covering solutions enabling high performing aviation in Europe, global interoperability, and the safe integration of all air vehicles. This evaluation resulted in the award of eight grants, and the signature of four grant agreements out of eight, representing a total value of EUR 17,2 million (EUR 6,1 million representing the four grants signed). The eight projects involve 65 beneficiaries across Europe.

In total, at the end of 2017, thirteen grants were awarded while nine projects were underway focussing on Very Large-Scale Demonstrations, representing a total effort of EUR 54,9 million and involving 90 beneficiaries (thirteen SMEs and five airlines).

Furthermore, the SESAR JU was requested by the European Commission (DG MOVE) to organise a call for proposals on Active Geo-fencing Service. The call targets demonstrations of web-based geo-fencing solutions that use location signals to prevent drones from flying in no-fly zones. No-fly zones can be generated, monitored and controlled by the authorities responsible. In response to this mandate, and according to the value of the delegation agreement (EUR 500 000), the SESAR JU launched an open non-H2020 VLD Geo-fencing call on 15 September 2017, with the aim to award one project. The SESAR JU received two proposals, which were evaluated and which led to an award recommendation and subsequent grant agreement signature planned in early 2018.

Finally, in response to a new mandate from the European Commission and with funds from the Connecting Europe Facility programme, the SESAR JU prepared a third open call with a value of EUR 9,5 million, ready for opening of the call in early 2018. The aim of the call is to select between 5 to 10 demonstrations activities focussing on U-space.

### **Deliver Transversal Steering and SESAR Outreach**

In addition to steering the SESAR 2020 programme, the SESAR JU engages with European and international stakeholders with a view to facilitating buy-in from the community and ensuring harmonisation of modernisation efforts.

In 2017, the SESAR JU maintained working and collaborative arrangements with third-party stakeholders, namely European Aviation Safety Agency (EASA), European Defence Agency (EDA), European Space Agency (ESA), Airports Council International (ACI), Clean Sky, Civil Airspace Users, Professional Staff Associations, National Authorities, standard-making organisations and the SESAR Deployment Manager (SDM). 2017 also saw the SESAR JU securing the participation of airspace users in the SESAR 2020 programme through the signature of four new framework contracts. In parallel, the SESAR JU initiated a process to secure the involvement of professional staff organisations, with contracts to be signed in 2018.

2017 saw continued engagement by the SESAR JU in international activities in the framework of the EU Aviation Strategy and in close coordination with the European Commission. The principal objectives are to secure SESAR's position as a global leader in ATM modernisation in support of ICAO's Global Air Navigation Plan (GANP), to support EU industrial leadership and to focus on SESAR Solutions for global interoperability and harmonisation. In this context, the SESAR JU maintained its close cooperation with ICAO, working closely with the European Commission to ensure that Europe's ATM-related priorities

were taken fully into account in ICAO's work to prepare the 2019 update of the Global Air Navigation Plan (GANP) and in the standards development processes.

The SESAR JU also conducted bilateral activities with regions, such as the U.S. FAA and its NextGen programme. Under Annex 1 of the U.S. – EU MoC on Civil Aviation Research and Development, the SESAR JU ensuring harmonisation and interoperability between the two programmes where appropriate. The SESAR JU also held discussions with a number of bilateral partners with whom cooperative arrangements were already in place, as well as signed a new Memorandum of Cooperation (MoC) with the Qatar Civil Aviation Authority (QCAA), to strengthen the efficiency of air traffic management and aviation between both regions and worldwide.

In order to continuously maintain a high profile and engagement with relevant stakeholders across the ATM community, the SESAR JU participated in several major international events in 2017, amongst which the World ATM Congress 2017, the SESAR U-space Workshop, the Paris Air Show, etc. In this context, the SESAR JU released the second edition of its SESAR Solutions Catalogue, presenting more than 60 SESAR Solutions delivered by SESAR JU members and partners to modernise Europe's ATM system. This second edition covers fully validated and documented solutions, which are confirmed as ready for implementation, and ranging from quick-win solutions to those that address more complex operations.

Furthermore, in line with previous years, in 2017, the SESAR JU continued to assist its stakeholders on a number of areas relating to the technical aspects of the SES initiative. This included the delivery of a proposal for the second Common Project (CP2), paving the way for the next phase of deployment of SESAR Solutions and the continuation of the work done with members on cybersecurity. In the field of U-space (drones), the SESAR JU developed the first U-space Blueprint followed by a Roadmap for the safe integration of drones into all classes of airspace. Additionally, the SESAR JU was mandated by the European Commission to deliver a proposal for the future architecture of European airspace (new delegation agreement signed in November 2017), aiming to support more efficient traffic flows and promote an optimised provision of air navigation services and the enabling ATM/CNS infrastructure.

In addition, in the course of 2017, the ATM Master Plan 2018 update campaign was prepared and launched during a dedicated event in Tallinn, Estonia, in November 2017 in the context of the Digital Transport Days organised by the European Commission. This was an important milestone in connecting the SESAR JU further with the EU digital transport strategy.

Lastly, in 2017, the SESAR JU defined and launched the process and activities for the definition of the future H2020 calls for proposals of the SESAR 2020 programme to be launched in 2019 (namely, the IR-VLD Wave 2 restricted call, the open ER4 call and the VLD Open 2 call).

### **Deliver effective financial, administrative and corporate management**

In 2017, as in previous years, the SESAR JU continued to fulfil its duties in corporate, financial, legal and human resources management, bringing a high level of expertise in these areas as it does in the operational and technical areas. The main achievements in this area were: the commitment of operational budget for the ongoing and new calls in line with budget, the conclusion of a large number of procurement procedures and contract management activities supporting the achievements of the SESAR JU, the financial closure of the SESAR 1 programme (see list of acronyms in annex IX.I), the implementation of a new Information and Document Management System (fulfilling ICS 11), and the implementation of a new collaboration platform (STELLAR) facilitating collaboration with the SESAR JU members in the context of the SESAR 2020 programme activities.

As previously mentioned, the SESAR JU receives funds from the EC of various origins in order to deliver specific results beyond the scope of its core SESAR 2020 activities. These funds have been delegated to the SESAR JU under four different legal frameworks, namely Horizon 2020 since 2015, CEF (Connecting Europe Facility) since 2017 and two types of AR (Assigned Revenues) since 2016 and 2017 respectively, each referring to the execution of grants (following calls for proposals) or studies (following calls for tender). The diversity of the applicable legal frameworks under which the SESAR JU operates, with each having its own templates and obligations, also comes with a high degree of complexity due to the number of derogations to these legal frameworks which have been defined in the corresponding delegation agreements.

In 2017, to effectively manage the mix of financial instruments and with a view to remaining up-to-date with all relevant information, the SESAR JU invested a significant effort in trainings (4 external courses, 16 EC courses (finance, legal, HR) and 2 all-staff training sessions) and participation to coordination networks in order to develop their financial, administrative and legal skills. In this regard, the SESAR JU staff participated actively in a number of coordination groups (especially H2020 coordination groups such as the H2020 Common Support Centre Executive Meeting, the H2020 Network of Lawyers, the H2020 Grant Management Steering committee and key user groups, the H2020 Dissemination and Exploitation Practitioners Platform (DiEPP), the H2020 Coordination of Audits in the Research family (CAR)) and to the meetings of the EU Network of Agencies and other Inter-Agency Networks. The SESAR JU also maintained a regular relationship with the European Commission's Shared Resource Directorate within this framework.

In the area of procurement, the SESAR JU conducted eight procurement procedures which resulted in the conclusion of 14 Framework Contract and Direct Services Contracts. In addition, 29 Specific Contracts and 13 amendments were conducted. The overall value of SESAR JU procurement activities in 2017 amounts to EUR 5,540 million, serving all the departments and all Strategic Areas of Operation.

The Staff Establishment Plan was updated in 2017 to reflect adjustment with current activities. At the end of 2017, the Staff Establishment Plan counts 39 positions, 45% being covered by men and 55% by women. In addition, the SESAR JU staff counted two Contract Agent positions authorised for the years 2016 and 2017.

In 2017, the European Parliament granted discharge to the SESAR JU regarding the 2015 financial year.

As in previous years, the SESAR JU conducted regular monitoring of risks and of assessment with regard to Internal Control Standards. In this area, no non-compliance has been reported in 2017.

Furthermore, recommendations from Audits in previous years (from both the Internal Audit Service and the European Court of Audit) resulted into action plans which were implemented or are in progress.

Lastly, the SESAR JU prepared for the new regulation on data protection, which will come into force in May 2018.

### General conclusion

In 2017, the SESAR JU successfully continued the implementation of the SESAR 2020 programme. This saw the launch of two calls, out of which 53 projects are now in execution, three additional calls for which nineteen grant agreements were signed, with nine in preparation and one new call in preparation ready for launch in early 2018. Furthermore, in 2017, the SESAR JU initiated the planning for the next series of calls for proposals, with a view to reaching the whole available funding by the

end of 2020. Additionally, the SESAR JU received two new mandates and developed its ability to operate under different legal frameworks.

The 53 projects in execution delivered results and especially the SESAR JU was in a position to run the first Release (Release #7) under the SESAR 2020 programme and to plan for the next Release (Release #8); in this context, validation exercises were conducted by the SESAR JU members and allowed to evaluate the maturity level of 11 new SESAR Solutions.

The Administrative Board approved the Single Programming Document for the period 2018-2020 in December 2017. In light of its achievements up to 2017, the SESAR JU is living up to its commitment to fostering innovation for modernised and sustainable aviation in Europe.

## Introduction

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### Background and objectives of this document

The SESAR JU established this Consolidated Annual Activity Report (CAAR) in accordance with Article 66(9) of the EU Financial Regulation<sup>2</sup> and Article 47 of the Framework Financial Regulation<sup>3</sup>, Article 16 of the Statutes of the SESAR JU<sup>4</sup>, and of Article 46 of the Financial Rules<sup>5</sup> of the SESAR JU.

This Consolidated Annual Activity Report (CAAR) has several purposes: it provides evidence of progress towards achieving the SESAR JU's key objectives as defined in the Single Programming Document for the period 2017 to 2019 (hereafter referred to as 'SPD 2017') implementing the SESAR 2020 Multi-Annual Work Programme (MAWP)<sup>6</sup>, taking into account resources used during the reporting period; it also outlines the management and oversight systems in place at the SESAR JU, including reference to the European Commission's Internal Control Standards; it includes a declaration of assurance in which the Executive Director, in his role as Authorising Officer, provides assurance as regards the true and fair view given by the report and pertaining to the legality and regularity and the sound financial management of all transactions under his responsibility.

This CAAR has been developed according to the guidelines set forth in Communication from the Commission on the guidelines for programming document for decentralised agencies and the template for the CAAR for decentralised agencies<sup>7</sup>.

### The SESAR JU: a key constituent of the EU Aviation Strategy

Aviation, in particular air transport supported by air traffic management (ATM), is a key driver of EU economic growth, jobs and trade, and essential for the life and mobility of its citizens. However, the current ATM system is highly fragmented and largely reliant on ageing technology, leading to inefficiencies evaluated at an amount of EUR 4 billion annually.

In December 2015, the publication of "An Aviation Strategy for Europe"<sup>8</sup> by the European Commission provided additional focus and momentum towards completion of the Single European Sky (SES) to generate growth for European business, foster innovation and let passengers profit from safer, cleaner

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<sup>2</sup> Regulation (EU, Euratom) No 966/2012 of the European Parliament and of the Council of 25 October 2012 on the financial rules applicable to the general budget of the Union and repealing Council Regulation (EC, Euratom) No 1605/2002. OJ L 298, 26.10.2012

<sup>3</sup> Commission Delegated Regulation (EU) No 1271/2013 of 30 September 2013 on the framework financial regulation for the bodies referred to in Article 208 of Regulation (EU, Euratom) No 966/2012 of the European Parliament and of the Council

<sup>4</sup> Annex to Council Regulation (EC) No 219/2007 of 27 February 2007 on the establishment of a Joint Undertaking to develop the new generation European air traffic management system (SESAR)

<sup>5</sup> Administrative Board decision ADB(D) 08-2015

<sup>6</sup> The MAWP, which was approved by the Administrative Board in 2015, is updated through Single Programming Documents established each year, can be consulted on the SJU website: <http://www.sesarju.eu/newsroom/brochures-publications/sesar-2020-multi-annual-work-programme>

<sup>7</sup> Communication from the Commission (2014)9641 final on 'Guidelines for programming document for decentralised agencies and the template for the Consolidated Annual Activity Report for decentralised agencies'

<sup>8</sup> <http://ec.europa.eu/transport/modes/air/aviation-strategy>

and cheaper flights, while offering more connections. The Strategy contributes directly to the Commission priorities of Jobs and Growth, Digital Single Market, Energy Union and the EU as a global actor, and the SESAR project and the SESAR JU are key components enabling the implementation of the Strategy's objectives.

The Single European Sky (SES) legislative framework aims to the achievement of the following High-Level Goals:

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

The SESAR Project, through its definition, development and deployment processes, aims at delivering the operational procedures and technologies necessary for a new and global interoperable concept of ATM, built around a continuous sharing of data between aircraft, air navigation service providers and airports.

The SESAR JU pursues the objectives to modernise ATM as defined in the SES. To this end, SESAR also remains a flagship project identified within the 'Flightpath2050' report, a roadmap for the provision of a clean, competitive, safe and secure European aviation industry prepared by the High-Level group on Aviation Research. SESAR's positive contribution to meeting the needs of citizens, markets and to maintaining a competitive advantage for Europe is key to the continued successful evolution of ATM.

## The SESAR JU membership

The SESAR JU was created under Article 171 of the Treaty establishing the European Union and confirmed under Article 187 of the Treaty on the Functioning of the European Union to provide an effective coordination role for all relevant research and development efforts within the European Union. Its mandate and mission is coherent with the High-Level Goals of the SES initiative.

Founded by the European Union and EUROCONTROL, established in 2007 as a joint undertaking<sup>9</sup>, the SESAR JU became a Union Body in 2009. It was augmented by 15 stakeholder members and then in 2016 four further members acceded to membership, all committing to achieving the mission of the Joint Undertaking by 2024.

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<sup>9</sup> The SESAR Joint Undertaking (SJU) was established under Council Regulation (EC) 219/2007 of 27 February 2007 (as modified by Council Regulation (EC) 1361 / 2008 (SJU Regulation) and last amended by the Council Regulation (EU) 721/2014)



Figure 1: SESAR JU membership from 2016 onwards

Together with their partners and affiliates, the members represent over 100 organisations from across the ATM community, from civil and military air navigation service providers, to airports, civil and military airspace users, staff associations, academia and research centres. Through these partnerships and further collaboration with staff associations, regulators and the larger scientific community, the SESAR JU unites the skills of some 3,000+ experts to fast-track and focus research leading to change in European ATM.

## The role and missions of the SESAR JU

Responding to the objectives of the EU Aviation Strategy and the Single European Sky, the challenges for ATM are captured by the SESAR JU in the European ATM Master Plan (currently 2015 Edition), which is the main planning tool for ATM modernisation in Europe. The role of the SESAR JU in steering the SESAR R&I programme is to define and develop solutions that meet what is needed and build a more connected, greener, safer ATM system as well as ensuring this is standardised as needed and made globally interoperable. Much of this work has been undertaken since 2008 through the SESAR R&I programme (called SESAR 1 for the period covering 2008 to 2016, and SESAR 2020 starting in 2015 with a maximum period for award of grants ending in December 2020), coordinated by the SESAR JU and performed by the industry at large. The SESAR 2020 activities are funded through three different funding instruments with a total EU funding of EUR 596,3 million at the end of 2017: the Horizon 2020 Framework Programme for Research and Innovation (H2020) for EUR 585 million, the Connecting Europe Facility (CEF) programme for EUR 10 million, and two initiatives funded through assigned



revenues for a value of EUR 500.000 and EUR 800.000. The SESAR JU maintains full compliance with these three frameworks.

The SESAR JU transfers the result of its ATM Research and Innovation activities in the form of SESAR Solutions that are made available for deployment, and therefore makes a positive contribution towards the achievement of the Single European Sky. This relationship between the EU Aviation Strategy, the SES objectives, the ATM Master Plan defining the medium and long-term planning of achievements, and the R&I activities delivering SESAR Solutions transferred to deployment, is structured in the SESAR Innovation Pipeline, which is depicted in the figure below:

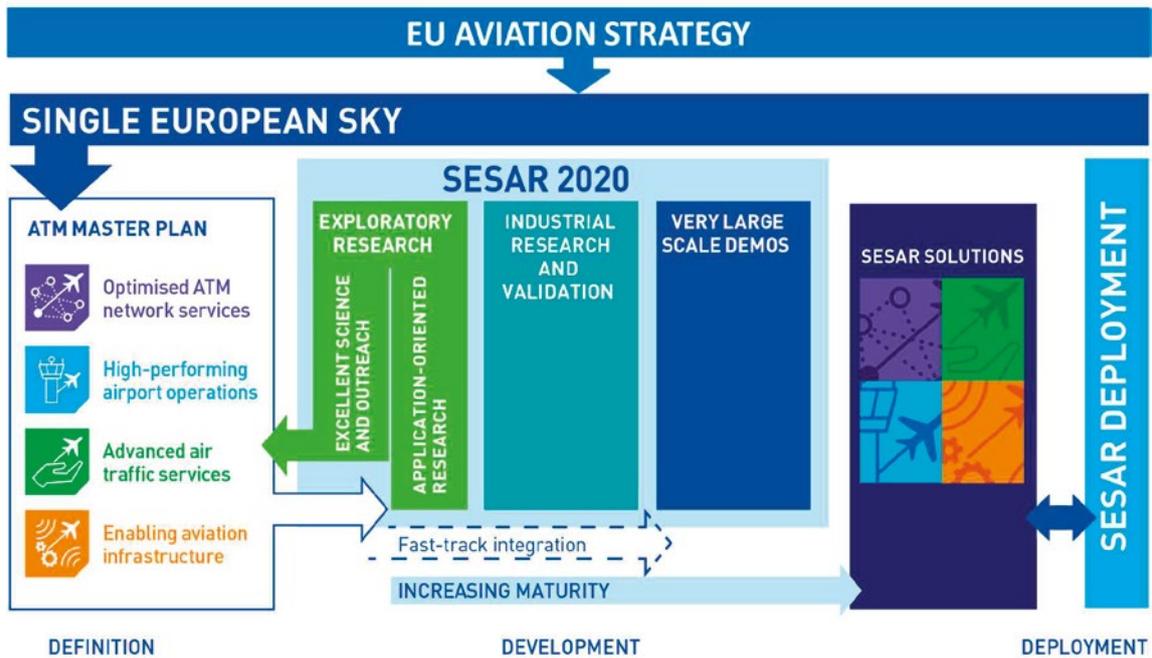


Figure 2: The SESAR Innovation Pipeline – from EU Aviation Strategy to SESAR Solutions

As depicted in figure 2, starting with the European ATM Master Plan which structures the ATM modernisation activities into four Key Features (Optimised ATM Network Services, High-performing airport operations, Advanced air traffic services and Enabling aviation infrastructure), the SESAR Innovation pipeline is organised in three main research and innovation phases which mature operational and technology solutions through the EOCVM (European Operational Concept Validation Methodology) well-established control and monitoring process linked to Technology Readiness Level (TRL):

- The **Exploratory Research (ER)** addresses relevant fundamental scientific subjects representing transversal topics for future ATM evolution ('Excellent Science & Outreach') investigates the initial applications of such science for the ATM sector ('Application-oriented research'). Exploratory Research covers research activities up to TRL 2<sup>10</sup>. It also addresses the Knowledge Transfer Network aimed at facilitating the development of ATM research in Europe

<sup>10</sup> As required by Horizon 2020, the maturity of research outcomes is assessed according to the Technology Readiness Level (TRL) model, combined with the European Operational Concept Validation Methodology (E-OCVM) model to allow for the assessment of technological and operational concept developments

in support to the SESAR JU. This phase of research is wholly funded from EU funds and done in full compliance with H2020 and “the rules of participation”. It is subject to open calls;

- Through the **Industrial Research and Validation (IR)**, which includes applied research, pre-industrial development and validation projects, SESAR Solutions are developed and, through validation exercises, their maturity and potential benefit is assessed in the context of yearly Releases (one per year). IR covers research activities up to TRL 6. Calls related to IR are restricted to the SESAR JU members.
- The third phase deals with **Very Large-Scale Demonstration activities (VLDs)** which are designed as demonstrations of particular programme concepts elements and SESAR Solutions. These demonstration activities provide the bridge between the development and deployment phases of SESAR. They are delivered done under the H2020 programme, or under the CEF programme or under Assigned Revenue, through work undertaken by SESAR JU members (through restricted calls), supplemented by open calls to ensure the widest possible stakeholder participation.

Solutions which are assessed with V3/TRL 6 level of maturity and a positive cost-benefit analysis are then transferred for deployment, either through Common Projects, or through other types of deployment activities (e.g. at the national level).

Additionally, the SESAR JU assists all its stakeholders on relevant subjects relating to SES’s technological pillar, providing independent support and advice in areas where there is a link between SESAR deliverables and initiatives that demonstrate a high level of interdependency with SESAR project objectives.

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, EUROCONTROL and EASA on building and executing a coordinated plan of action involving third countries and the ICAO.

### Factsheet: the SESAR JU in 2017

The table below provides an overview of key facts and figures related to the SESAR JU structure and management in 2017:

<b>Name</b>	SESAR Joint Undertaking (SESAR JU)
<b>Objectives</b>	The SESAR JU is responsible for coordinating, rationalising and concentrating all relevant ATM research and development efforts in the EU, aiming to contribute to the modernisation and harmonisation of ATM in Europe
<b>Founding Legal Act</b>	Established under Council Regulation (EC) 219/2007 of 27 February 2007 <sup>11</sup> Modified by Council Regulation (EC) 1361/2008 (SESAR JU Regulation) <sup>12</sup>

<sup>11</sup> Council Regulation (EC) No 219/2007 of 27 February 2007 on the establishment of a Joint Undertaking to develop the new generation European air traffic management system (SESAR)

<sup>12</sup> Council Regulation (EC) No 1361/2008 of 16 December 2008 amending Regulation (EC) No 219/2007 on the establishment of a joint undertaking to develop the new generation European air traffic management system (SESAR)

	Last amended by Council Regulation (EU) 721/2014 <sup>13</sup>
<b>Executive Director</b>	Florian Guillermet (mandate running up to March 2022)
<b>Administrative Board composition<sup>14</sup></b>	<p><b>Members with voting rights:</b></p> <p>A) SESAR JU members</p> <ul style="list-style-type: none"> <li>• European Union (Founding Member)</li> <li>• EUROCONTROL (Founding Member)</li> <li>• Airbus</li> <li>• AT-One consortium</li> <li>• B4-consortium</li> <li>• COOPANS Consortium</li> <li>• Dassault Aviation</li> <li>• DFS</li> <li>• DSNA</li> <li>• ENAIRE</li> <li>• ENAV</li> <li>• Leonardo</li> <li>• Frequentis Consortium</li> <li>• Honeywell</li> <li>• INDRA</li> <li>• NATMIG</li> <li>• NATS</li> <li>• SEAC 2020</li> <li>• Skyguide</li> <li>• Thales Air Systems SAS</li> <li>• Thales Avionics SAS</li> </ul> <p>B) Representative at European level of civil users of airspace</p> <p><b>Members without voting rights:</b></p> <ul style="list-style-type: none"> <li>• Military</li> <li>• Air Navigation Service Providers</li> <li>• Equipment manufacturers</li> <li>• Airports</li> <li>• Staff in the ATM sector</li> <li>• Scientific community</li> </ul>
<b>Other Advisory Bodies</b>	<p>The Programme Committee (PC) and its sub-committees: Delivery Management Sub-Committees (DMSC) and Operational &amp; Technical Sub-Committee (OTSC)</p> <p>The Scientific Committee (SC)</p> <p>The Master Planning Committee (MPC)</p>

<sup>13</sup> Council Regulation (EU) No 721/2014 of 16 June 2014 amending Regulation (EC) No 219/2007 on the establishment of a Joint Undertaking to develop the new generation European air traffic management system (SESAR) as regards the extension of the Joint Undertaking until 2024

<sup>14</sup> As at 31 December 2016. The list of participants to the Administrative Board is provided in annex IX. Before 2016, the SJU membership was composed of the 2 Founding Members (EU and EUROCONTROL) and 15 additional Members

<p><b>Human Resources<sup>15</sup></b></p>	<p>44 positions:</p> <ul style="list-style-type: none"> <li>• Temporary Agents: 39 positions</li> <li>• Seconded National Experts: 3 positions</li> <li>• Contract Agents: 2 positions (temporary in 2016 and 2017)</li> </ul> <p>45% men / 55% women</p>
<p><b>2017 Budget</b></p>	<p>Budget revenue: EUR 113.346.265</p> <ul style="list-style-type: none"> <li>• EU contribution: EUR 103.240.000</li> <li>• Other revenue: EUR 10.106.265</li> </ul> <p>Revenue payment appropriations: EUR 191.813.383 (of which EUR 90.898.989 is SESAR 2020 budget and EUR 100.914.393 is SESAR 1 budget)</p> <p>Budget expenditure:</p> <ul style="list-style-type: none"> <li>• Commitments: <ul style="list-style-type: none"> <li>○ Title I (staff expenditure): EUR 6.160.000</li> <li>○ Title II (infrastructure and operating expenditure): EUR 4.180.351</li> <li>○ Title III (operational expenditure): EUR 103.005.914 (of which EUR 101.638.498 is SESAR 2020 budget and EUR 1.367.416 is SESAR 1 budget)</li> </ul> </li> <li>• Payment appropriations: <ul style="list-style-type: none"> <li>○ Title I (staff expenditure): EUR 6.160.000</li> <li>○ Title II (infrastructure and operating expenditure): EUR 4.180.351</li> <li>○ Title III (operational expenditure): EUR 181.473.032 (of which EUR 81.145.482 is SESAR 2020 budget and EUR 100.327.549 is SESAR 1 budget )</li> </ul> </li> </ul>
<p><b>2017 Budget implementation</b></p>	<p>Implementation of budget revenue: EUR 162.522.424</p> <ul style="list-style-type: none"> <li>• EU contribution: EUR 113.147.252 (of which EUR 76.147.252 is SESAR 2020 Budget and EUR 37.000.000 is SESAR 1 budget)</li> <li>• EUROCONTROL contribution: EUR 32.605.112 (of which EUR 6.682.000 is SESAR 2020 budget and EUR 25.923.112 is SESAR 1 budget)</li> <li>• Other revenue: EUR 16.770.060 (of which EUR 24.705 is SESAR 2020 budget and EUR 16.745.355 is SESAR 1 budget)</li> </ul> <p>Implementation of budget expenditure:</p> <ul style="list-style-type: none"> <li>• Actual commitment appropriations: <ul style="list-style-type: none"> <li>○ Title I (staff expenditure): EUR 5.278.238</li> <li>○ Title II (infrastructure and operating expenditure): EUR 3.795.736</li> <li>○ Title III (operational expenditure): EUR 95.994.973 (of which EUR 94.283.680 is SESAR 2020 budget and EUR 1.711.293 is SEAR 1 budget)</li> </ul> </li> <li>• Actual payment appropriations: <ul style="list-style-type: none"> <li>○ Title I (staff expenditure): EUR 5.047.521</li> <li>○ Title II (infrastructure and operating expenditure): EUR 3.321.466</li> <li>○ Title III (operational expenditure): EUR 136.415.895 (of which EUR 56.271.200 is SESAR 2020 Budget and EUR 80.144.695 is SESAR 1 budget)</li> </ul> </li> </ul>

<sup>15</sup> As at 31 December 2017. Details on the implementation of the Staff Establishment Plan are provided in section 2.4

<b>Strategic Research Agenda</b>	SESAR 2020 Multi-Annual Work Programme (MAWP): <a href="http://www.sesarju.eu/newsroom/brochures-publications/sesar-2020-multi-annual-work-programme">http://www.sesarju.eu/newsroom/brochures-publications/sesar-2020-multi-annual-work-programme</a>
<b>Call implementation</b>	<p>A total of 9 calls for proposals is planned over the period 2015-2019:</p> <ul style="list-style-type: none"> <li>• 2 calls (1 open, 1 restricted to SESAR JU members) launched in 2015 under the H2020 programme, resulting in:             <ul style="list-style-type: none"> <li>○ 28 Exploratory Research projects with the corresponding grants signed with 88 beneficiaries and linked third-parties, for a total value of EUR 20,4 million, resulting from the open call H2020-SESAR-2015-1 (ER1)</li> <li>○ 20 Industrial Research &amp; Validation projects with the corresponding grants signed with the 20 stakeholders members of the SESAR JU (EUROCONTROL and 19 other SESAR JU members<sup>16</sup>) and linked third-parties, for a total value of EUR 208,8 million, resulting from the restricted call H2020-SESAR-2015-2 (IR/VLD Wave 1)</li> <li>○ 4 Very-Large Scale Demonstration activities (1 was terminated in 2017) with the corresponding grants signed with the 20 stakeholders members of the SESAR JU (EUROCONTROL and 19 other SESAR JU members<sup>16</sup>) and linked third-parties, for a total value of EUR 37,7 million, resulting from the restricted call H2020-SESAR-2015-2 (IR/VLD Wave 1)</li> </ul> </li> <li>• 2 additional open calls launched in 2016 under the H2020 programme, resulting in:             <ul style="list-style-type: none"> <li>○ 9 Exploratory Research projects focusing on RPAS with the corresponding grants signed with 43 beneficiaries and linked third-parties, for a total value of EUR 8,3 million, resulting from the open call H2020-SESAR-2016-1 (ER2-RPAS)</li> <li>○ 8 Exploratory Research projects with the corresponding grants signed with 29 beneficiaries and linked third-parties, for a total value of EUR 9,9 million, resulting from the open call H2020-SESAR-2016-2</li> <li>○ 8 Very Large-Scale Demonstration activities for a total grant value of EUR 17,2 million, 4 of them with the corresponding grants signed with 50 beneficiaries and linked third-parties, 4 remaining to be signed at the end of 2017 (10 additional beneficiaries and linked third-parties), resulting from the open call H2020-SESAR-2016-2</li> </ul> </li> <li>• 1 additional open call for proposals launched in 2017 for Very Large-Scale Demonstration activities focusing on Active Geo-fencing Service, launched under assigned revenue from the European Commission (open call with reference SESAR-2017-1)</li> <li>• 4 additional calls, both open and restricted to SESAR JU members, planned in the upcoming years:             <ul style="list-style-type: none"> <li>○ U-space call for proposals in 2018, managed under the Connecting Europe Facility (CEF) programme, focusing on U-Space demonstration activities (open call with reference CEF-SESAR-2018-1)</li> <li>○ Three calls for proposals in 2019 under the H2020 programme, with award planned between the second part of 2019 and 2020, and corresponding projects taking place until the end of 2021 (current plan):</li> </ul> </li> </ul>

<sup>16</sup> As some SJU Members are consortia, the 19 SJU Members and EUROCONTROL represent in total 39 organisations. There are in additional 80 "linked third-party" organisations in this call for IR and 17 for VLD

	<ul style="list-style-type: none"> <li>▪ Wave 2 call, restricted to the SESAR JU members, for Industrial Research &amp; Validation and for Very Large-Scale Demonstration activities (restricted call with reference H2020-IBA-SESAR-2019-1)</li> <li>▪ ER4 call for Exploratory Research (open call with reference H2020-SESAR-2019-2)</li> <li>▪ VLD Open 2 call for Very Large-Scale Demonstration activities (open call with reference H2020-SESAR-2019-3).</li> </ul> <p>Additional calls for proposals may be organised as required</p>
<p><b>Procurement management</b></p>	<p>Overall value of procurement activities in 2017 amounts to EUR 5.540.000 million through:</p> <ul style="list-style-type: none"> <li>• 14 Framework Contract and Direct Services Contracts</li> <li>• 29 Specific Contracts</li> <li>• 13 amendments</li> </ul>

**Table 1: The SESAR JU at end 2017 in brief**

## 1 Part I: Achievements of the year

This section highlights progress and presents the achievements of the year 2017 in comparison with the SESAR JU's main objectives in 2017:

1. Deliver Exploratory Research,
2. Deliver Industrial Research & Validation,
3. Deliver Very Large-Scale Demonstration Activities,
4. Deliver Transversal Steering & SESAR Outreach,
5. Deliver effective financial, administrative and corporate management.

At the end of 2017, the SESAR 2020 programme covers the full SESAR innovation pipeline through:

- 2 calls for proposals (launched in 2015, with the award procedure completed in 2016) resulting in a total of 53 projects:
  - ER 1 open call with reference H2020-SESAR-2015-1 resulting in 28 'Exploratory Research' projects and the corresponding grant agreements (1 of which was completed and closed in 2017),
  - IR/VLD call restricted to SESAR JU members with reference H2020-SESAR-2015-1 resulting in 20 Industrial Research & Validation projects and 5 Very Large-Scale Demonstration activities (1 of which has been terminated in 2017), and the corresponding grant agreements subject to an annual grant budget amendment procedure (see paragraph 1.2.1.2);
- 2 calls for proposals launched at the end of 2016 and evaluated in 2017, resulting in the award of 25 additional grants (21 projects in execution):
  - ER2-RPAS call with reference H2020-SESAR-2016-1 (9 grants, projects in execution),
  - ER3 & VLD open call with reference H2020-SESAR-2016-2 (8 ER grant agreements signed and 4 VLD, plus 4 grant agreements for VLD to be signed in the beginning of 2018).
- 1 call for proposals launched under a non-H2020 framework (assigned revenue) in 2017, resulting in a recommendation for award of one grant (grant agreement signature will take place in early 2018).

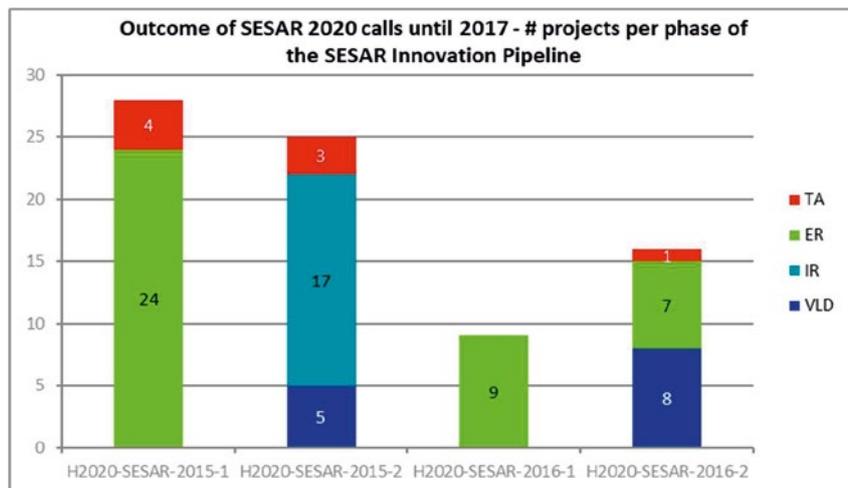


Figure 3: Number of projects per phase of the SESAR Innovation pipeline, per call (end 2017)

As a result of the calls for proposals organised by the SESAR JU since 2015, at the end of 2017, the SESAR 2020 programme is thus organised in the following work breakdown structure:

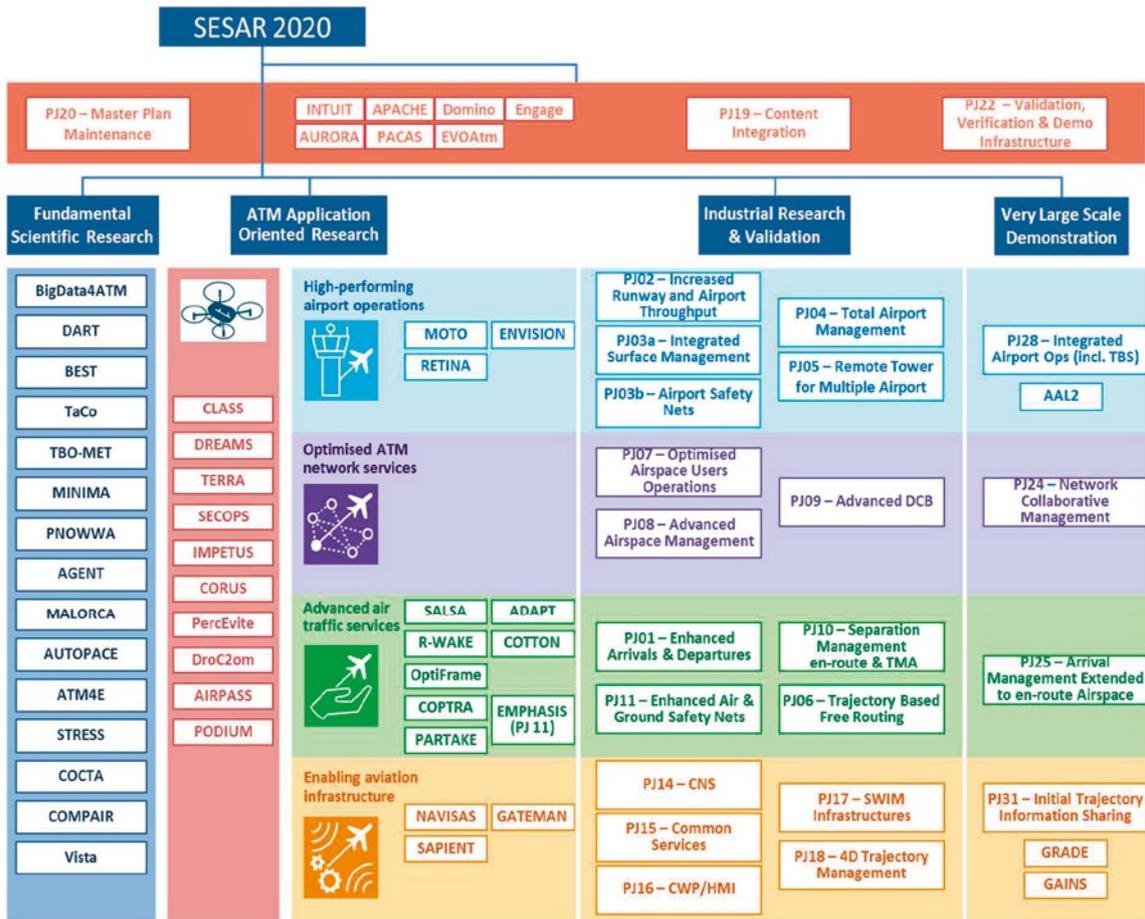


Figure 4: Work breakdown structure of the SESAR 2020 programme at end 2017

The status of these calls for proposals and the related projects is presented in further detail in the following sections of this chapter, as well as the work breakdown structure of the SESAR 2020 programme at the end of 2017. In total, up to 2017, the SESAR JU has successfully awarded grants for a total cumulated value of around EUR 300 million, which represents 56% of the overall objective of funding of SESAR 2020. As initially planned in the SESAR 2020 Multi-Annual Work Programme, the funding of activities through restricted and open calls for proposals will continue over the coming years with a forecasted cumulated amount close to EUR 540 million by end 2020, as depicted in the graph below (dates refer to the grant awards):

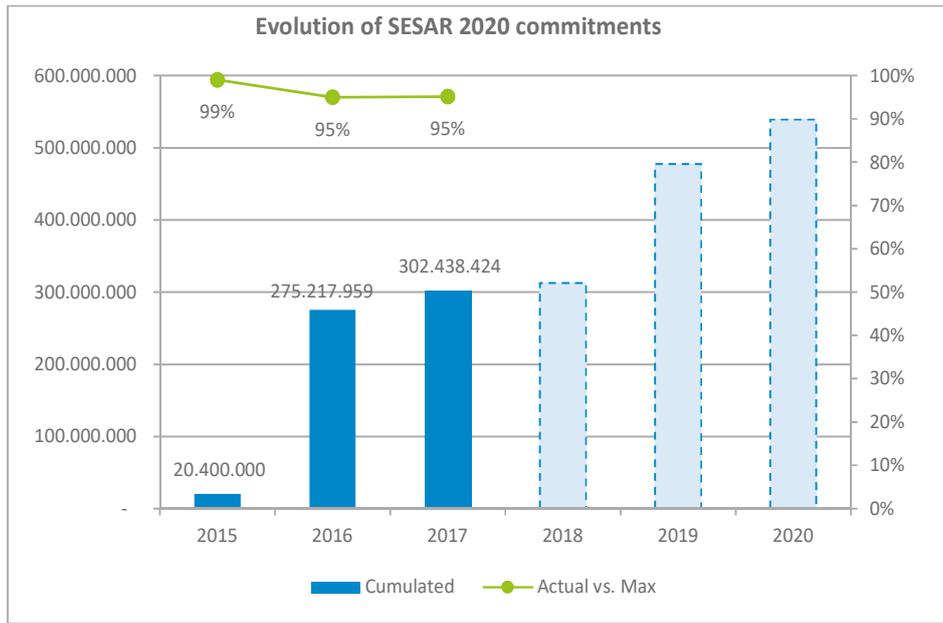


Figure 5: Evolution of commitments under SESAR 2020 (forecasts beyond 2017 appear in dashed columns)

Beneficiaries and linked third-parties of the SESAR H2020 calls for proposals represent all types of organisation targeted by Horizon 2020:

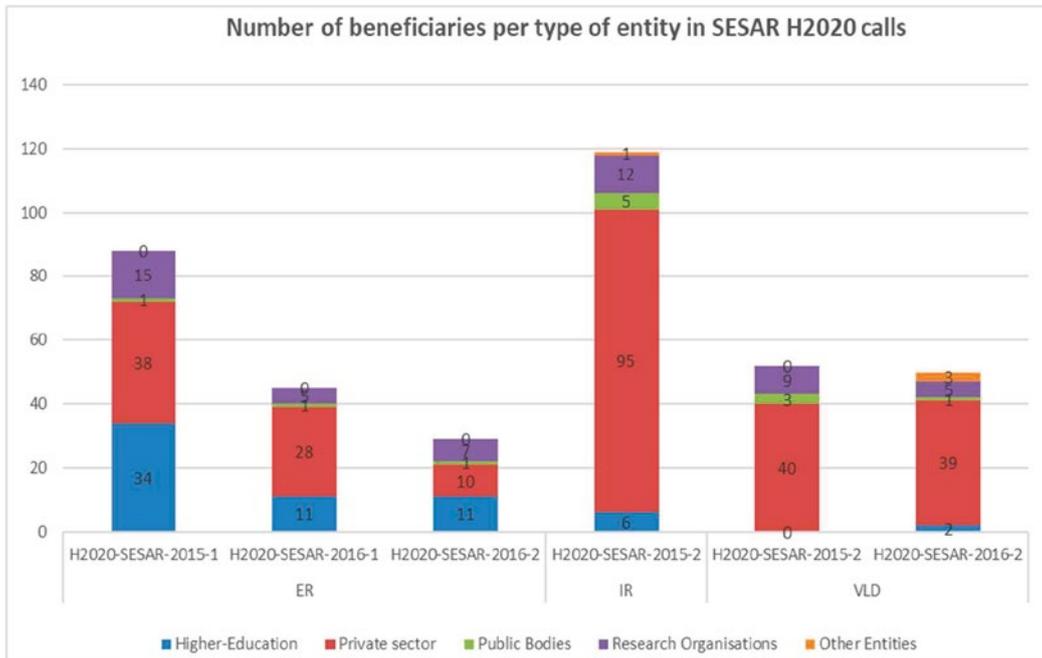


Figure 6: All types of organisations are beneficiaries from SESAR 2020 funding

This funding is distributed across 24 EU Member States:



Figure 7: SESAR 2020 funding per EU Member State and other countries at end 2017

## 1.1 Strategic Area of Operation 1: Deliver Exploratory Research

### *Objectives and target achievement status at the end of 2017:*

- *Call reference H2020-SESAR-2015-1 (ER1 Call) projects execution: delivery of initial results by the 28 projects, 1 project completed*
- *Call reference H2020-SESAR-2016-1 (ER2 – RPAS Call): 56 proposals evaluated, 9 grants awarded for a total value of EUR 8,3 million (92% of the maximum call value), all projects launched into execution*
- *Call reference H2020-SESAR-2016-2 (ER 3 Call): 56 proposals evaluated, 8 grants awarded for a total value of EUR 9,9 million (99% of the maximum call value), all projects launched into execution*

The SESAR JU delivers Exploratory Research results (both fundamental research and ATM Application-oriented research) through 45 projects resulting from the following calls for proposals:

- The first Exploratory Research call, ER1 with call reference H2020-SESAR-2015-1 (28 projects),
- The second Exploratory Research call, ER2 focusing on RPAS, with call reference H2020-SESAR-2016-1 (9 projects),
- The third Exploratory Research call, coupled with the first Open VLD call, with reference H2020-SESAR-2016-2 (8 projects).

The status of these 3 calls is presented in the following paragraphs.

### 1.1.1 Status of Exploratory Research 1 call (H2020-SESAR-2015-1)

The first open Exploratory Research call, H2020-SESAR-2015-1<sup>17</sup>, was closed on 25 June 2015. Call provisions are summarised in the SESAR JU's Consolidated Annual Activity Report for 2015<sup>18</sup>. The evaluation of the proposals (done in 2015) resulted in the award of 28 projects with a total value of EUR 20,4 million, under two work areas: **Work Area 1 – ATM Excellent Science & Outreach research** (15 projects) and **Work Area 2** (13 projects) – **ATM application-oriented research** (the latter covering the 4 Key Features of the ATM Master Plan. The main outcome of these projects is summarised in the paragraph below, while further detail on the general objectives, funding level of each project and its main activity in 2017 can be found in the annex I.1. In 2017, 153 deliverables were received from these 28 projects and 137 were assessed and approved. A first ER project, 'SAPIENT', was closed in 2017. Other ER1 projects will be closed in the second half of 2018.

Under **ATM Excellent Science and Outreach**, ER1 projects delivered the following in 2017:

- **AUTOPACE** project focused on the identification of the effects of automation on the cognitive processes and the research on the psychological model elements, while addressing safety risks and ensuring performance benefits. The key deliverables were the proposed ATCo Psychological Model, the identification of the required competences and training strategies to address the effects of automation on the ATCo performance, a Preliminary Hazard of

<sup>17</sup> Call documentation is available on the [Participant Portal](#)

<sup>18</sup> [SESAR JU Annual Activity Report for 2015](#)

AUTOPACE scenarios, the assessment the benefits of the future automation scenarios and the evaluation of the usefulness of AUTOPACE Psychological Model;

- **TaCo** project has been devoted to the definition and preliminary analysis of the airport environment. The beneficiaries put a main focus on the tools, operational conditions, procedures and working methods contributing to the definition of the current working environment for ground Air Traffic Controllers working in Malta International Airport;
- In the **AGENT** project, the basic concept of the Multi-Agent Simulation (MAS) tool for analysis of ecosystems has been defined as well as procedure for the modules integration into the Open Demonstrator (OD). One of the most important tasks was the design and development of the Open Demonstrator and of the two AGENT airborne tools: the Multi-Objective State Space Analysis Tool (MSSAT) tool, intended for generation of the ecosystem resolution trajectories, complemented by the Multi-Agent Simulation (MAS) tool, aimed at representing the negotiation process between the ecosystem aircraft, within the tracking phase, before the resolutions have been initialized;
- **STRESS** project designed four indexes for assessing these factors using electroencephalography (EEG), eye-tracker and skin-conductance-response measurement tools. These Human Factors aspects were investigated during the validation trials held in June 2017 at Anadolu University. Sixteen ATC students were involved in the trials. They were asked to manage the traffic in a realistic operational scenario designed to induce different levels of Attention and Stress. The user's neurophysiological signals were recorded continuously. Besides neurophysiological data, behavioural and performance data (how controllers handled the traffic) as well as subjective data (the perception of stress and attention) were collected. The project also delivered the validation scenarios that will be used during the final validation trials planned at ENAC in February 2018, in order to simulate the conditions of future highly automated systems in a Free Route Airspace context;
- **MINIMA** project prepared and conducted the evaluation trials of the MINIMA concept at ATC Training Centre in Forlì, with the participation of fifteen ENAV Air Traffic Controllers. During the two week experiment, the controllers completed several ATC scenarios with either a continuously high level of automation or MINIMA's vigilance and attention-based adaptive automation concept;
- **BigData4ATM** focused on the following tasks:
  - Development of methodologies and algorithms to infer activity-travel patterns at different scales. Due to their worldwide coverage, Twitter data have been used to reconstruct international passenger flows at a more aggregated level. Mobile phone records, which provide bigger samples and higher temporal granularity, have been used to reconstruct in a more detailed manner the airport access/egress legs in those countries where mobile phone data are available.
  - Development of statistical approaches and data fusion algorithms to upscale the observed behaviour to the total population.
  - Comparison of the information extracted from non-conventional data with that available from other sources (e.g., surveys), in order to validate the newly developed methods.
  - Development of methodologies to extract information from credit card transactions data. This information includes passenger expenditure (both inside and outside the airport), comparison between different airports and seasons, and the impact of disruptions in ATM on airport non- aeronautical revenues.
  - Development of a tool to visualise and calculate airport accessibility indicators both by public transport and private car.

- **DART** project performed the following activities:
  - Acquisition and validation of all needed data sources including Flight Plans, Weather data, Surveillance data, Airspace Structure and NM data.
  - Exploration of state of the art approaches for data-driven single trajectory predictions, training, testing and evaluation of these methods towards improving scalability, reducing dimensionality, while exploiting the appropriate features for the prediction process.
  - Implementation of hybrid approaches (mixture of data-driven with model-based ones), reinforcement learning approaches, trajectory prediction using Hidden Markov Models (HMMs), and trajectory clustering approaches for the trajectory prediction process.
  - Delivery of visualizations methods for analysing single trajectory prediction algorithms.
  - Description of the project operational context, towards resolving Demand-Capacity Balance (DCB) problems at the pre-tactical stage, and contribution towards an envisioned collaborative decision making process involving all ATM actors.
  - Formulation of the DCB problem as a multi-agent Markov Decision Process to assess delays on flights, w.r.t. operational constraints, also including strategic delay cost indicators.
  - Implementation of three collaborative reinforcement learning algorithms aiming towards resolving DCB problems efficiently and effectively by exploring hierarchical collaborative reinforcement learning methods.
- **MALORCA** project set up an initial basic Assistant Based Speech Recognition (ABSR) for Prague and for Vienna. The project achieved a command recognition rate of about, respectively, 80% and 60%. In order to improve the command recognition rate, a full-fledged Assistant Based Speech Recognition was developed by MALORCA, which uses the output of an Arrival Manager to predict a set of controller commands which are possible in the current situation (i.e. called as situational context), where radar data is used as a second sensor. This approach significantly reduces the search space of the speech recognizer, correct the ASR hypotheses and can also be used for plausibility checking of the output of the speech recognizer. For Prague approach, the developed ABSR yields the command recognition error rates below 0.6% and for Vienna below 3.8%. Prague results are generally better than Vienna results due to better audio quality.
- **BEST** project produced the ontology infrastructure for BEST was completed, including running of experiments to evaluate and fine-tune it. The concept of “semantic container” was defined, and a structure for administrative metadata was developed. The suitability of different ontology languages was assessed, including aspects related to performance issues. Work started on developing an abstract data model of semantic containers that accounts for logical and physical containers. Operational scenarios for demonstrating how BEST could support SWIM were defined. The scenarios include flight re-routing, failure of a data provider and quality of ATM information;
- In the **TBO-MET** project, for the trajectory planning problem at pre-tactical level (up to three hours before departure), a methodology has been developed to plan efficient trajectories with low levels of uncertainty. At tactical level (during the flight), a methodology has been developed to re-plan trajectories that are efficient, so that they are safe in the sense of avoiding the convective cells, considering that the cells evolution is uncertain. For the sector demand problem, the objective has been to quantify the impact of trajectory planning under weather uncertainty (as performed at the trajectory scale) on sector demand. A methodology has been developed to analyse the uncertainty of sector demand (probabilistic sector loading) in terms of the uncertainty of the individual trajectories.
- **ATM4E** project developed the algorithm-based Environmental Change Functions (ECFs), which can be calculated using routinely available meteorological data, were developed. Progress was achieved in the verification of the algorithm-based Environmental Change Functions and in the

evaluation of environmentally-optimized routes in a future atmosphere by using a comprehensive climate-chemistry modelling;

- **PNOWWA** project studied the effect of precipitation areas crossing Alps in winter weather conditions with radar images. Behaviour of the precipitation area has been linked to properties of the weather situation. The studies revealed that in contrast to the observations made with the moderate Scandinavian hills, the Alps show a major influence on the controlling synoptical systems which results in a more complex behaviour of the flow properties. User feedback was collected after PNOWWA winter 2017 demonstration campaign in Finnish and Austrian airports. Two cases studies suggested by users were provided as demonstration example. A training event with stakeholders took place at two Austrian and two Finnish airports for different user groups.
- **COCTA** project prepared data for COCTA modelling, by using EUROCONTROL Demand Data Repository (DDR), and by analysing data of aggregated traffic and ATFCM regulations in SPSS. A conceptual framework for the COCTA mechanism was developed in cooperation with the Advisory Board (comprising NM, AUs and ANSPs), specific roles were assigned to the different stakeholders in the Value Chain, and the process of capacity planning as well as the use of incentive schemes was described. The delivered process was designed aiming to minimize the overall costs of capacity provision as well as costs resulting from insufficient capacity supply, to provide flexibility in case of changing traffic patterns, and to introduce incentives within the charging scheme that contribute to an overall efficient outcome. The project delivered the COCTA model and progressively increased its complexity. As a foundation for model improvement, the project proposed a new ATM value-chain redesign, as recommended by the Advisory Board, followed by the development of the COCTA Capacity and Demand Management process. The improved COCTA model was evaluated using a small-scale case study using simulated data. The project started developing a final model suitable to tackle large flight networks and preparing a large-scale case study based on real data for a final proof-of-concept.
- **VISTA** projected progressed has been made in the core technical work:
  - Identification of relevant regulations and business factors that affect the processes/metrics;
  - Definition of regulatory factors (and instruments) and business factors (and tools/technologies), based on a detailed literature review
  - Selection of the foreground and background factors from the regulatory and business factors, with an indication of which phase of the ATM process (strategic, pre-tactical, tactical) is affected;
  - Definition of background scenarios from the background factors;
  - Identification of model variables that are affected by the background scenarios and foreground factors, and how they are affected.
  - High-level model definition and platform description: the identification of key characteristics of the stakeholders to be modelled; the temporal and spatial scope; the metrics and trade-offs to be analysed and the modelling technique selected for Vista.
  - Refinements to the impact trade-off and new visualisation interfaces.
- **COMPAIR** project assessed the potential for unbundling by illustrating the main economic mechanisms using tower control as an example. Furthermore, the project developed a game theoretic modelling approach to analyse the ATM market existing in 2014 and ask what-if questions as to how the market may change were an auctioning system to be introduced. It assumed that each country will organize their own auction or tender specifying the minimum

level of service desired, and undertook an analysis of six countries, that represents approximately 50% of the European aircraft movements. The models were applied to 2014 and were then run in order to analyse potential ATM markets in 2035 and 2050. Finally, the project developed an Agent-based model to simulate the auctioning of licenses to operate ANS. It started the specification of a second model which will be used to explore a hypothetical, more futuristic sector-less scenario in which air navigation services are provided on an origin-destination basis.

Under **ATM application-oriented research**, the 9 ER1 projects' main delivery included:

- **MOTO** project team focused their effort on preparing and starting the execution of the validation activities that should confirm the potential for the MOTO concept. In particular, the project team designed and implemented a virtual reality head-mounted display based validation platform reproducing the remote tower environment augmented by the multisensory information required by the MOTO concept. In parallel, the project team developed an 'embodiment index' in order to measure the sense of presence of the air traffic controllers as objectively as possible. The project team was then able to run a first validation exercise in the virtual reality environment with ATCOs in the loop. The project team also progressed on the design and implementation of a remote tower platform to test the MOTO concept in an environment as close as possible to the reality. Initial measurements started in this context at the end of the year;
- **RETINA** project finalised the conceptual design initiated in 2016, identifying the required sensing technologies and data provision standards, selecting the most suitable V/AR technologies to implement the concept in a control tower and defining the associated procedures and functionalities. Then the project team developed a proof of concept to validate the RETINA concept in an immersive interactive airport tower simulation platform. They also planned and executed the validation activities, defining scenarios where ATCOs would test the RETINA concept using a head mounted display and a simulated spatial see-through display in different traffic and visibility conditions. The initial results released at the very end of 2017 showed promising results in terms of ATCO situational awareness increase, efficiency of runway operations in low visibility conditions and safety;
- **SALSA** project has developed specific models and scenarios necessary for the exploration of a set of options addressing the surveillance coverage-gaps in the non-radar airspace (NRA). The developed models support the research on a Multi-source Automatic Dependent Surveillance-Broadcast (ADS-B) using Space-Based ADS-B and a ground based surveillance. The project has then performed various simulations, set expert workshops using simulation and traffic capacity models. Thanks to this work, the project has validated performance-requirements, potential enhancements for the Separation Minima in the NRA. This will lead the project to a preliminary impact-analysis for the Air Traffic Control (ATC) operations and the safety;
- **R-WAKE** project has developed, integrated and validated the simulation tools and scenarios necessary to conduct the targeted research. This led to the conduction of the simulations that clearly identified and preliminary quantified with enough level of confidence the ATM need (and the opportunity) for enhancing the current separation minima schemes provisioned in En-route operations;
- **OptiFrame** project focused on the following activities:
  - Refinements of a Data Management Platform (DMP) and completion of the validation activity (Task 3.3);
  - Refinements of the mathematical model in view of the WebEx with the PO on May 29th, 2017;

- Development and implementation of exact and heuristic algorithms;
- Qualitative assessment of the OptiFrame models.
- In the **COPTRA** project, the concept of probabilistic trajectory and its prediction was defined. By using the definition of probabilistic trajectory, the concept of probabilistic traffic situation was defined and how probabilistic traffic situations can be built by combining probabilistic trajectories was studied. Furthermore, probabilistic traffic situations was applied to ATC planning.
- **PARTAKE** project results included
  - To Achieve ATC Minimum Tactical Interventions
    - Implementation of the TBO mapping tools
    - Adjustment of TBO mapping tools toward TMA environment
    - Identification of concurrence and coupling interdependencies allow defining metrics that could lead to greater clearance time.
  - To identify TBO interdependencies
    - Implementation of TBO mapping tools
    - Graph based analysis
    - Identification of Concurrence
    - Coupling interdependencies
  - To determine feasible departure configurations
    - TBO mapping tools
    - Implementation of the optimization model
  - To develop a TBO Service Oriented “Information Management” Platform
    - Implementation of an Information System giving access to traffic real data and enabling the definition of scenarios for traffic analysis and mitigation.
    - Implementation of web services supporting the main PARTAKE functionalities (mapping, detection and filtering, analysis and mitigation)
  - To maximize trajectory adherence at key waypoints
    - Identification of concurrence and coupling interdependencies allow to define metrics that could lead to greater clearance times
  - To verify and validate the implemented Tools
    - Verification Concept
    - Verification of TBO mapping tools, Analysis Tool and Mitigation Tool
- **NAVISAS** project investigated multiple constellation satellite positioning systems with miniature atomic clocks (MAC), atomic gyroscope and vision-based navigation. The project analysed several paths for technology mergers for applications in small aircraft navigation, in particular: (i) standalone high grade inertial navigation system (INS) based on atomic gyros, (ii) hybridized multi-constellation multi-frequency system coupled with high grade INS, and (iii) vision-based navigation. The project also considered the relevance of specific PBN aspects to small aircraft operations. The TRL of atomic gyroscope reached level 3 within the scope of NAVISAS. Envisioned performances are promising and could challenge currently used high grade laser gyros. Several solution at the system level have been developed to reduce the price of the entire Inertial Measurement Unit (IMU) system combing 3 axis gyros, accelerometers, GPS /GNSS /GLONASS and atomic clock for application in UAV and ULA. Hybridization of multi-constellation multi-frequency GNSS coupled with high-grade INS has been assessed. It has been shown that multi-frequency receivers for A-PNT did not bring significant improvement against conventional single constellation GPS. Multi-constellation GNSS tight coupling with INS needs further research. Purely inertial performance of high-grade INS based on atomic gyros

is expected to reach the one from currently used laser gyros. Vision-based navigation was also assessed in real flight and showed good performances for RPAS navigation and light aircraft as well. It is expected to become a standard for RPAS in the coming years.

- **SAPIENT** project main result was the conceptual description of the “SAPIENT system” to measure, share and distribute information about the quality of terrestrial and satellite datalinks. The conceptual description is supplemented by a set of requirements. This set includes requirements regarding the 4D Tagging, the 4D-MAP Protocol and general, functional, performance and interface requirements of the SAPIENT system. It should be noted that a patent [2] was requested for this system. The Maturity Assessment of the “SAPIENT system” performed at the end of the project confirmed a maturity of TRL2. “SAPIENT system” here refers to a concept of measuring and sharing quality information and utilizing this information to decide about handovers. A link with the 4D-Trajectory concept and predictions about datalink quality are not part of the “SAPIENT system” although the Grant Agreement could give the impression that these elements would be included. The SAPIENT project was closed in September 2017. The project is considered to have achieved its target with respect to a maturity level of TRL2.

Furthermore, under **ATM application-oriented research**, 4 ER1 projects focused on Innovative ATM Architecture, Performance & Validation. Their main delivery included:

- **APACHE** project made progress by baselining its definition of the Concept of operations for the project and that defines the operational context which encompasses the evaluation studies that will be carried out. It also reviewed current applicable KPIs and do this different performance frameworks were thoroughly reviewed. In particular, a survey of key performance areas (KPA) and key performance indicators (KPI) was done by analysing different organizations worldwide, including the International Civil Aviation Organisation (ICAO), the Civil Air Navigation Services Organisation (CANSO), the Single European Sky (SES) Performance Scheme, EUROCONTROL, and the SESAR 2020 performance framework. In follow up, it proposed new KPIs, devoting a significant effort to enhance current indicators or even proposing new ones aiming at better capturing ATM performance. Across 9 key performance areas (KPAs), a total of 40 new, or enhanced, performance indicators (PIs) were proposed, with a total of 18 PIs variants (making a total of 58 proposed indicators). The APACHE System developed implements a total of 25 new (or enhanced) PIs and 17 PI variants. To implement the framework five main tasks were done:”
  - A "Trajectory planning" module has been developed, based on previous background from UPC. This module is able to generate trajectories at ECAC level simulating some SESAR solutions
  - A "Traffic and capacity planning" module is being developed simulating the most important functions of the Network Manager. A demand and capacity balance algorithm, similar to current air traffic flow management practices, has been implemented together with an advanced demand and capacity balance algorithm, in line with SESAR 2020 solution PJ09.
  - An "Airspace planning" module has been developed, based on previous background from ENAC. The module has been implemented based on current air navigation service provider practices. A dynamic sectorisation algorithm, in line with SESAR 2020 solution PJ08, has also been developed.
  - A "safety and risk assessment framework" to compute several safety related metrics.
  - A "performance analyser" implementing new defined performance indicators and providing tools for benchmarking and visualisation of ATM performance.

- **AURORA** project assessed the state-of-the-art of current performance indicators to measure flight efficiency (i.e. Horizontal Flight Efficiency indicator). Based on previous state-of-the-art, a gap analysis of the current indicators was performed in coordination with the airspace user representatives. This was the starting point for the definition of enhanced efficiency and equity indicators and associated methods to obtain them based on the design of user-preferred trajectories (e.g. optimum trajectory in terms of fuel consumption taking into consideration the weather conditions). AURORA tested that the methods to obtain the new indicators is technologically feasible through the use of historical surveillance data (ADS-B), flight plans and weather forecasts. Three different days with all flights arriving and departing at the ECAC area were considered. AURORA's Airspace Users Group participated in the analysis of results and conclusions on the added value of the new indicators. In parallel to the calculation of indicators based on historical data, AURORA has developed a model for the on-line calculation of the state of the indicators during the flight execution.
- **INTUIT** project has defined quantitative indicators to assess access and equity; new KPIs for future SES reference periods; and new forms of KPI visualisation. It used a combination of visual analytics and machine learning techniques to study interdependencies between KPAs/KPIs. The work has been structured in the form of 3 case studies that address one or more of the research questions outlined above:
  - Case study 1. Modelling of airline route choices and the influence of unit rates on performance. The goal is to develop new models able to predict airline route choices between different airport pairs in order to evaluate the performance trade-offs arising from these decisions (e.g., cost efficiency vs environment). The proposed approach has shown significant potential to improve the understanding of route choices, and it is of potential application to the problem of pre-tactical traffic forecast.
  - Case study 2. Multi-scale representation of performance data. This case study aims to disaggregate traffic data and performance indicators at sector and/or traffic volume level, with different levels of temporal disaggregation, and later on model the relationship between these variables at different scales (e.g., what is the influence of individual sector characteristics on the aggregated performance of a certain ANSP?).
  - Case study 3. Identification of sources of en-route flight inefficiency. The case study aims to investigate the causes of inefficient routes in the European Network and their effects on performance.
- **PACAS** project progressed well to almost achieve all the project's objectives set:
  - released the second stable version of the PACAS platform, which is the result of several iterations, starting from gap analysis and interactions with ATM domain stakeholders performed
  - established the PACAS scenario so to focus on particular decision points
  - It redefined the participatory change management process including roles involved and this to help users understand the status and take actions in case of deviations or focus the effort in specific tasks
  - It defined gamification elements, including the avatar and incentives, which have undergone evaluation too
  - It released the modelling notations for the four expert views, with the security and safety ones being quite stable from the first release, and the organizational and economic views undergoing some customizations being more domain-dependant.
  - It released and evaluated with external users automated reasoning techniques for impact propagation in the form of a web service that is integrated in the platform.

### 1.1.2 Status of Exploratory Research 2 call on RPAS (H2020-SESAR-2016-1)

The second Exploratory Research open call for proposals, H2020-SESAR-2016-1<sup>19</sup>, was open on 14 July 2016 and closed on 15 November 2016 and aimed to address the domain of Remotely Piloted Aircraft Systems (RPAS) and unmanned vehicles (UAS).

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

#### Call evaluation process

A total of fifty-nine proposals were received, of which one was withdrawn (case of abusive submission), two were ineligible and fifty-six evaluated in 2017. The proposal evaluation process involved several phases where external experts (independent experts) evaluated proposals received fully in accordance with H2020 procedures.

The Scientific Evaluation started in December 2016 and continued in January 2017. The ethics review process was conducted in January 2017.

#### Call results

The evaluation of the proposals was completed in January 2017 with the award of nine projects with a total value of EUR 8,3 million. The grants awarded in that context will deliver their results in the period 2018-2019. The table below provides an overview of the projects currently in execution phase, and further detail on the initial activities of each in 2017 can be found in the annex I.2:

Topic description	Projects	Max. total co-financing value (in EUR)
SESAR UTM Concept Definition	Building on the state-of-the-art, <b>CORUS (Concept of Operations for European UTM Systems)</b> will develop an operational concept enabling safe interaction between all airspace users in Very Low Level considering contingencies and societal issues.	800.000

<sup>19</sup> Call conditions were set in SJU Annual Work Programme 2016. Call documentation is available on the [Participant Portal](#)

Topic description	Projects	Max. total co-financing value (in EUR)
Aircraft systems	The <b>AIRPASS (Advanced Integrated RPAS Avionics Safety Suite)</b> project addresses the on-board technologies for drones that are required in order to implement the Unmanned Traffic Management (UTM) concept for drone operations at Very Low Level (VLL) and within the Visual Flight Rules (VFR) environment. The project will cover Detect And Avoid (D&A) systems for cooperative and non-cooperative traffic, auto-pilot systems as well as Communication, Navigation and Surveillance (CNS) systems. This project will identify the available CNS infrastructure and on-board technologies to formulate an implementation approach. Based on this an on-board system concept will be developed and evaluated.	986.224
Ground-based technology	<b>CLASS (Clear Air Situation for uaS)</b> will mature ground based technologies for a real-time Unmanned Aerial System Traffic Management System (UTMS) to monitor and separate Unmanned Aerial System (UAS) traffic	909.973
Ground-based technology	<b>TERRA (Technological European Research for RPAS in ATM)</b> addresses the research topic Ground-based technology, focusing on the performance requirements associated with the UTM concept, and identifying the technologies (existing and new) which could meet these requirements	937.000
Drone Information Management	The <b>DREAMS (DRone European AIM Study)</b> project aims at contributing to the definition of the European UTM Aeronautical Information Management operational concept by exploring need for and feasibility of new processes, services and solutions for the drone aeronautical information management within the new UTM concept	710.435
Drone Information Management	<b>IMPETUS (Information Management Portal to Enable the inTegration of Unmanned Systems)</b> will research on the application of the ‘micro-services’ paradigm as a flexible and cost efficient solution for lifecycle support of the expected high variety of drones and missions	899.160
Datalink	<b>DroC2om (Drone Critical Communications)</b> addresses Drone Critical Communications. The key objective of the DroC2om project is to contribute to the definition of integrated cellular-satellite data link specifications for UASs	1.270.543
Science for higher levels of automation	<b>PercEvite</b> addresses Sense and avoid technology for small drones for autonomously detecting and avoiding “ground-based” obstacles and flying objects. To avoid ground-based obstacles, we aim for a lightweight, energy-efficient sensor and processing package that maximizes payload capacity	899.008
Security & cyber-resilience	<b>SECOPS</b> deals with an Integrated Security Concept for Drone Operations. SECOPS' objective is to push drone technology forward by ensuring that security risks in the Unmanned Traffic Management (UTM) concept are mitigated to an acceptable level	909.294

**Table 2: Exploratory Research projects selected as a result of the call H2020-SESAR-2016-1 in 2017 and their max. co-financing value**

### 1.1.3 Status of Exploratory Research 3 call (within the call with reference H2020-SESAR-2016-2)

The third open Exploratory Research call for proposals, within the call with reference H2020-SESAR-2016-2<sup>20</sup>, was open on 15 December 2016 and closed on 11 May 2017. The H2020-SESAR-2016-2 call for proposals consisted of two different Work Areas: ‘Exploratory Research’ covering 6 topics and ‘Very Large Scale Demonstrations’ covering a further 10 topics. The total budget of the call was EUR 28.000.000, of which EUR 10.000.000 for Exploratory Research (the EUR 18.000.000 other for VLD, see chapter 1.3).

#### Call evaluation process

For the ‘Exploratory Research’ Work Area, a total of 29 proposals were received, of which 3 were withdrawn (two of which were cases of abusive submission) and 26 evaluated in 2017. The proposal evaluation process involved several phases where external experts (independent experts) were paired with SESAR JU ATM scientific expert representatives and together they evaluated proposals received in accordance with the published procedures of H2020.

The Scientific Evaluation Process and Ethics Review Process were conducted according to H2020 procedures and started in June 2017.

#### Call results

The evaluation of the proposals was completed in September 2017 for the ‘Exploratory Research’ Work Area with the award of 8 projects and the subsequent grant signature process, for a total value of EUR 9,9 million (in December 2017). The grants awarded in that context will deliver their results in the period from 2018 through to 2020.

The table below provides an overview of the projects currently in execution phase following the successful completion of the grant signature process. As the grants were signed in the last period of 2017, no detail on the project activities is reported in Annex I.1.

ATM Master Plan Key Feature / Topic	Projects	Max. total co-financing value (in EUR)
 <p>High-performing airport operations</p>	<p>The <b>ENVISION project (Enhanced Situational Awareness through Video Integration with ADS-B Surveillance Infrastructure on Airports)</b> aims to make use of technical progress in CCTV cameras, light detection and ranging (LIDAR) technology and image processing techniques, and at taking advantage of reduced equipment costs, to provide regional and local airports safe and affordable surface movements surveillance capabilities</p>	983.083

<sup>20</sup> Call conditions were set in SJU Annual Work Programme 2016. Call documentation is available on the [Participant Portal](#)

ATM Master Plan Key Feature / Topic	Projects	Max. total co-financing value (in EUR)
 <p>Advanced air traffic services</p>	<p>The <b>ADAPT project (Advanced prediction models for flexible trajectory-based operations)</b> proposes strategic models to predict the volume, flexibility and complexity of traffic demand taking into account both individual flights and network infrastructure (i.e. sectors and airports). The aim is to enable early flight information sharing in order to identify potential network bottlenecks and the degree of flexibility of all flights. At the tactical level, the extent to which strategically assessed pre-departure and en-route flight flexibility mitigates actual network congestion, will be evaluated</p> <p>The <b>COTTON project (Capacity Optimisation in TrajecTory-based OperatiONs)</b> aims to maximise the effectiveness of capacity management processes in trajectory-based operations taking full advantage of available trajectory information. Specifically, the project explores the integration of demand and capacity and flight centric solutions</p> <p>The <b>EMPHASIS project (EMPowering Heterogeneous Aviation through cellular Signals)</b> aims to increase safety, reliability and interoperability of general aviation/rotorcraft (GA/R) operations both with commercial aviation and with emerging drones operations. These aspects are foreseen as critical elements to secure and improve airspace access for GA/R users in future airspace environment and improve operational safety of their operations</p>	<p>997.250</p> <p>622.522</p> <p>937.130</p>
 <p>Enabling aviation infrastructure</p>	<p><b>GATEMAN</b> stands for <b>GNSS NAVIGATION THREATS MANAGEMENT</b>. Global Navigation Satellite System (GNSS), such as the Galileo constellation, will become the primary means of aircraft navigation in the mid and long term. However, GNSS signals are vulnerable to threats, especially to jamming and spoofing, which may cause the total loss of navigation. The project will research multiple measures that could be deployed on most aircrafts to manage these threats, either on their own or in a collaborative fashion with other aircraft</p>	<p>565.744</p>
<p>ATM Operations, Architecture, Performance and Validation</p>	<p>The <b>EvoAtm project (Evolutionary ATM. A modelling framework to assess the impact of ATM evolutions)</b> aims to build a framework to better understand and model how architectural and design choices influence the ATM system</p>	<p>968.880</p>

ATM Master Plan Key Feature / Topic			Projects	Max. total co-financing value (in EUR)
			and its behaviours, and vice versa how the expected ATM overall performances drive the design choices. The EvoATM project will model a specific part of ATM system combining the agent based paradigms with evolutionary computing	
			The <b>Domino</b> project focuses on novel tools to evaluate ATM systems coupling under future deployment scenarios. The project will develop a set of tools, a methodology and a platform to assess the coupling of ATM systems from a flight and a passenger perspective. The platform will allow ATM system designers to gain insight on the impact of applying new mechanisms. It will provide a view of the impact of deploying solutions in different manners, e.g., harmonised vs. local/independent deployment, and information on the criticality of elements in the system and how this might be different for different stakeholders	805.125
Knowledge (KTN)	Transfer	Network	<b>Engage</b> is a KTN proposed for European air traffic management, building on the solid foundation of previous actions, and introducing novel features and actions. Previous attempts to involve industry in the earlier maturity phases of ATM research have only partly been successful. At the core of the network are thematic challenges, supported by dedicated workshops. Catalyst funding will support focused projects, thus stimulating the transfer of exploratory research results towards ATM application-oriented research. This will include an observatory and undertake the role of devising and maintaining the long-term roadmap development of innovative and interdisciplinary ATM concepts beyond SESAR 2020. The knowledge hub will be the one-stop, go-to source for information in Europe.	3.971.875

**Table 3: Exploratory Research projects selected as a result of the call H2020-SESAR-2016-2 in 2017 and their max. co-financing value**

## 1.2 Strategic Area of Operation 2: Deliver Industrial Research & Validation

### *Objectives and target achievement status at the end of 2017:*

- *Call reference H2020-2015-2 (IR Wave 1 Call): all 20 IR projects in execution delivering results in accordance with plan, and relevant grant budget amendments (except 1) completed to define the next phase of delivery*
- *Execute validation exercises of Release 7 - 1st Release under S2020: 11 Solutions assessed in V-TRL2 under Release #7, Release #8 Plan initiated*
- *Ensure that the new challenge of Cyber-security is addressed across the IR projects of SESAR 2020 in a fully integrated approach*

In the beginning of 2017, all projects resulting from the IR/VLD Wave 1 call for proposal launched in 2015 (call with reference H2020-SESAR-2015-1) were in full execution. This represents 17 IR projects (Wave 1 VLD activities are presented in the next chapter) and 3 transversal activities for a total amount of EUR 208,8 million.

With the aim to assess the maturity of SESAR Solutions developed in the 17 IR projects, the SESAR JU and its members conducted the Release 7, which was the first Release conducted under the SESAR 2020 programme. Additionally, in 2017 the SESAR JU started off the planning phase of the Release 8, expected to be completed in the beginning of 2019.

During the year 2017, SESAR JU and its members got support from SDSS (SESAR Development Support Services) in the implementation and execution of the processes and procedures required guaranteeing consistency in the Programme lifecycle. In particular, SDSS has rolled out in March 2017 a first version of the STELLAR collaborative platform replacing the obsolete SESAR 1 extranet. Along the year additional upgrades of the platform have been deployed in order to better answer to the users' needs. This Stellar collaborative platform is used on a daily basis by SESAR JU and all projects contributing to the SESAR 2020 programme for sharing documents and reports, organising meetings, integrated schedules, deliverables and dependencies management, etc. SDSS also contributed to the definition of the Release 7 Plan in identifying the different Solutions to be validated and delivered according to the Release process. Activities related to the maturity assessment of the Solutions have also been supported by SDSS through the delivery and maintenance of the maturity assessment tool together with the organisation of the maturity gates and the preparation of the required material as input and as outcomes of the gates.

This chapter presents the status of the projects resulting from the Wave 1 call for proposals and their main achievements, then results and achievements of the Release 7 and planning of the Release 8, then developments in relation with the Wave 2 planning.

## 1.2.1 Industrial Research & Validation Wave 1 call (within the call with reference H2020-SESAR-2015-2)

### 1.2.1.1 Call status and project results

The first call on industrial Research and Validation, which was restricted to SESAR JU members, within the call with reference H2020-SESAR-2015-2<sup>21</sup> also covering VLD, was closed on 20 April 2016. Call provisions are summarised in the SESAR JU's Consolidated Annual Activity Report for 2015<sup>22</sup>. The main outcome of these projects is summarised in the paragraph below, while further detail on the general objectives, funding level of each project and its main activity in 2017 can be found in the annex I.1.

In 2017, 264 deliverables were received from these 20 projects and 5 demonstration activities (see next chapter) and 186 were assessed and approved. Furthermore, IR projects contributed to validation exercises which are presented in the paragraph 1.2.2.1 which summarises the Release 7 execution and temporary results (as per the Release Plan, Release 7 will finish in Q1 2018). The tables below, which are structured per Key Feature, provide an overview of the projects currently in execution phase, and further detail on the activity of each in 2017 can be found in the annex I.1. It is expected that all IR projects will continue over 2018 and will complete their delivery in late 2019 or early 2020.

Under the '**High Performing Airport Operations**' Key Feature, IR projects delivered the following:

- **PJ.02 EARTH** 'Increased Runway and Airport Throughput': the project team started the developments at solution level, describing each solution's concept and, in most cases, the related technical specifications. The team also initiated the validation activities, planning the exercises and developing the prototypes and validation platforms. The first validation activities were run in solutions PJ.02-01 (Wake turbulence separation optimization), PJ.02-02 (Enhanced arrival procedures), PJ.02-08 (Traffic optimisation on single and multiple runway airports) and PJ.02-11 (Enhanced Terminal Area for efficient curved operation);
- **PJ.03a SUMO** 'Integrated Surface Management': the project team started the developments at solution level, describing PJ.03a-01, PJ.03a-04 and PJ.03a-09 concepts and the related technical specifications. Technological solution PJ.03a-03's technical specifications were also initiated. PJ.03a-01's cost benefit analysis was started. The project team also initiated the validation activities, planning the exercises and developing the prototypes and validation platforms. The two PJ.03a-09 V1 validations were performed at the end of 2017.
- **PJ.03b SAFE** 'Airport Safety Nets': the project team started the developments at solution level, describing each solution's concept and, for PJ.03b-01, PJ.03b-03 and PJ.03b-05, the related technical specifications. PJ.03b-01 and PJ.03b-03's cost benefit analyses were started. Some project members participated in EUROCAE and EASA activities on the basis of the ongoing PJ.03b-01 and PJ.03b-05 developments. The team also initiated the validation activities, planning the exercises and developing the prototypes and validation platforms for PJ.03b-01, PJ.03b-03 and PJ.03b-05. Finally, the PJ.03b-06 V1 data pack was submitted, approved and the maturity gate was passed in September 2017, concluding that V1 had been completed with acceptable issues. The PJ.03b-06 V2 activities then started on this basis with the refinement of the operational concept.
- **PJ.04 TAM** 'Total Airport Management': the project team started the developments at solution level, describing each solution's concept and the related technical specifications. PJ.04-01's

<sup>21</sup> Call documentation is available on the [Participant Portal](#)

<sup>22</sup> [SESAR JU Annual Activity Report for 2015](#)

cost benefit analysis was started. The team also initiated the validation activities, planning the exercises and developing the prototypes and validation platforms for PJ.04-01. The first two validation activities were run for this solution in the last months of 2017. Finally, the PJ.04-02 V1 data pack was submitted at the very end of 2017, triggering confirming the V1 maturity gate meeting planned for end of January 2018.

- **PJ.05 Remote Tower** ‘Remote Tower for Multiple Airports’: the project team started the developments at solution level, describing PJ.05-02 and PJ.05-03’s concept and the related technical specifications. Technological solution PJ.05-05’s technical specifications were also initiated. The team also initiated the validation activities, planning the exercises and developing the prototypes and validation platforms for the three solutions. The first PJ.05-02 V2 validation exercise was executed in November 2017.

Under the ‘**Optimised ATM Network Services**’ Key Feature, IR projects delivered the following:

- **PJ.07 OAUO** ‘Optimised Airspace Users Operations’: for Solution 07.01 Airspace Users’ Processes for Trajectory Definition V1 an initial OSED was produced (mid-2017) and for the 2 planned exercises one exercise validation plan was delivered. V1 validation activities started in Q4 2017 involving the AUs in different ways, since the preparation of the activity to the involvement of all of them in the initial phases of the validation exercises. The V2 concept and contents discussions about the FF-ICE planning service and the provision of Enriched DCB information to AUs are progressing in close coordination with ICAO and NM developments. A draft version of the OSED/SPR/INTEROP was ready by the end of 2017 and its provision has been delayed to the end of February to ensure full consistency with latest NM and ICAO developments and integrate AU experts’ inputs. Preparations for the joint validation exercise (07.01.02 / 09.03.02) are very well advanced and a pre-run took place in Dec 2017. For Solution 07.02 Airspace Users’ Fleet Prioritisation and Preferences (UDPP): key tasks, such the Initial OSED, first iteration of the VALP, Initial TS, as well as the development of the prototype have been prepared, reviewed and delivered internally and on-time. For Solution 07.03 Mission Trajectory Driven Processes, the Initial OSED V2 and initial VALP V2 were produced. At the end of 2017 all prototyping developments of the different parties were completed and the first integration tests took place.
- **PJ.08 AAM** ‘Advanced Airspace Management’: for Solution 08.01 – Management of Dynamic Airspace Configurations, initial OSED, VALP and Initial TS were prepared and delivered according to the Project Schedule.
- **PJ.09 DCB** ‘Advanced DCB’: for Solution 09-01 – Network Prediction and Performance, initial OSED, first iteration of the VALP and Initial TS have been prepared, reviewed and delivered on-time. In September 2017, the team has also kicked off the preparation for one of the two main human-in-the-loop (HIL) exercises, EXE-09.01-02. The prototyping and NM system developments are going well. Solution 09.02: Integrated Local DCB Process was successfully kicked off and is progressing according to plan. Initial version of the deliverables (OSED, VALP and TS) has been produced. Solution 09.03: Collaborative Network Management has been successfully kicked off and is progressing according to plan with a first successful iteration of validation exercise (09.03-02 Collaborative NOP - iteration 1.a) and a successful workshop for EXE 09.03-01 Collaborative DCB Framework. Initial version of the deliverables (OSED, VALP and TS) has been produced.

Under the ‘**Advanced Air Traffic Services**’ Key Feature, IR projects delivered the following:

- **PJ.01 EAD** ‘Enhanced Arrival and Departure’: All work packages prepared an initial description of the investigated operational services and their corresponding operational environments. For the first set of exercises, detailed descriptions of validation objectives, anticipated benefit

mechanisms and various assessment plans were prepared. Operational requirements were captured, the necessary validations were started and the first exercises were successfully conducted. One Maturity gate on solution 01-03b (Improved parallel operations) was performed at v1 level.

- **PJ.06 ToBeFREE** ‘Trajectory-Based Free Routing’: Initial Concepts definition for developing and validating concepts enabling Airspace Users to plan flight trajectories without reference to a fixed route network or published directs within high & very high-complexity environments has been done. The required infrastructure (and supporting tool) enabling the provision of air traffic services in a Free Route environment have been identified. For Solution 06.01 Optimized traffic management to enable Free Routing in high and very high complexity environments, the Initial and interim versions of the SPR-INTEROP/OSED (V3) have been produced. As part of this task the initial Safety Assessment Report has been produced as well. Consolidated VALP and Platform integration and trials preparation has progressed in line with the planning and Performance assessment and CBA activity has started. For Solution 06.02 Management of Performance Based Free Routing in Lower Airspace, OSED including the initial safety assessment has been almost completed in line with the updated planning. VALP (V1) has been produced.
- **PJ.10 PROSA** ‘Separation Management & en-route & TMA’: All work packages prepared an initial description of the investigated operational services and their corresponding operational environments. For the first set of exercises, detailed descriptions of validation objectives, anticipated benefit mechanisms and various assessment plans were prepared. Based on the operational requirements an initial set of technical specifications were derived and the necessary prototype and validation platform preparations were started and the first exercises were successfully conducted.
- **PJ.11 CAPITO** ‘Enhanced Air & Ground Safety Nets’: CAPITO project members participate in standardisation activities, in particular EUROCAE and RTCA/EUROCAE meetings to disseminate validation results and analysis. It is to be noted the project covers a large spectrum of Airspace Users including the ones related to Remotely Piloted Aircraft Systems (RPAS), General Aviation (GA), rotorcrafts (R) and military operations.

Under the ‘**Enabling ATM Infrastructure**’ Key Feature, IR projects delivered the following:

- **PJ.14 EECNS** ‘Essential and Efficient Communication Navigation and Surveillance Integrated System’: Key deliverables within the initial reporting period for the transversal Solution 14.01.01 CNS Environment Evolution include, the first release version of the “CNS Evolution, Strategy and Roadmap”.
  - From the 5 Communication related solutions, the following key points include: for “Solution 14.02.01 FCI Terrestrial Data Link”, the PMP first version deliverables for the LDACS A/G Specification and LDACS deployment report being made available. For “Solution 14.02.02 Future SATCOM datalink”, interaction with ESA was established at preliminary requirements for SPR and INTEROP collected and shared. The “Solution 14.02.04 FCI” provided towards the V1 gate Initial Concept Description, FRD and Identification of potential benefits and risks. Solution 14.02.05 New Services for GA had started the OSED but was slightly behind schedule. The last COM “Solution 14.02.06 Completion of AeroMACS” provided an initial TS/IRS and standardisation report.
  - From the 3 Navigation related Solutions, the key points of progress include: for “Solution 14.03.01 GBAS”, for the extended scope of GAST D an Availability Note with respect to the upgrade at Frankfurt, GAST F (MC/MF) mock-up in Barcelona Availability Note and a TVALP. All other tasks were progressing to schedule. The “Solution 14.03.02 MC/MF GNSS”

- provided an initial TS/IRS and showed progress in the prototype developments. The “Solution 14.03.04 A-PNT” identified a need to expand its scope to include a Mid-Term solution for Airborne Multi DME Architecture. As a result, their FRD will be resubmitted to address Short, Medium and Long term A-PNT solutions.
- From the 2 Surveillance related Solutions, the key progress include: for “Solution 14.04.01 SPM”, an initial TS/IRS and the identification of an additional Data Pack. For the “Solution 14.04.03 on the evolution of C and NC Surveillance”, has provided the initial TS/IRS.
  - **PJ.15 COSER** ‘Common Services’ work performed in 2017 can be summarised as follows:
    - PJ.15-01 has delivered the Business Model and the High Level Architecture and started the V2/TRL3 phase by developing the validation plan, and detailing the content of the V2/TRL4 validations, subsequently defining the services, a subset of which will be used for the validations.
    - PJ.15-02 has delivered the Business Model and the High Level Architecture. The solution already passed the corresponding V1 maturity gate. In addition, PJ.15-02 has started the V2/TRL4 phase by defining the services, which will be used for the validations, developing the validation plan, and starting the development of the V2/TRL4 validations.
    - PJ.15-08, PJ.15-10 and PJ.15-11 have delivered the Data Pack V1 containing the Business Model and the High Level Architecture. Finally,
    - PJ.15-09 has developed an initial draft of the Business Model and High Level Architecture. Discussions about the scope of the Virtual Centre and adjustments of the Common Service method have taken place during this period.
  - **PJ.16 CWP/HMI**: Solution PJ.16-03 Workstation, Service Interface Definition & Virtual Centre Concept has already delivered some concrete results, as an agreed definition of the concept, a target architecture recognised by the ATM community, a definition of some services, and assessed risks that goes with it. At the end of 2017 the proposal was close TRL2 maturity level i.e. concept validated and has started the work to reach the “ready for industrialisation” maturity. Solution PJ.16-04 Workstation, Controller Productivity has ramped up and finalised first the methodology, literature research on the following 6 activities included in this solution: Good progress is made and the forecast is that TRL2 maturity (Concept validated) will be attained in the course of 2018.
  - **PJ.17 SWIM-TI** ‘SWIM Technical Infrastructure’: The Solution 17-01 Purple Profile for A/G Advisory Information Sharing provided their technical specification and validation plan.in preparation for TRL4. The Solution 17-03 Green Profile for G/G Civil Military Information Sharing made good progress and is on schedule to deliver their FRD and TVALP at the beginning of 2018 prior to their TRL2 Maturity Gate. The Solution 17-08 SWIM TI Common runtime registry delivered on schedule their FRD in preparation for the V1 Maturity Gate at the beginning of 2018.
  - **PJ.18 4DTM** ‘4D Trajectory Management’: this project covers the interoperability (IOP) topic on which the SESAR JU took a specific action in 2017. See below in paragraph 1.4.3.3.

In addition, under that call, four projects delivered results related to the transversal steering of the SESAR 2020 programme:

- **PJ.19 CI** ‘Content Integration’: The first months in 2017 were dedicated to the set-up of the project, internally between the four main PJ.19 work packages and externally with the SESAR 2020 Projects / Solutions and the SESAR 2020 Governance (SESAR JU).

- By mid of 2017, PJ.19 and the Content Integration process was running full speed with tools, method, process and coaching to support the working together set up within PJ.19, with the SESAR 2020 Projects/Solutions and other transversal activities (ATM Master Plan (PJ.20) and Requirement Management (PJ.22)).
- The first Content Integration cycle was completed by mid of 2017 with the provision of the first update of the SESAR 2020 CONOPS, the SESAR Operational, Technical, Service and Information architecture (via the European ATM Architecture – EATMA framework) in EATMA V9, the SESAR Architecture Document (ADD) and associated Service Roadmap and Portfolio.
- The first performance consolidation was made by the end of 2017 based on the early validation results of the SESAR 2020 Projects/Solutions (via the SESAR Performance framework) and the Performance Targets defined early 2017.
- After this first Content Integration cycle, PJ.19 defined the baseline for the second Content Integration cycle with the update (when need be) of the working together processes, architecture and performance frameworks and the definition of the validation targets 2018.
- During 2017, the PJ.19 contribution to the ATM Master Plan 2018 was reinforced with the definition of the common change management process, the management of the Integrated Roadmap (DS17 and DS17b) and the direct contribution to the ATM Master Plan Key Focus teams (ATM Vision, Drone and Performances).
- During 2017, PJ.19 contributed to the Cyber-Security Task Force launched by SESAR JU. Results of the task force were handed over to PJ.19 in October 2017. Also, PJ.19 contributed to the Operational and Technical Sub Committee (OTSC) and to the Management Sub Committee (DMSC).
- **PJ.20 AMPLE** ‘Master Plan Maintenance’: the project worked in particular on two major tasks, planned as optional but which were activated almost simultaneously as a consequence of EC mandates / delegations: the support to the SESAR JU on the preparation of a Roadmap for drone integration into all categories of airspace, and the support to the SESAR JU on the development of a recommendation on a second common project (CP2). These tasks had to be carried out simultaneously and in parallel and were expected as crucial inputs for the Master Plan update campaign, which was kick started in the Digital Transport Days event in Tallinn on 8 November 2017 (see section 1.4.7) and will continue all over 2018;
- **PJ.22 SEabird** ‘Validation, Verification and Demonstration infrastructure’ focused on:
  - The set-up, definition and maintenance of processes, methods and tools for System Engineering Data Management in the SESAR programme and operationally set-up the SE-DMF (System Engineering Data Management Framework). The activities included the analysis and specification of the SE-DMF and the overall service, set up and maintenance of the implementation plan, pre-service verification, pilot phase with selected SESAR solutions, set-up of the SE-DMF cloud service, the provision of training and coaching to the solution projects, SE-DMF annual maintenance, set up of help desk service and monitoring of SE-DMF adoption at programme level.
  - Support to SESAR Solution Maturity Lifecycle and Gates e.g. traceability matrix.
  - Maintenance of Platforms Catalogue: internal coordination activities have been carried out among contributing partners in order to progress with technical activities, and with WP3 to build and share a common view about the implementation of Platform Catalogue.
  - Maintenance of the V&V and Demonstration platform development methodology, including the creation of V&VPs, V&VIs and Demonstration Platforms Development Methodology Compliance Check List (CCL).

- Elaboration of the V&V and Demonstration platform development methodology training plan and supporting material, and preparation of questionnaires for collection of solution project’s feedback on the use of the methodology.
- Identification of validation tools and interoperability solutions required by the other Solution Projects and the development of specifications. In particular:
  - To develop a questionnaire supporting the identification of Solution Project needs
  - To establish contact with the Solution Projects and request the questionnaire feeding and analyse the outputs of the questionnaire
  - To develop interoperability solutions specifications
  - To coordinate the integration of solutions in the ED-147 developed by EUROCAE Working Group 81

**1.2.1.2 Wave 1 grant budget amendment**

In 2017, the SESAR JU applied the approved grant amendment procedure for adjustment of maximum grant amount and associated EU contribution. Since the first IR/VLD call for proposals (Wave 1) had a total value of 260,075 M€ and the available funding for grants awarded before 2017 was limited to 50 M€ (+1,47 M€ EFTA contributions), this grant amendment procedure was introduced in the Amendment number 1 of the Annual Work Programme 2015, adopted by the Administrative Board on the 23/10/2015. This procedure, further detailed in the Annual Work Programme 2016 has been followed in order to revise all complementary grants under call H2020-SESAR-2015-2. The total amount of budget increase with Wave 1 of grant budget amendment in 2017 has been EUR 91.196.479,54 (corresponding to the total foreseen amount of EUR 100.219.181 minus the amount for one project, for which the amendment was processed in 2018).

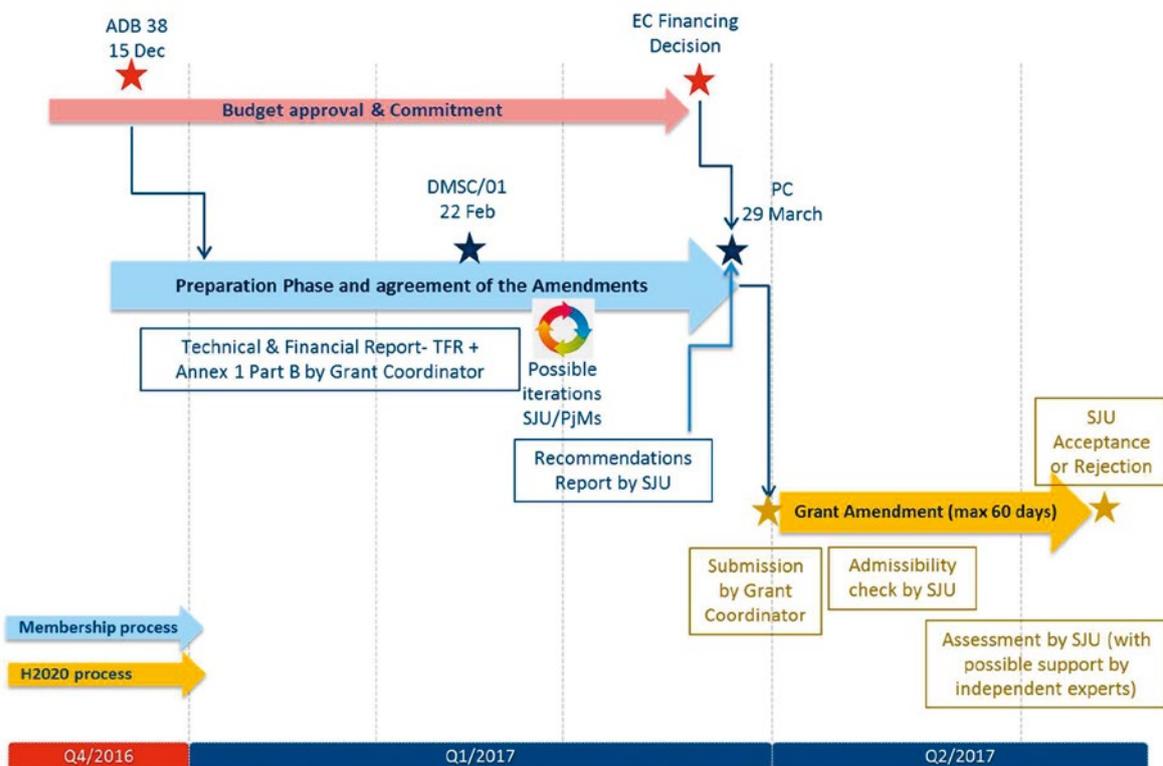


Figure 8: Grant budget amendment process overview in 2017

The process consisted of the following phases:

1. Preparation phase and agreement of the Amendments:
 

The SESAR JU has requested from each Action a specific report detailing the technical and the financial results for the activities undertaken with the initial grant amount.

The SESAR JU has calculated an allocation to be proposed as the additional budget to each Action, on the basis of the ratio between the total maximum additional budget made available (in the SESAR JU annual budget) and the total EC contribution initially requested for Wave 1 Actions. This proposed allocation has been submitted to the members.

In the light of the technical and financial results of the work previously done in each Action, and the proposed allocation of additional budget calculated by the SESAR JU, the members and the SESAR JU have discussed and agreed, in the context of the governance arrangements foreseen in the SESAR 2020 Membership Agreement (in particular the PC and the DMSC), the update of next set of activities of the selected proposals to be performed and the allocation to be effectively awarded as additional budget to each Action within the limits of the total maximum additional budget available.
2. Formal H2020 Budget Grant Amendment phase
 

After completion of this preparatory process, the standard H2020 grant amendment process has been initiated by the grant coordinators. The content of the amendments corresponded to the technical and budgetary outcomes of the 2nd phase. The process has been documented in the H2020 tool with specific supporting documents.

The members have been invited to sign the grant amendments to increase the grant amount up to the level decided above and to initiate the activities corresponding to the new amount(s). Considering the exceptionality of this procedure, a series of meetings have been organised with DG RTD in order to agree on the business procedure and IT steps to implement it. The novelty of the process has resulted in some delays and a learning effort for both SESAR JU and the members.

## 1.2.2 SESAR Solutions delivery: the Release process in 2017

### 1.2.2.1 Release #7 execution

As in the previous years, the SESAR ATM and Technological Solutions were assessed in the context of the SESAR Release #7. The Release #7 Plan was delivered in June 2017; it covers SESAR Solutions performing Maturity gates up to April 2018. The execution of validation activities on these Solutions was conducted during 2017 and up to February 2018.

The Release #7 enabled to work on 10 SESAR Solutions in V1/TRL2 (2 solutions getting a few delays and be moved into Release 8) and 1 Solution in V3 level of maturity. It should be noted that in 2017, the SESAR JU together with the PC conducted a review and update of the Extended Release Strategy, which has been made available in the SESAR JU SPD 2018-2020 and which from mid-2017 on forms the reference for the planning of the Solutions delivery:

ATM Master Plan Key Feature	Solution ID	Solution Name	Maturity Level (Release #7)
 High-performing airport operations	PJ.03b-06	Safety support tools for runway excursions	V1
	PJ.04-02	Enhanced Collaborative Airport Performance Management	V1

ATM Master Plan Key Feature	Solution ID	Solution Name	Maturity Level (Release #7)
	#26	Graphical Taxi Routing display for pilots	V3
 Advanced air traffic services	PJ.01-03a	Improved Parallel Operations	V1
	PJ.14-03-04	Alternative Position, Navigation and Timing (A-PNT)	V1 (TRL2)
 Enabling aviation infrastructure	PJ.15-01	Sub-regional Demand Capacity Balancing Service	V1 (TRL2)
	PJ.15-02	Delay Sharing Service	V1 (TRL2)
	PJ.15-08	Trajectory Prediction Service	V1 (TRL2)
	PJ.15-09	Data Centre Service for Virtual Centres	V1 (TRL2)
	Moved to Release 8		
	PJ.15-10	Static Aeronautical Data Service	V1 (TRL2)
	PJ.15-11	Aeronautical Digital Map Service	V1 (TRL2)
	PJ.16-03	Work Station, Service Interface Definition & Virtual Centre Concept	V1 (TRL2)
	Moved to Release 8		
PJ.17-08	SWIM TI Common runtime registry	V1 (TRL2)	

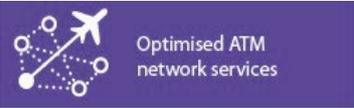
**Table 4: Solutions assessed in the context of Release #7 and their maturity level**

These achievements were regularly monitored against plan and reported into the SESAR JU’s formal governance structure, notably the Programme Committee.

**1.2.2.2 Release #8 planning**

The Release #8 definition phase was started off in late 2017, with an objective to deliver the Release Plan in March 2018, covering those SESAR Solutions performing Maturity gates up to April 2019 with validation activities conducted during 2018 and up to February 2019.

In its draft status at end 2017, the Release Plan for Release #8 plans the execution of 11 SESAR Solutions in V1/TRL2 and 14 Solutions in V2/TRL4 level of maturity:

ATM Master Plan Key Feature	Solution ID	Solution Name	Target Maturity Level (Release #8)
 <p>Optimised ATM network services</p>	PJ.07-03	Mission Trajectory Driven Processes	V2
	Includes PJ.18-01a	Addressed the technical part of "Mission Trajectory Driven Processes" (Not a SESAR Solution but an enabler to solution PJ.07-03)	V2 (TRL4)
 <p>High-performing airport operations</p>	PJ.02-08	Traffic optimisation on single and multiple runway airports	V2
	PJ.03a-09	Surface operations by RPAS	V1
	PJ.04-01	Enhanced Collaborative Airport Performance Planning and Monitoring	V2
	PJ.05-02	Remotely Provided Air Traffic Service for Multiple Aerodromes	V2
 <p>Advanced air traffic services</p>	PJ.01-01	Extended Arrival Management with overlapping AMAN operations and interaction with DCB and CTA	V2
	PJ.01-03A	Improved Parallel Operations	V2
	PJ.10-01b	Flight Centred ATC	V1
	PJ.10-02a <sup>23</sup>	Improved Performance in the Provision of Separation	V2
	PJ.10-05	IFR RPAS Integration	V1
	PJ.10-06	Generic' (non-geographical) Controller Validations	V1
	PJ.11-A2	Airborne Collision Avoidance for Remotely Piloted Aircraft Systems – ACAS Xu	V1
	PJ.11-A4	Airborne Collision Avoidance for General Aviation and Rotorcraft – ACAS Xp	V1
	PJ.14-02-04	FCI Network Technologies incl. voice solutions and military interfacing	V1 (TRL2)
PJ.14-02-05	Development of new services similar to FIS-B to support ADS-B solutions for General Aviation	V1 (TRL2)	

<sup>23</sup> In 2017, PJ.10.02b in V1 in 2018 has been planned for Release #9

ATM Master Plan Key Feature	Solution ID	Solution Name	Target Maturity Level (Release #8)
	PJ.15-01	Sub-regional Demand Capacity Balancing Service	V2 (TRL4)
	PJ.15-02	Delay Sharing Service	V2 (TRL4)
	PJ.15-09	Data Centre Service for Virtual Centres	V1 (TRL2)
	From Release 7		
	PJ.15-10	Static Aeronautical Data Service	V2 (TRL4)
	PJ.15-11	Aeronautical Digital Map Service	V2 (TRL4)
	PJ.16-03	Work Station, Service Interface Definition & Virtual Centre Concept	V2 (TRL4)
	From Release 7		
	PJ.16-04	Workstation, Controller productivity	V1 (TRL2)
	PJ.17-01	SWIM TI Purple Profile for Air/Ground Advisory Information Sharing	V2 (TRL4)
	PJ.17-03	SWIM TI Green profile for G/G Civil Military Information Sharing	V1 (TRL2)
	PJ.17-08	SWIM TI Common runtime registry	V2 (TRL4)

**Table 5: Solutions assessed in the context of Release #8 (as per draft Release Plan as at end 2017) and their target maturity level**

## 1.3 Strategic Area of Operation 3: Deliver Very Large-Scale Demonstration Activities

### *Objectives and target achievement status at the end of 2017:*

- *Call reference 2015-2 (VLD Wave 1 Call): all projects launched into execution & relevant grant budget amendments completed*
- *Call reference 2016-2 (VLD Open Call): evaluation, Grant preparation & signature, 4 projects launched into execution and 4 additional grant agreements are in preparation*
- *Call reference 2017-1 (VLD Geo-fencing Call): preparation, launch and evaluation*
- *Call reference 2018-1 (U-Space demonstrations) preparation*

In the beginning of 2017, all projects resulting from the IR/VLD Wave 1 call for proposal launched in 2015 (call with reference H2020-SESAR-2015-1) were in full execution. This represents 5 VLD activities (IR projects are presented in the previous chapter) for a total amount of EUR 37,7 million.

Furthermore, in 2017, the SESAR JU conducted the evaluation of proposals received in response to the open call for VLD activities (coupled with ER3 in the call with reference H2020-SESAR-2016-2).

This chapter presents the status of the projects resulting from the Wave 1 call for proposals and their main achievements, then results and achievements of the Release 7 and planning of the Release 8, then developments in relation with the Wave 2 planning.

### 1.3.1 Status of the calls already launched before 2017

#### 1.3.1.1 VLD Wave 1 call (with reference H2020-SESAR-2015-2)

The first call on Very Large-Scale Demonstration activities, which was restricted to SESAR JU members, within the call with reference H2020-SESAR-2015-1<sup>24</sup> also covering Industrial Research, was closed on 20 April 2016. Call provisions are summarised in the SESAR JU's Consolidated Annual Activity Report for 2015<sup>25</sup>. The evaluation of the proposals (run in 2016) resulted in the award of grants for 5 VLD activities with a total value of EUR 37,7 million. The main outcome of these projects is summarised in the paragraph below, while further detail on the general objectives, funding level of each project and its main activity in 2017 can be found in the annex I.1.

- **PJ.28 IAO** 'Integrated Airport Operations': The project team refined the project management plan, communication and dissemination plan and work schedule in the first months of 2017. The rest of the year was dedicated to the planning of the different demonstrations, including the development of the demonstration platforms and pre-operational prototypes.
- **PJ.24 NCM** 'Network Collaborative Management' submitted the DEMO Plan, which from that moment constitutes the main document in terms of management of the Project and also serves as Exercise Guide. It includes from the spread of the participation of partners in each of the tasks to Use Cases to be demonstrated and schedule of the different executions. Project

<sup>24</sup> Call documentation is available on the [Participant Portal](#)

<sup>25</sup> [SESAR JU Annual Activity Report for 2015](#)

also focused on the planning of the different demonstrations, including the development of the demonstration platforms and pre-operational prototypes.

- **PJ.25 xStream** 'Arrival Management Extended to en-route Airspace' submitted the DEMO Plan, which from that moment constitutes the main document in terms of management of the Project and also serves as Exercise Guide. It includes from the spread of the participation of partners in each of the tasks to Use Cases to be demonstrated and schedule of the different executions. Project also focused on the planning of the different demonstrations, including the development of the demonstration platforms and pre-operational prototypes.
- **PJ.31 DIGITS** 'Initial Trajectory Information Sharing': The project submitted the Demonstration Plan, (DEMOP) which constitutes the main document in terms of project management planning of validation exercises. More specifically it addresses the demonstration objectives, assumptions, nine demonstration exercise plans, simulator sessions and Airspace User participation. Eleven development flights were performed to provide baseline data. Ground simulator coupling sessions are being performed between Airbus and ANSPs, between Aircraft and ANSPs and between Ground partners.

PJ.27 was terminated in 2017 following the SESAR JU specific action related to the Interoperability (IOP) topic which is reported upon in section 1.4.3.3 below.

It is expected that all VLD activities will continue over 2018 and will complete their delivery in late 2019 or early 2020.

### 1.3.1.2 VLD Open 1 call (within the call with reference H2020-SESAR-2016-2)

The second call for proposals on Very Large-Scale Demonstration, which was an open call within the call with reference H2020-SESAR-2016-2<sup>26</sup> also covering Exploratory Research (see above in 1.1.3), was open on 15 December 2016 and closed on 11 May 2017.

#### Call evaluation process

For the 'Very Large-Scale Demonstrations' Work Area, a total of 19 proposals were received and evaluated in 2017. The proposal evaluation process involved several phases where external experts (independent experts) were paired with SESAR JU ATM scientific expert representatives and together they evaluated proposals received in accordance with the published procedures of H2020.

The Scientific Evaluation and Ethics Review Process was conducted according to H2020 procedures.

#### Call results

The evaluation of the proposals was completed in December 2017 for the 'Very Large-Scale Demonstration' Work Area with the award of 8 projects for a total value of EUR 17,2 million. The subsequent grant agreement signature process started in 2017 and will be concluded in early 2018. The grants awarded in that context will deliver their results in the period from 2018 through to 2020.

The table below provides an overview of the projects currently in execution following the successful completion of the grant signature process. As the first grant agreements were signed in the last period of 2017 and the last ones will be signed in 2018, no detail on the project activities is reported in Annex I.1.

<sup>26</sup> Call conditions were set in SJU Annual Work Programme 2016. Call documentation is available on the [Participant Portal](#)

Topic description	Projects	Max. total co-financing value (in EUR)
Increased access to airports for low visibility mixed fleet	AAL2 (Augmented Approaches to Land 2)	2.110.729
Solutions for General Aviation and Rotorcraft	GRADE (GNSS Solutions for Increased GA and Rotorcraft Airport Accessibility Demonstration)	1.156.015
	GAINS (General Aviation Improved Navigation and Surveillance)	1.453.690
Safe integration of drones	PODIUM (Proving Operations of Drones with Initial UTM Management)	1.395.649

**Table 6: Very Large-Scale Demonstration activities selected as a result of the call H2020-SESAR-2016-2 in 2017 and their max. co-financing value**

In addition, in 2017 the SESAR JU prepared grant agreements for the following project which are expected to be signed in early 2018:

Topic description	Projects	Max. total co-financing value (in EUR)
Arrival Management Extended to En-route airspace	Airline Team xStream (Airspace User Support to Arrival Management)	1.800.963
Network collaborative Management	Airline Team NCM (Airspace User support to the development of Network Collaborative Management)	2.008.650
Initial Trajectory Information sharing	DIGITS-AU (Demonstration of ATM Improvements Generated by Initial Trajectory Sharing- Airspace User Part)	4.527.147
Applications for trajectory based and queue management using EPP extended into oceanic/intercontinental operations: inter-continental trajectory based operations enabled by Satellite based CNS	EAGLES (Europe-America Global Links Enabled by Satellites) <sup>27</sup>	2.777.622

**Table 7: Very Large-Scale Demonstration activities selected as a result of the call H2020-SESAR-2016-2 in 2017 for which grant agreement has not been signed and their max. co-financing value**

### 1.3.2 Very Large-Scale demonstrations Active Geo-fencing call (SESAR-2017-1)

As set forth in the SESAR JU's Single Programming Document 2017-2019, the SESAR JU has been requested by the EC DG MOVE to organise Active Geo-fencing Service demonstration activities. The financing decision to organise the call for proposals in response to this request was made by the

<sup>27</sup> In 2017, the SJU prepared grant agreement for this project which was expected to be signed in early 2018 but was finally definitively rejected

Administrative Board in the context of the adoption of an amendment to the Single Programming Document 2017-2019. This call scope focuses solely on Active Geo-fencing Service. It is targeting demonstrations of web-based Geo-fencing solutions that use location signals to prevent drones from flying in no-fly zones. No-fly zones can be generated, monitored and controlled by the authorities responsible. The call for proposals has a total value of EUR 500 000. In response to this Delegation Agreement, in 2017 the SESAR JU has:

- Prepared and launched a call for proposals focusing on the purposes of the Delegation Agreement: the 'VLD Geo-fencing Call' (with call reference 2017-1),
- Received and evaluated proposals,

in accordance with the principles of sound financial management, transparency and non-discrimination detailed Title VI of the Financial Regulation.

### Call definition and publication

The SESAR JU was looking to award 1 project in response to the call for proposals, with a maximum duration of 2 years and an end-date no later than December 2019. Covering the integration of Remotely Piloted Aircraft Systems (RPAS) in the European airspace using an Active Geo-fencing Service (AGS), the project should demonstrate the benefits of an Active Geo-fencing Service for drones for operations below 150 metres (500 feet) and propose the necessary deployment actions to deliver fully the benefits claimed.

In finalising the scope of this call, the SESAR JU took into consideration the outcome of the VLD Open Call (call reference H2020-SESAR-2016-2, see 1.3.1.2) launched in the end of 2016, which included activities related to geo-fencing functions. This aimed to ensure that any gaps in the SESAR Project could be targeted and opportunities explored in order to make the most of the limited funding available.

The call was open on September 15th, 2017<sup>28</sup>, with a call closure on November 22<sup>nd</sup>, 2017, and with a plan to complete the evaluation and award process by early 2018.

The SESAR JU had investigated with the CSC the feasibility of using the H2020 IT Tools for the call publication, evaluation, grant preparation and award, and subsequent management of the grant. After analysis, the CSC confirmed on November 18<sup>th</sup>, 2016 that it was not possible to use H2020 IT tools. Therefore, the SESAR JU decided to revert to internal SESAR JU procedures.

### Call evaluation process

Two proposals were received on 22/11/2017 in response to the call for proposals. The proposals were first checked against the admissibility and eligibility criteria and then, for the ones passing admissibility and eligibility criteria, against the selection and award criteria.

The evaluation of proposals was carried out between 22/11/2017 and 13/12/2017 by an evaluation committee appointed by the Executive Director with ED Decision 2017-641, with the assistance of 2 external experts, selected in a way to ensure a high level of skills, experience and knowledge in the areas of the call (including domain expertise, project management, innovation, exploitation, dissemination and communication). The external experts were not members of the evaluation committee, and could not score the proposals, but their assessment was taken into account by the evaluation committee.

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<sup>28</sup> Call documentation is available on the SJU website: <http://www.sesarju.eu/sites/default/files/documents/procurements/SESAR-2017-1%20-%20VLD%20Geofencing%20-%20Call%20for%20proposals-%20CORRIGENDUM%201.pdf>

It was checked whether any of the applicants resulted in EDES. For 7 out of 11 Entities there was no flag in EDES system preventing them from participating to this Call. The remaining 4 Entities are relatively newly established and no information exists in ABAC. Additionally, the EC Beneficiary register (PDM) has been checked in order to identify whether any of these entities has been rejected under other Programmes (FP7 and H2020). As a result of the verification, the committee concluded that all proposals were eligible and that none of the proposals should be rejected on grounds of exclusion criteria.

The proposals were then assessed by each individual evaluator, both members of the evaluation committee, and external experts who briefed the evaluation committee on their findings. The evaluation committee then conducted consensus meetings with the aim to discuss individual points of view of its members and receive the opinion of the external experts.

### Call results

The proposals were evaluated and ranked against the award criteria set out in the Call for Proposals Section 9. The evaluation led to the recommendation for award of one of the proposals. The SESAR JU will adopt the award decision in early 2018 and will then establish the grant agreement with the selected beneficiary within Q1 2018.

### 1.3.3 Future calls in relation with Very Large-Scale Demonstration activities

In December 2017, the SESAR JU was mandated by the EC to perform U-Space demonstration activities under the Connecting Europe Facility (CEF) programme, related to the performance of a number of large-scale demonstrations to validate systems that support U-space services against the relevant requirements and standards. The Delegation Agreement has a total value of EUR 10 million.

In response to this Delegation Agreement, the SESAR JU organised and defined a call for proposals which will complement ongoing U-space activities, speed up U-space deployment and stimulate close cooperation with EASA, standardisation bodies and industry including newly emerging stakeholders. In 2017, the SESAR JU has prepared the call material ready to be launched by January 31<sup>st</sup>, 2018, including technical specifications and call specifications. The call conditions have been documented in the Single Programming Document 2018-2020 which was adopted by the Administrative Board on December 14<sup>th</sup>, 2017 and acts as the financing decision for the call.

Furthermore, the SESAR JU has investigated with INEA the feasibility and opportunity to use CEF tools for the publication, evaluation, award and management of the grants. Given the specifics of this call for proposals, it was decided, in agreement with INEA, to revert to internal SESAR JU procedures.

Subsequently, the SESAR JU has launched the call for proposals in January 2018<sup>29</sup> with a deadline for submission of proposals set on May 15<sup>th</sup>, 2018. The objective is to award 5 to 10 grants, for a total value of EUR 9,5 million<sup>30</sup>. An information day was organised on February 2<sup>nd</sup>, 2018. Subsequent to the reception of proposals, the SESAR JU will run the evaluation process and award the grants by end of Q2 or beginning of Q3 2018, so to launch projects in execution within Q3 2018. The SESAR JU plans to define the management procedures in 2018. Furthermore, in defining its management procedures,

<sup>29</sup> Call documentation is available on the SJU website: <http://www.sesarju.eu/procurement> (CALL FOR PROPOSALS - CEF-SESAR-2018-1 U-SPACE)

<sup>30</sup> The SJU dedicates 5% of the Union contribution to cover its running costs (especially for ex-post audit activities) as foreseen by the Delegation Agreement in its Article 5.1.



the SESAR JU will pay attention to ensuring a reasonable protection of personal data in accordance with Article 10 of the Delegation Agreement.



## 1.4 Strategic Area of Operation 4: Deliver Transversal Steering & SESAR Outreach

### **Objectives and target achievement status at the end of 2017:**

- ***IR Wave 1 Call: all Wave 1 Transversal projects were in execution & relevant grant amendments were completed***
- ***Strengthen the Global Interoperability activities and links towards Standard Making Organisations: the SJU maintained a continuous dialogue and took part in the working groups of EUROCAE, EASCG, EUSCG and RTCA, as well as in the working groups of ICAO and ECAC. Furthermore, the SJU leveraged existing cooperation agreement with international stakeholders (e.g. Japan and the US) and signed a memorandum of cooperation with the Qatar Civil Aviation Authority***
- ***Active cooperative arrangement with all European (Member States and Regions), International actors and other modernisation initiatives in Aviation relating to SESAR Definition and Development***
- ***Strengthen coordination with relevant Master Plan stakeholders and prepare next update of the Master Plan: the SESAR JU conducted the Master Plan update pre-campaign with the support of the Master Planning Committee***
- ***Strengthen dissemination of SESAR solutions/demonstrations through demonstration events, ATM events and publication: the SESAR JU participated to most important events relevant for ATM and Aviation at the European and international levels. The SESAR JU also used innovative dissemination method such as Virtual Reality tools***
- ***Continue to address identified R&D needs and gaps to secure safe integration of Drones: the SJU developed the U-space blueprint and delivered the addendum to the European Master Plan on Drones***
- ***Provide support to EC on other areas linked to the technological pillar of the SES including CP2: the SESAR JU developed the Common Project 2 proposal in collaboration with all relevant stakeholders for SESAR deployment***
- ***The SESAR JU planned the process for the definition of IR/VLD Wave 2, ER4 and VLD Open 2 calls for proposals in view of launching these calls in 2019***

A critical element of the mandate of the SESAR JU is to ensure the involvement of all stakeholders of the European ATM and of international aviation, and the steering of the SESAR programme activities for the modernization of ATM. To this end, the SESAR JU develops engagement frameworks at both the European and the international levels, and communication activities towards a variety of stakeholders.

Furthermore, as stated in Article 1.5 of its Founding Regulation<sup>31</sup>, the SESAR JU has the mission of “coordinating and concentrating all relevant research and development efforts in the Community” and “ensuring the supervision of activities related to the development of common products duly identified in the ATM Master Plan, through grants to members and through the most appropriate measures, such as procurement or the award of grants following calls for proposals to achieve the programme

<sup>31</sup> Council Regulation (EC) 219/2007 of 27 February 2007, as modified by Council Regulation (EC) 1361 / 2008 (SJU Regulation) and last amended by the Council Regulation (EU) 721/2014

*objectives*". These activities are grouped under the expression of "Transversal Steering". This section describes the activities conducted in 2017 in this context.

### 1.4.1 Master Planning activities

#### 1.4.1.1 Consistency of the three levels of the Master Plan

In terms of Master Plan maintenance activities, Level 1 (Executive Level) was unchanged in 2017 as the major update of the European ATM Master Plan is taking place in 2018 (see 2017 pre-campaign activities in 1.4.1.2 below).

As every year, consistency of Levels 2 and 3 with Level 1 was secured in 2017 through:

- For Level 2: The delivery of a Dataset 17 accompanied by a release note describing the evolution of this Level and confirming that none of the proposed changes affect the content of Level 1;
- For Level 3: The delivery of a Master Plan Level 3 implementation Plan – 2017, aiming at implementing Level 1 through implementation objectives of mature and performing Solutions. This work was delivered later than usual (October instead of July) to allow incorporating work carried out on the development of the CP2 recommendation, without prejudging on the adoption by the Commission. The Board is expected to launch the formal approval of the document in February – March 2018.

#### 1.4.1.2 Pre-campaign activities

As the major update of the European ATM Master Plan takes place in 2018, and in the light of the lessons learned from the previous campaign (2015) and the perceived need to implement a permanent governance and steering, pre-campaign activities were carried out throughout 2017.

A Campaign charter was developed by the SESAR JU and endorsed by the Master Planning Committee in July 2017, covering three main pre-campaign activities:

- The development of a CP2 recommendation reflecting another coordinated phase of SESAR 1 implementation;
- The development of a "Roadmap for the safe integration of drones into all classes of airspace";
- The development of a CNS Strategy.

Pre-campaign activities also consisted in a high-level campaign launch event, held under Estonian Presidency in Tallinn on 8 November 2017 as part of the "digital transport days", allowing placing the Master Plan under the overarching principle of "digitalisation of aviation".

##### 1.4.1.2.1 CP2 recommendation

Based on the Mandate received from the commission on 16 March 2017, the SESAR JU developed a CP2 Recommendation for the Commission. Three Working Groups, with members designated by the Master Planning Committee members and thus covering all stakeholder categories plus the key players in the European ATM (EC, EDA, EASA, EUROCAE, NM, SDM, EUROCONTROL) were set up to support the development of the Recommendation: WG1 Business Cases and Deployment scenarios, WG2 CNS rationalisation, and WG3 Standards & Regulations.

The SESAR JU made a final presentation of the CP2 draft Recommendation to the Master Planning Committee on 23 November and sought advice on a few but important remaining issues. The MPC found agreement on a way forward and asked the SESAR JU to finalise the Recommendation

accordingly. This will imply a few weeks of delay in the submission of the Recommendation to the Commission.

#### **1.4.1.2.2 Roadmap for the safe integration of drones into all classes of airspace**

Following the Drones market study of 2016, the SESAR JU was mandated by the Commission to, first, develop a “U-space Blueprint” and then a “Roadmap for the safe integration of drones into all classes of airspace”. The BluePrint was successfully delivered to the Transport Commissioner in May 2017, and served as stepping stone to develop the Roadmap, which aim at constituting an input to the Master Plan update campaign. Approval by the SESAR JU Board of the Roadmap document was initiated in December 2017, and the results will be known early in 2018 with a view to a smooth integration into the Master Plan campaign, also incorporating the comments collected and the points raised in the Helsinki declaration on the Regulatory roadmap.

#### **1.4.1.2.3 CNS Strategy**

On request of the European Commission, the SESAR JU developed a SESAR CNS and Spectrum strategy document, which was endorsed in November 2017 by the Master Planning Committee and will constitute a substantial input to the 2018 Master Plan update campaign.

### **1.4.2 Planning the IR/VLD Wave 2, ER4 and VLD Open 2 calls**

As specified in the Multi Annual Work Programme (MAWP)<sup>32</sup>, the end of projects under the calls already launched at the end of 2017 is scheduled between mid-2018 (for projects and grants under ER1), the end of 2019 (for projects and grants under IR/VLD Wave 1) and 2020 (for ER2-RPAS and ER3). In order to complete SESAR 2020 Programme research and innovation objectives, the SESAR JU plans to launch three new Calls for proposals in 2019, referred to as “ER4”, “IR/VLD Wave 2” and “VLD Open 2”. These Calls for proposals will lead to grant signature and actions to be in execution from late 2019 (IR/VLD Wave 2), Q1 2020 (ER4) and mid-2020 (for VLD Open 2) onwards. ER4 and VLD Open 2 are open Calls for proposals, while IR/VLD Wave 2 will be restricted to the SESAR JU members.

In 2017, the SESAR JU has prepared the planning activities related to these calls, by setting up an approach to the definition of the content (including the prioritisation of the Solutions to be developed and topics to be addressed), by defining the link with the ATM Master Plan update that will take place in 2018 and which should drive the priorities of these calls for proposals, and by defining the consultation with advisory bodies (namely, the Programme Committee and its sub-committees, the Master Plan Committee and the Scientific Committee, see below in section 1.4.4). This process and approach have been documented in the SPD 2018-2020 and approved by the Administrative Board in that context.

### **1.4.3 Advice to the EC on technical and business aspects of the SES**

#### **1.4.3.1 Airspace Architecture study**

On 10 November 2017, the SESAR JU signed a Delegation Agreement with EC (DG MOVE) to develop a proposal for the future architecture of the European Airspace.

Inspired by the concept of “Trans-European Motorways of the sky” of the European Parliament, embracing a new era of innovation and digital technologies in consistency with the Single European Sky initiative, the European Aviation Strategy and the European ATM Master Plan, this proposal for the

<sup>32</sup> The Multi-Annual Work Programme was adopted by the Administrative Board in 2015 (decision [ADB\(D\)-05-2015](#))

future European airspace architecture, will aim to more efficiently support traffic flows and promote an optimised provision of air navigation services and the enabling ATM/CNS infrastructure. It will fully respond to the needs of the airspace users and support the concept of European Upper Information Region (EUIR).

This activity should take into account SESAR-related operational concepts and technologies in view of defining a high-level deployment scenario. It should also support the development of a SES vision towards the 2035 horizon and associated high-level goals in particular with regards to the contribution to performance in terms of safety, capacity, environmental impact and flight efficiency. Furthermore this activity will provide the rationale and underlying assumptions to further update the European ATM Master Plan.

The outcome of this activity shall set the SESAR JU vision on how the European airspace architecture should look like in the medium to long term (2035), describing the intended airspace organisation, design and operations and the steps to be taken to achieve that architecture.

Building on the expertise of the SESAR JU and the Network Manager in this area, the SESAR JU will prepare, launch and manage the project, involving where appropriate the contribution from the Network Manager.

The Delegation Agreement has a total value of EUR 800 000.

In response to this Delegation Agreement, in 2017 the SESAR JU has established an action plan including procurement activities to be conducted in 2018 in accordance with the principles of sound financial management, transparency and non-discrimination detailed Title VI of the Financial Regulation.

These procurement activities have been documented in the Single Programming Document 2018-2020 which was adopted by the Administrative Board on December 14th, 2017 and acts as the financing decision for the procurement activities.

In 2018, the SESAR JU will prepare specifications for calls for tender and procurement procedures to be launched from early 2018 onwards, in view of conducting the study and developing the proposal by the end of 2018.

The study will follow procedures that comply with the applicable regulation(s). The SESAR JU plans to define the applicable management procedures in 2018. Furthermore, in defining its management procedures, the SESAR JU will pay attention to ensuring a reasonable protection of personal data in accordance with Article 10 of the Delegation Agreement.

#### 1.4.3.2 Cyber-security

Early 2017, under the authority of the Programme Committee, a cyber-security taskforce, with representation from all SESAR JU members, was launched. The taskforce prepared the programme's cyber security strategy introducing the notion of prioritization that allowed a focused cyber-security approach. This strategy, with supporting methodology, catalogues, templates, maturity criteria and confidentiality framework, as endorsed in October 2017 by the Programme Committee, ensures full commitment by all members to the agreed cyber-security approach.

The key is to deliver securable and cyber-resilient solutions. Priority is given to security activities for solutions that can improve cyber-resilience through security by design, solutions that come with a substantial risk of delivering an un-securable solution if security were not properly addressed during R&D, and those solutions that address technologically complex architectures or use new technologies. For other solutions elements of the security risk assessment that can harmlessly be postponed beyond

the R&D phase, will indeed be postponed to free up resources for the more essential security risk assessments.

The level to which security risk assessment, applying security architecture principles, managing security requirements and designing/prototyping security risk mitigation measures, including security-by-design and security management principles should be performed, depends on security prioritization of the solutions and the actual TRL-level achieved. This notion of security prioritisation has been fully integrated into the SESAR's Security Risk Assessment methodology, the corresponding templates and the solution maturity criteria.

With the aim to share best practices, the security “community of practice” has been kicked-off, allowing security experts from all over the programme to exchange ideas and learn from each other. In support of this, best practices on primary assets, supporting assets, threats, vulnerabilities and controls are documented and maintained through the SecRAM security catalogues that are shared across the programme.

A cross check of the produced security material at solution level against the programme generic maturity criteria will serve as input to the project maturity gates, ensuring availability and quality of the required security material.

The strategy includes the definition of a confidentiality framework to enforce a strict access control and protection of security sensitive material. The objectives of enforcing access control are to enable sharing of security-sensitive information amongst SESAR actors as much as possible to allow for the improvement of best practices, while restricting access to security-sensitive information as necessary, and certainly to protect against malicious use of security-sensitive information.

The SESAR JU also participates to all working streams of the Cyber Security European Strategic Coordination Platform (ESCP), to ensure consistency with the overall European approach and also to ensure considerations and needs from an R&D perspective will be addressed.

#### 1.4.3.3 IOP recovery activity

Efficient use of Air Navigation Services infrastructure based on interoperable standards and services is central to the SESAR vision as outlined in the European ATM Master Plan. This approach builds directly on Interoperability Regulation (EC) No 552/2004 with an objective to establish the new generation of information exchange between Air Traffic Control centres in Europe. While the plan for deploying this new technology is already established through the Pilot Common Project, the finalisation of the development and delivery of the related SESAR Solutions (in particular the SESAR Solution relating to Interoperability between ground systems (IOP)), and subsequent standardisation steps are now on the critical path. Following the identification in October 2015 of risks between the SESAR delivery of the “IOP” Flight Data Processing exchange solution and the associated standardisation work within EUROCAE, the SESAR JU established, as part of the SESAR 1 Programme, a dedicated Task Force and specific decision-making process at technical level which enabled already the delivery of a first set of operational and technical requirements called “initial IOP”. “Initial IOP” was clearly identified as a first mitigation action related to the identified IOP risks.

In SESAR 2020, IOP activities aim at further completing the validation of these requirements with the objective of delivering the IOP solution ready for standardisation and deployment (including industrialisation). In 2017, during the ramp up of the SESAR 2020 projects dealing with IOP (PJ.18 & PJ.27), some additional issues on projects dependencies, time line and technical development were raised by participating SESAR JU members leading to a possible additional delay of the solution delivery date, putting the development–deployment sequence at risk.

Consequently, the Programme Committee in its third session held in July 2017 recommended additional mitigation actions with in particular the endorsement of the key IOP roadmap milestones to secure the PCP IOP requirement by 2025 (implementation), to ensure the update of the EUROCAE standards by 2021 and to ensure close monitoring of the IOP solution development for a delivery of the solution by September 2020.

As a consequence, the PJ.27 dealing with IOP demonstration activities has been terminated in order to ensure that all resources will be focused on the development of the IOP solution.

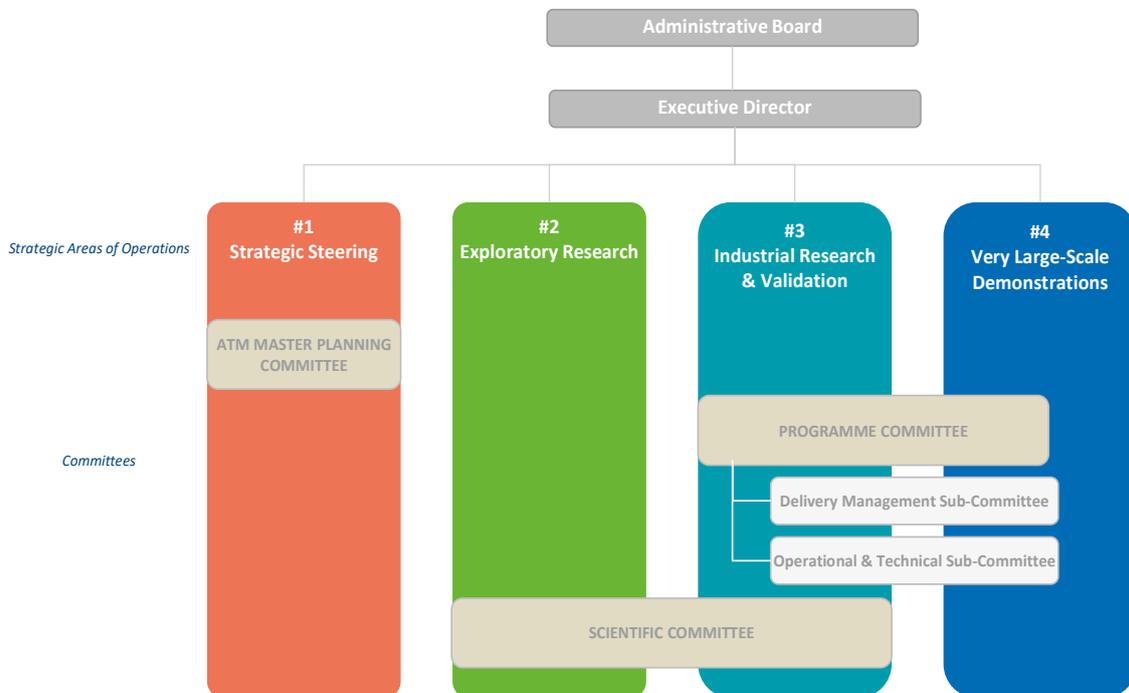
The proposed recommendations and mitigation actions were supported by DG MOVE that invited the SESAR JU members contributing to the IOP development to confirm their commitment.

Recognising that an IOP solution is critical to enable the European aviation infrastructure to evolve towards higher level of interoperability, digitalization and automation, the SESAR JU members contributing to the IOP development did confirm their commitment in the delivery and subsequent deployment of a SESAR Flight-Object IOP solution.

Simultaneously and with a close SESAR JU monitoring, work has been progressing as part of the existing project (PJ.18 – Wave1) to further define a set of operational and technical requirements mature enough to progress towards the target set by the PCP regulation according to the agreed IOP Roadmap. SESAR JU will continue to steer the work towards a deployable IOP Solution and will carefully consider efforts and funding dedicated to it.

**1.4.4 Contributions from the SESAR JU governance and advisory bodies in steering the SESAR 2020 programme**

The governance of the SESAR 2020 Programme can be depicted as follows:



**Figure 9: Governance of the SESAR 2020 Programme**

The following paragraphs summarise the contribution of the Administrative Board (SESAR JU governance board) and of the advisory bodies (Programme Committee, ATM Master Planning Committee, Scientific Committee) to the SESAR JU activities.

#### 1.4.4.1 Contributions of the Administrative Board in 2017

Contributions of the Administrative Board are addressed in Part IIa. Section 2.1.

#### 1.4.4.2 Contributions of the Scientific Committee in 2017

The Scientific Committee (SC) supports the SESAR JU Executive Director in assuring the scientific excellence of the SESAR 2020 Programme. In particular, this Committee will, under the chairmanship of the SESAR JU, take a monitoring view (content and results) over the Exploratory Research activities of the SESAR 2020 Programme and transition to Industrial Research and Validation, while also providing the ED with scientific advice covering the whole range of SESAR JU's SESAR 2020 research activities. Since its establishment in February 2017, the Scientific Committee has progressed at a fast pace pursuing clear, well defined and structured tasks. The strong commitment of the members, their geographical heterogeneity (represented states are Germany, Hungary, Italy, Netherlands, Serbia, Slovenia, Spain, United Kingdom), their heterogeneous background (universities, Air Navigation Service organisations, research centre organisations,) and respective expertise have paved the way to the achievement of significant results achieved over the first ten months of work.

In order to foster transition between Exploratory Research and applied and industrial research, an observer seat is reserved to a representative of the Programme Committee. In 2017, 5 new members of the Scientific Committee were appointed following an open call for expression of interest.

Furthermore, the constant engagement with the SESAR JU communication media (e-news, LinkedIn, Twitter) and the attendance of external observers from DG-MOVE, EUROCONTROL and the SESAR Programme Committee have boosted the visibility of the Committee to all levels inside and outside the organisation (e.g. SESAR JU was contacted for more insight on the SC for "revamping the way of working of the Scientific Committee in the Shift2Rail JU") and created a higher awareness of its scope and ongoing work.

The involvement of the members of the SC in the evaluation of the applications for the SESAR Call on Active Geo-fencing Service to prevent the incursion of drones into protected areas, for the Young Scientist Award assignment and for the SID's papers review have created a positive working climate and a commitment to maintain the current momentum supporting the setup of a common network for the promotion of air traffic management research in Europe.

Moreover, the active contribution of the SC members to the organisation of thematic workshops and fora falling within the SESAR JU initiatives has also contributed to put their work under the spotlight of the SESAR JU communication media.

The most important achievements and conclusions of the four active Task Forces are summarised hereafter.

Regarding the **Automation** Task Force, during the first ten months it has performed an assessment on automation-related research in SESAR1 and SESAR 2020, especially focused on IR and ER (WPE) research projects of SESAR1. It also analysed how automation is being used in other related fields of application, such as autonomous and connected cars, trains and underground automation, maritime transport and aerial and maritime drones, with a focus on the role of machine learning/artificial intelligence (ML/AI) in those systems, and how they could be incorporated into heavily constrained, safety-oriented sociotechnical systems such as ATM. The Task Force derived a list of limitations both

on the (somehow restrictive) definition of automation as “a device or system that accomplishes (partially or fully) a function that was previously carried out (partially or fully) by a human operator” and on the limitations of the assessment and validation procedures of automation systems used in SESAR. From this list, and also from the analysis of limitations of learning/artificial intelligence system applicability, the Task Force provided recommendations and possible directions for future research such as analysing the team dimension and role of communications, or research on agent- based simulation to search for emergent behaviours due to interaction in complex systems. Other recommendations regard the need to strengthen some of the current research areas related to the identification of applications of ML/AI all across ATM (to solve problems which are complex, non-linear, having high dimensionality relations, and/or blurry definitions). Finally, the definition of a 2035+ ATM automation framework is still a work in progress and a focus for the next year’s activity of the Task Force.

Regarding the **Innovation Pipeline** Task Force, it aims to help streamline the innovation pipeline, from the basic, fundamental (exploratory) research, through the industrial research development to the deployment of the developed solutions. During the first year, the Task Force focused on the first part of the pipeline – the bridge between the Exploratory Research (ER) and Industrial Research (IR) activities. Based on the experience of the SESAR1 Scientific Committee, a review of the ER projects’ presentations, and dedicated presentations of the chosen projects, the TF recommends:

- Need a “pull” from the IR/VLD projects not just “push” the ER projects into the IR/VLD programme;
- IR/VLD projects to consider using some of the resources used in ER projects (as a LTP or subcontractor) to ensure knowledge transition;
- Definition of a ‘Benefits Owner’ (PoC) role, and the PoC support for each of the ER projects in the main programme;
- PJ.19 to play a key role but specific projects could ‘own’ the specific outputs;
- Gap Analysis of what is missing (to identify new ER projects for wave 2) – by PJ.19 / IR projects;
- Use the OTSC.

Proposed next steps include the continued analysis of the results of ER-1 projects to help identifying the links between ER and IR, and the definition of the recommendations for the ER-4 and Wave2 calls; definition of the scheme/mechanism/possibilities of the transition from ER to IR/VLD (potentially making use of the ER-3 Engage Knowledge Transfer Network project), as the knowledge transfer should be ensured, and the IPR matters addressed.

Regarding the **Performance Measurement** Task Force, the aims are to identify key challenges in performance measurement in the wider context of air transport, and to establish an initial performance measurement ‘scoping framework’ to capture the state-of-the-art regarding existing and new indicator development. This ‘scoping framework’ is a horizon scanning action, differentiated from the SESAR 2020 “performance framework” maintained by PJ.19. The two activities are complementary and mutually aligned.

The initial scope was to identify indicators that were currently missing, with a particular focus on the ‘long term’ timeframe, defined as lying beyond the SESAR ambitions of 2035 (as specified in the (2015) Master Plan), and the ‘far term’ (at and beyond 2050). This scoping assessment clearly required an understanding and mapping of the ATM (and air transport) operational and policy (target) landscape of the future timeframe, in order to determine the type of indicators that might be required. For example, to measure progress towards the Flightpath 2050 (ACARE) target regarding 4-hour door-to-door travel in 2050, there clearly needs to be a corresponding metric, which is currently absent. The

scoping framework was formalised into a collaborative, on-line document. High-level groups of factors and drivers of future change were specified.

A systematic review of SESAR Exploratory Research is considered useful to help populate the scoping framework. Liaison with PJ.19 is likely to be sufficient for coordination with the SESAR industrial research programme, due to the existing integration of the performance framework with planned deployment. The necessity of better tools to understand KPA/KPI trade-offs is well established. Covering a number of the recommended actions developed, the Task Force is organising a one-day Performance Work Forum, hosted at the SESAR JU premises, targeting the identification of priority actions for ATM performance assessment in Europe. Inter alia, Task Force members, the SESAR JU, a number of SESAR ER projects, PJ.19, PJ.20, EUROCONTROL, and selected other European performance assessment experts, will attend. The conclusions of this Work Forum will be reported subsequently. This should include planning for liaison with the Scientific Research Agenda Task Force and the SESAR Knowledge Transfer Network (KTN).

Regarding the **Scientific Research Agenda** Task Force, it focussed on assessing parameters of success and challenges in defining research programmes in ATM, and more broadly in air transport. It decided to investigate two primary contexts:

- Firstly, the importance of managing knowledge related to the state of the art in technology, systems and operations. Challenges and potential solutions for assessing, disseminating and recognising the state of the art across different TRLs and at different integration levels have been discussed;
- Secondly, specific focus was applied to creating an inventory of the master plans and high-level initiatives in the air transport domain. It was recognised that each master plan has its individual, specific perspective in terms of region, mobility segment, drivers and success criteria. To pave the way towards a coherent master planning document the Task Force opted for proposing and defining actions required to identify gaps and omissions, along with identifying and analysing actions already ongoing at European level.

Seven Coordinated Support Actions of H2020 were reviewed and a priority for coordination with four of them has been defined. In addition, the SESAR Knowledge Transfer Network “Engage” was identified as a potential highly relevant mean in supporting the process of developing a scientific research agenda. Finally, the Task Force recommended establishing a focus beyond the international ‘ATM master plan’ initiatives addressing aviation, beyond SESAR, and including multi-modal transport to assess dependencies and synergies. The potential to launch a coordination action, such as a Work Forum was identified, which could include selected entities in H2020 CSAs and projects, for example, and the SESAR KTN.

#### 1.4.4.3 Contributions from the Programme Committee in 2017

Since its establishment in November 2016, the renewed Programme Committee did assist the ED in the establishment of clearly defined and effective programme management through strategic guidance and tactical steering of the SESAR JU’s work programme, but with its remit limited to the higher maturity Industrial research, validation and large scale demonstration activities.

A total of 4 meetings were held in 2017 with the aim of addressing the following key topics:

- The ramp up of the Wave 1 projects was closely monitored to ensure alignment to the programme management processes and to the H2020 rules. Any project issues (e.g. difficulties with ethics deliverables, Project Management Plan) reported by the members were assessed and fixed through collaborative approach.

- The specific Budget Amendment process defined in the Annual Work Programme 2016 was launched in early January. In a first phase, this process requires a preparation of the amendment to be done based on the SJU members reporting on their achievements and justifying the need for additional budget for covering the following projects activities. These reports were reviewed by the SESAR JU in a collaborative way with the different projects, taking 2 months to complete. The outcomes of the review together with the projects proposed amendments were tabled to the programme Committee in March for approval. As a follow up, the Programme Committee agreed to launch the formal H2020 Budget amendment. However, besides the fact that this process of amendments is complex and requires a lot of effort from members and the SESAR JU, it can start only once the SESAR JU receives the “Annual Financial Implementation Agreement” from the EC, which ‘unlocks’ funds for the year ahead. In 2017 the formal launch of the amendment had to be delayed because of the late delivery of this “Annual Financial Implementation Agreement”. Therefore the H2020 process was only completed in September.
- The SESAR JU delivery approach is based on the Release process that identifies on a yearly basis the Solutions that will be delivered at a specific maturity level together with the planned demonstration activities from the VLDs. With the launch of the projects at the end of 2016, the Release 7 Plan had to be defined in 2017 based on the validation activities information extracted from the projects schedules. The Programme Committee approved the Release 7 Plan before the summer. The monitoring of the execution of the validation activities was performed by the SESAR JU who regularly reported the progress to the Programme Committee. Similarly, the Release 8 Plan was progressively established with a focus on the SESAR Solutions to be validated in 2018. A first draft Release 8 Plan was made available by the end of 2017 for member’s perusal. This will allow the approval of the Release 8 Plan by the Programme Committee early in 2018.
- Considering that the IOP solution (Interoperability between ATM Ground Systems) is critical to enable the European aviation infrastructure to evolve towards higher level of interoperability and automation, the Programme Committee closely monitored the progress made in its development. Some issues about the design of the features, use cases and requirements were reported leading to the identification of mitigation actions recommended by the Programme Committee.
- Moving ATM towards increased automation and connectivity also requires cyber security to be addressing adequately. Therefore in November 2016, SESAR JU presented to Programme Committee a cyber-security strategy aiming at delivering securable solutions. The Programme Committee decided to launch a specific task Force mainly to identify the security prioritized projects and to update the Security Risk Assessment Methodology (guidance material to be applied by the projects). The work performed by the Task Force was monitored by the Programme Committee. As a result, the Cyber Security Strategy and the security guidance material were approved by the Programme Committee that also agreed to close the Task Force and transfer the security transversal activity to PJ.19.
- As specified in the Multi Annual Work Programme (MAWP), the end of the Wave 1 projects is scheduled by the end of 2019. In order to complete SESAR 2020 Programme research and innovation objectives, the SESAR JU plans to launch, at the end of 2018, a Wave 2 call restricted to the SESAR JU members and covering industrial research activities and very large scale demonstrations. To prepare the Wave 2 call, SESAR JU defined a clear and coordinated procedure including a consultation process with the Programme Committee. In compliance with the process defined in the SPD 2018-2020, discussions were launched with the Programme Committee with the aim of identifying possible key solutions that would be

changing and improving the ATM in both an evolutionary and a disruptive way for the next coming 10 years. A first list of innovative solutions was included in the draft SPD2019-2021. The consultation of the Programme Committee will continue in 2018 with the objective of proposing a shorter list of Wave 2 SESAR Solutions by June (cut-off date). Subsequently, the SESAR JU will finalise the Wave 2 call technical specifications.

#### 1.4.4.4 Contributions from the ATM Master Planning Committee in 2017

The Master Planning Committee (MPC) was created as a governance body within the SESAR 2020 set-up, also building on the lessons learned from the 2015 Master Plan update campaign and the finding that it had become necessary to create and operate a permanent governance structure for all Master Planning activities in the wider sense of the term (e.g. also including work on common project recommendations, or on the “drones roadmap”). The MPC is a strategic advisory body reporting to the SESAR JU Executive Director. According to Article 1 of its approved Terms of reference, it *“shall provide expert advice and recommendations to the SESAR JU Executive Director on the maintenance, execution and update of the European ATM Master Plan and will contribute to maintaining a strong connection between the SESAR development and deployment activities”*.

The Master Planning Committee is composed of members mirroring the composition of the SESAR JU Administrative Board, i.e. ensuring representation of all key stakeholders (ANSPs, airspace users, airports and professional staff associations), the manufacturing industry (ground and airborne) and the key aviation institutions (European Commission, EUROCONTROL, European Defence Agency, SESAR Deployment Manager, Network Manager, EASA, EUROCAE).

A total of 4 face-to-face meetings were held in 2017, plus a web conference, with the aim of addressing the following key topics:

- Pre-campaign activities: Endorsement of the Campaign Charter with its key success criteria, high-level schedule and organisational structure, and the preparation of the high-level campaign kick-off event in Tallinn on 8 November 2017;
- Oversight and steering of the preparation of the “Drone Master Plan addendum”, which evolved into a “Roadmap for the safe integration of drones into all classes of airspace”. This implied the creation and steering of three dedicated working groups (1/ Controlled airspace, 2/ U-space and 3/ Standards and Regulations) which were active from March to September 2017;
- Oversight and steering of the preparation of the SESAR JU Recommendation on the content of a second common project. This implied the creation and steering of three dedicated working groups (1/ Business cases and Deployment scenarios, 2/ CNS rationalisation and 3/ Standards and Regulations) which were active from May to November 2017;
- Oversight and endorsement of the SESAR JU’s “CNS and Spectrum Strategy”, to serve as an input to the 2018 Master Plan update campaign.

The main results of these activities in 2017 are described in more detail in section 1.4.1 as part of the Master Planning activities of the SESAR JU.

#### 1.4.5 External Affairs

A fundamental principle of the SESAR JU is to broaden and deepen collaboration with a range of different stakeholders in order to benefit from their expertise and gain their assurance that SESAR activities and the SESAR Solutions meet the needs of the entire European ATM and aviation community. The fact that such stakeholders contribute to the SESAR JU activities, SESAR 2020 projects and validation activities, secures to a large extent the necessary operational and business inputs and

that results are in line with stakeholder expectations, specifically of the airspace users on the delivery of SESAR solutions. As such, their participation and active support to the SESAR JU and thereby the SESAR 2020 projects continued during 2017.

In 2017, the renewed cooperative arrangements with external stakeholders started up as a consequence of SESAR 2020 to fit with the financial rules and the rules of H2020. Updates to the arrangements were scheduled not to interfere with the activities in relation to the closing down of projects in SESAR 1 and to ease the workload on the SESAR JU legal and procurement sector. Most of them were concluded and restarted in 2017 with only a few remaining in 2018. The required changes from SESAR 1 due to the H2020 rules and arrangements were carefully considered so not to lose momentum in terms of active participation to the SESAR JU activities and the SESAR 2020 programme. The collaboration with external stakeholders is crucial to the success of SESAR JU tasks and a major contributor to the success of the SESAR JU deliverables.

The SESAR JU continued in 2017 to receive an even greater interest in several content areas including the Master Plan from third countries and ICAO. The SESAR JU participation with its members in the ICAO GANIS/SANIS event was a very good example proving interoperability and harmonisation globally, internationally, towards standard making organisations and of course to ICAO. The SESAR JU received several requests from ICAO to support the Secretariat in several areas to stay aligned with the European ATM Master Plan during 2017 and in the light of the upcoming ANC/13 continues in 2018. It is also worth mentioning that coordination under ECAC started in 2017 for the ICAO ANC/13 in October 2018

#### 1.4.5.1 The SESAR Deployment Manager (SDM)

During 2017, the collaboration under the 2015 MoU between the SESAR JU and SDM continued with bi-monthly meetings to iron out any particular areas of concern early and to create good relationships between the complete SESAR teams. During 2017 two Steering Committee meetings were held where the cooperative work was reviewed, discussed and given a steering on key topics. The cooperative arrangement covers as described previously the full ATM modernisation lifecycle all described in four annexes to the MoU. The SESAR JU and SDM respective focal points act as secretaries to the SC and the Annex leads work out common SDM/SESAR JU reports as steered by the SC meetings. Of particular interest during 2017 were the coordination around the MP 2018 campaign, PCP review. NextGen programme as a consequence of the 2017 amendment of the previous MoC from 2012. Also part of the coordination was building on the common strategy for communications with events and publications, specifically for events like the World ATM Congress 2017. The collaboration between the SESAR JU and the SDM is part of the mitigation of risks recognised in the coordination of the ATM Master Plan (see in particular risks CORP01 and CORP04 in chapter 1.6 'Overall risk level of SESAR JU activities at end 2017').

Aligning and bridging between development and deployment requires a major collaboration effort from both sides to support respective tasks and activities in order to safeguard the interoperability standards provisions of SESAR solutions. The differences in the organisations and the need to connect the full lifecycle of ATM modernisation requires monthly meetings in order to have all on the same page and to properly bridge between innovative research through industrial developments and validations/demonstrations (SESAR 2020) all the way to and including deployment of SESAR Solutions. The coordination platform under the MoC worked reasonably well during 2017 and will continue to improve during 2018.

Under the leadership of the SESAR JU, the MoC between EU and the U.S. on NextGen – SESAR interoperability has been enhanced in terms of participation, resulting in the complete SESAR JU and DM expertise being available and involved where necessary in common activities relating to the

definition (Master Plan), development (SESAR 2020) and Deployments (MP Level 2 and 3, Deployment Programme. Certain areas like, Risk management for interoperability and harmonisation, A/G Data communications, SWIM and Navigation have seen the full SESAR teams being involved in developing interoperability and harmonisation strategies and roadmaps for covering the short/medium/long term planning.

In the domain of interoperability and standards, the cooperation has further strengthened the links with Standard Making Organisations like EUROCAE (RTCA) etc. to support standardisation with SESAR material and by doing so ensuring alignment of priorities in relation to SESAR 2020, the ATM Master Plan, industry standards developments and the evolution of ICAO provisions.

#### **1.4.5.2 The European Aviation Safety Agency (EASA)**

The cooperation and coordination between EASA and the SESAR JU under the Memorandum of Cooperation from 2016 was furthered in the regulatory arrangements to prepare in good time for deployment of SESAR Solutions, research in the areas of aviation safety, environment, and interoperability, international cooperation on ATM with key third countries such as the U.S., China and South East Asia, supporting SESAR JU on ICAO activities on the Global Air Navigation Plan (GANP) and the ASBU's and Global Aviation Safety Plan (GASP) providing necessary support for international technical cooperation and on general mutual technical advice in the areas of CNS, Avionics, Spectrum technologies, drones especially in the light of air to ground interoperability.

#### **1.4.5.3 Standard-Making Organisations**

The collaboration between the SESAR JU and the standard-making organisations is part of the mitigation of risks recognised in the coordination of the ATM Master Plan (see in particular risks CORP01 and CORP04 in chapter 1.6 'Overall risk level of SESAR JU activities at end 2017').

##### **1.4.5.3.1 EUROCAE**

The SESAR JU continued to ensuring ongoing alignment between SESAR work and standards proposal developments and the EUROCAE working arrangements and planning through its active participation in the EUROCAE Council and Technical Advisory Committee. This included specifically drafting parts of the EUROCAE Technical Work Programme to ensure alignments with SESAR planning and needs.

During 2017, SESAR deliverables were made available in support of standardisation development work in several EUROCAE Working Groups covering several key content areas of the SESAR 2020 work as well as towards the coordination with the equivalent Special Committees of RTCA.

EUROCAE published 7 standards in 2017 with contributions from and of direct relevance to SESAR Solutions.

##### **1.4.5.3.2 The European Air Traffic Management Standards Coordination Group (EASCG)**

In 2017 the SESAR JU continued as an active participant in the European Air Traffic Management Standards Coordination Group (EASCG), with the objective to coordinate standardisation activities, identify their links with the R&D activities and to provide a forum for discussion. The SESAR standardisation roadmap is used as a major input in the European ATM Standardisation Rolling Development Plan, and provides not only the reference for ATM standardisation needs in European (including SESAR specific needs) but also serves as the basis for the European input of both the process and contents into the ICAO standardisation roadmap development.

### 1.4.5.3.3 *The European UAS Standards Coordination Group (EUSCG)*

In 2017 the SESAR JU joined as an active participant in the newly formed European UAS Standards Coordination Group (EASCG), with the objective to coordinate UAS related standardisation activities and needs.

### 1.4.5.4 **National Aviation Authorities**

Within 2017 SESAR JU renewed bilateral cooperation arrangements with National Aviation Authorities. The main objective of such cooperation with NSAs is to secure their early involvement in R&D activities so as to minimise the risks inherent to the transition between SESAR development and deployment activities. Sixteen Aviation Authorities expressed willingness to continue cooperation with SESAR JU and the SESAR JU started the Memorandum of Cooperation signature process. The first meeting between SESAR JU and Aviation Authorities has been conducted in Q4 of 2017, where a work plan and the main activities were discussed in detail.

### 1.4.5.5 **Military and State Aviation – European Defence Agency**

In Europe, military aviation represents hundreds of military areas and dozens of military airfields. An estimated 30% of military flights fly according to the rules of General Aircraft Traffic (GAT), while the remaining operates as Operational Air Traffic (OAT). Sovereign military undertake a wide variety of missions for training purposes, homeland security (incl. sovereignty missions), as well as cross-border crisis management operations. For such missions, access to airspace is vital, however, given that these missions are often launched at short notice, military use of airspace is immediate and by default less predictable requiring more dynamic arrangements for securing efficient military operations without negatively impacting an efficient overall flow of air traffic. For this reason, the wide military involvement has been and still is paramount for SESAR solutions to enable effective military missions and airspace usage to be integrated with other users of airspace across Europe.

The SESAR JU and the European Defence Agency (EDA) have been engaged in close dialogue since 2011 and this relationship continued in 2017 to deepen on military matters and opinions into the Programme. EDA now serves as the main interface between SESAR 2020 and SESAR JU activities and military aviation and ATM and sets the responsibilities for EDA to facilitate the coordination of military views with regard to Single European Sky and SESAR. The cooperation under the MoC resulted in 2 Steering Committees in 2017 steering the activities securing military inputs into the Master Plan as well as technical advice to project evaluations and the programme in general. SESAR JU input into the EDA activities was at the same time increased in several areas where the SESAR input was and is required. Coordination between EDA, EUROCONTROL and NATO as well as with DGMOVE is established directly by EDA to make sure coordination with the greater military community in relation to key areas of the SESAR JU activities. During 2017 was also the year when EDA's participation was successfully established for the European SESAR inputs to the ICAO GANIS/SANIS and in events such as the World ATM Congress.

### 1.4.5.6 **Civil Airspace Users**

Civil airspace users (AUs) cover a wide spectrum of activities and undertakings, ranging from scheduled and charter airlines, cargo service providers to business and general aviation, including rotorcraft operations.

Civil airspace users are directly integrated within the Programme through four framework and related specific contracts, signed in the course of 2017 and reflecting the specific interests and skills of different categories of airspace users (Lot 1 European scheduled airlines; Lot 2 Global airlines, Lot 3

Business aviation and Lot 4 General aviation and rotorcraft). Their expertise is recognised as key in ensuring the overall success of SESAR.

In 2017 the airspace users started supporting the SJIU in the monitoring and steering of SESAR 2020 projects, providing substantial expertise into reviewing and commenting the first Solution Projects' deliverables, allowing assessing actual feasibility and testing the quality of SESAR Solutions and the benefits expected from their implementation. Their input was particularly important to provide airspace user communities' views, concerns and requirements on the SESAR JU recommendation on a CP2 and the preparation of the "Roadmap for the safe integration of drones into all classes of airspace".

#### 1.4.5.7 Professional Staff Organisations

The SESAR JU collaboration with the Professional Staff Organisations of the International Federation of Air Traffic Controllers' Associations (IFATCA), the European Cockpit Association (ECA), the International Federation of Air Traffic Safety Electronics Associations (IFATSEA), the European Transport Workers' Federation (ETF), and the Air Traffic Controllers European Union Coordination (ATCEUC).

The integration of Professional Staff Organisations expertise and direct support to the SESAR JU and thereby the SESAR 2020 programme continued with pool of a large number of licensed and operational controllers, pilots and engineers of all nationalities providing relevant and cross border operational knowledge of direct relevance to the successful deliveries of SESAR results and solutions.

In 2017, 4 quarterly coordination meetings were held to coordinate activities, priorities in a work programme agreed to support the SESAR JU and the Professional Staff Organisations in relation to ATM modernisation. The initiation of the 2018 ATM Master Plan campaign and the SESAR 2020 programme saw the planning for participation of the PSO's with a prioritised focus on areas of concern to the PSO's and the SESAR JU. Amongst these was an operational input on human performance/factors in relation to automation and safety resilience, cyber security, remote towers.

#### 1.4.5.8 Airports Council International, Europe

Recognising the need for further airport integration, the SESAR JU works closely with Airports Council International (ACI) to raise awareness about SESAR among airport partners – beyond the hub operators represented in the SESAR European Airports Consortium (SEAC 2020).

In 2017, the close collaboration between ACI Europe and the SESAR JU continued, allowing an efficient and constructive relationship, materialised by a new specific contract implementing the framework contract established in 2016 (see section 1.5.2.4 on Procurement). Through this contract, the following main activities were performed:

- ACI Europe and the SESAR JU organised three thematic workshop to promote airport related SESAR R&D and deployment activities:
  - A workshop titled 'airport operations management: the APOC story' in Brussels on 28 June 2016, preceded by a visit of the Airport Operations Centre (APOC) of Brussels Airport on 27 June 2017. The workshop attracted more than 50 participants who were given an overview of the SESAR 1 and SESAR 2020 activities on airport operations management. They could also learn about ongoing APOC implementations at various airports in Europe from the airport staff directly involved in these activities;
  - A workshop on remote towers in Budapest on 28 September 2017, preceded by a visit of HungaroControl's Remote Tower Centre on 29 September 2017. The workshop attracted more than 70 participants. The participants were given an overview of outcome of

- delivered SESAR 1 remote tower solutions and the ongoing SESAR 2020 remote tower activities. Several local remote tower projects and the status of the EUROCAE standardisation activities and EASA rulemaking activities were also presented;
- A workshop titled 'improving low-visibility operations at airports' in Frankfurt airport on 23 November 2017. The workshop attracted around 40 participants. The SESAR 1 and SESAR 2020 activities aiming at improving airport operations in low visibility and ranging from exploratory research to industrial research and demonstrations were presented by a variety of stakeholders;
  - ACI Europe supported the SESAR JU in communication activities by publishing several SESAR related news items and articles in ACI Europe's newsletters and magazine;
  - The SESAR JU promoted the work performed in SESAR and explained the benefits for airports at main ACI Europe events: the General Assembly, Airport Exchange, the Regional Airports' Conference and Exhibition, and the Technical and Operational Safety Committee bi-annual meetings;
  - A team of operational and technical experts from ACI Europe's member airports initiated an activity to identify the priorities for airports in terms of ATM R&D;
  - ACI Europe representatives participated in two PJ.04 validation open days on behalf of the SESAR JU, providing an airport experts' view on these activities to the SESAR JU; and
  - An ACI Europe representative participated in the SESAR Innovation Days 2017 in Belgrade as observer in order to increase the awareness of the airport community on the SESAR exploratory research activities.

#### 1.4.5.9 Space

##### 1.4.5.9.1 European Space Agency

The European ATM Master Plan clearly identifies the need for space-based positioning for navigation and communication services in support of time-based and trajectory-based operations, as well as for improved operations into less well-equipped airports or with differently-equipped vehicles. Coordination between ESA/Inmarsat Iris activities and the SESAR JU PJ.14 projects continued on SatCom. This activity allowed the development of a shared view on the value chain and interdependencies between both programmes.

##### 1.4.5.9.2 European GNSS Agency (GSA)

Informal coordination with GSA continued during 2017 pending the agreement of a MoC now scheduled for Q3 of 2018. This includes provision of SESAR views and exchange about potential overlaps, content issues, scope of ongoing and future calls and the development of a joint dashboard of GNSS projects/calls to avoid duplications and better manage the interdependencies.

#### 1.4.5.10 Clean Sky

In 2017, the cooperative arrangements with Clean Sky continued under the Memorandum of Cooperation signed in December 2015. The cooperation in 2017 covered areas like rotorcraft and general aviation capabilities and procedures, environmental performance measures and goals and to explore Clean Sky's process and relationship SME's in European regions. A particular area investigated during 2017 was on a deep-dive on Clean Sky JU and SESAR JU projects definitions and planning in order to avoid duplications and help to find synergies.

### 1.4.6 International Affairs

The SESAR JU continues to engage in international activities in the framework of the EU Aviation Strategy and in close coordination with the European Commission. The principal objectives are to secure SESAR's position as a global leader in ATM modernisation in support of ICAO's Global Air Navigation Plan (GANP), to support EU industrial leadership and to focus on SESAR Solutions for global interoperability and harmonisation.

During 2017, the SESAR JU continued its international relations work at ICAO and at bilateral levels. At the level of ICAO, the SESAR JU worked closely with the European Commission to ensure that Europe's ATM-related priorities were taken fully into account in ICAO's work to prepare the 2019 update of the Global Air Navigation Plan (GANP) and in the standards development processes. The SESAR JU participated to the European ICAO ATM Coordination Group together with the EASA, EUROCONTROL, ECAC and EUROCAE, and in particular helped to coordinate an active European participation at the ICAO GANIS/SANIS conference in December 2017 on topics related to SESAR definition, development and deployment.

The SESAR JU maintained its close cooperation, both formally and informally, with the FAA and its NextGen programme. Under Annex 1 of the U.S. – EU MoC on Civil Aviation Research and Development, the SESAR JU and FAA continued their collaboration aimed at ensuring harmonisation and interoperability between the two programmes where appropriate. This included delivery of an air-ground data communication strategy involving industry on both sides, development of a harmonisation risk management framework covering the full ATM lifecycle from planning, development and deployment, and establishment of cooperation in the fields of drones and cyber security. .

In December 2017 the SESAR JU signed a Memorandum of Cooperation (MoC) with the Qatar Civil Aviation Authority (QAA), which will provide a basis for enhanced collaboration on ATM modernisation in order to contribute to the development and harmonisation towards global interoperability. The scope of the collaboration between the parties includes the sharing of information, knowledge and expertise and co-operating in activities related to ATM modernisation.

During 2017 the SESAR JU also held discussions with a number of bilateral partners with whom cooperative arrangements were already in place, either via the SESAR JU's own MoCs (Singapore and UAE) or via arrangements at the level of the European Commission (Japan and China). In particular the SESAR JU co-organised with EASA a SESAR Workshop in Beijing in November 2017, at which SESAR JU members were able to showcase their contributions to various aspects of the ATM Master Plan.

### 1.4.7 Communication activities

Communication and marketing plays an integral role in engaging with and informing the wider air transport community as well as institutional stakeholders in Brussels about the SESAR JU's work and results. This work also encourages wider international commitment to the Single European sky (SES) approach to ATM modernisation and also contributes to maintaining the momentum around the SESAR project.

In 2017, the SESAR JU carried a number of communications activities in accordance with the objectives of its 2015-2020 Communications Strategy to show the uptake of SESAR 1 Solutions and raise visibility about SESAR 2020 projects, promoting the notion of the innovation pipeline.

A main focus of communications in 2017 was on the digital transformation that is underway thanks to the delivery of SESAR Solutions and the innovation taking place in SESAR 2020.

The following is a summary of activities undertaken by the SESAR JU.

#### 1.4.7.1 Events

Over the course of 2017, the SESAR JU organised a series of events to maintain a high profile and engagement with relevant stakeholders across the ATM community. In addition, SESAR JU staff participated in over 100 further events, raising the visibility of the SESAR project. The following are highlights from events in which the SESAR JU actively participated:

##### **World ATM Congress, 7-9 March 2017, Madrid**

Partnering for excellence in global aviation” was the theme of the activities taking place on the SESAR stand and theatre during the World ATM Congress, from 7 to 9 March 2017. The activities were hosted by the SESAR JU and the SESAR Deployment Manager (SESAR DM) in collaboration with the European Commission, Network Manager, European Defence Agency (EDA), European Aviation Safety Agency (EASA) and EUROCAE.

The SESAR stand and theatre, which were officially opened by Commissioner for Transport Violeta Bulc, featured a wide variety of sessions, and illustrated with concrete examples how SESAR works with these partners and with ANSPs, airports, airspace users, industry, the scientific community and staff associations represented through the SESAR JU and SESAR DM partnerships. These events demonstrated the benefits that this coordinated approach are bringing to airspace users and passengers, and the overall European economy. The SESAR stand also played host to the Single European Sky awards, which recognised many SESAR projects.

##### **U-space Workshop, 20 April, Den Haag**

The drone market is steadily growing and is poised to generate significant economic growth and societal benefits. The challenge will be to create a framework that will facilitate this growth, while at the same time handling the increased drone traffic safely, efficiently and securely. This is where the notion of U-space comes in, for which the blueprint for its development and rollout was discussed on 20 April in The Hague at a SESAR workshop, hosted by TUS EXPO against the backdrop of the first International Robotics Week. The event brought together more than 150 stakeholders from air traffic management and aviation, as well as the drone industry both in Europe and worldwide to provide feedback on the draft blueprint, and to discuss the opportunities and challenges of making the U-Space a reality.

##### **International Paris Air Show, 19-25 June, Paris**

The digital transformation of air traffic management was the focus of an exhibition hosted by the SESAR JU and the FAA’s NextGen Programme at the Paris Air Lab, an innovative space within the 2017 International Paris Air Show at Le Bourget from 19-25 June.

Throughout the week, industrial leaders, members of the European parliament, French institutional representatives and international delegations visited the SESAR/NextGen exhibition space to find out more about these two leading modernisation programmes and their joint efforts to ensure interoperability and harmonisation in global air traffic management.

Using a 3D virtual system, visitors were given the opportunity to step into the shoes of an air traffic controller and manage traffic at a busy airport using a range of digital tools delivered by both programmes. The 3-minute experience showed how the digital transformation of ATM can improve the efficiency and safety of airport operations, while also reducing the fuel consumption and emissions of aircraft. The 3D experience was particularly popular with the younger visitors to the air show, who patiently lined up to see for themselves the future of ATM.

### **SESAR anniversary event, 19 October, Brussels**

In 2017, the SESAR JU celebrated ten years of defining and developing solutions to modernise Europe's air traffic management. On 19 October, the anniversary year was marked by the SESAR JU and its members on the occasion of the partnership's Administrative Board meeting.

Henrik Hololei, Director General of DG MOVE and Chair of the SESAR JU Administrative, expressed his pride in the partnership, which was very much a pioneer in terms of public-private collaboration, not just in Europe but worldwide. Referring to the 63 solutions delivered by the SESAR JU, he remarked that, "we have collectively achieved what was not possible individually".

The modernisation of air traffic management is a team game, agreed Frank Brenner, Director General of EUROCONTROL and Vice-Chair of the SESAR JU Administration Board. He encouraged the membership to forge ahead with SESAR 2020 with the same spirit of partnership to deliver even greater results in the years to come.

### **Innovation in Action, European Parliament, 23-26 October, Strasbourg**

The SESAR JU, together with six other joint undertakings (JUs), held an exhibition with the theme 'Innovation in Action' in the Espace Emilio Colombo in the European Parliament in Strasbourg, France, from 23 to 26 October 2017. Over the course of the exhibition, the SESAR JU promoted the SESAR Solution Catalogue and demonstrated some of the solutions delivered so far by its programme using its virtual reality tool.

The JUs also held a working breakfast with MEPs, during which representatives of respective industries explained the added value of the JUs to their sectors. SESAR was represented by David Luengo of Indra, who outlined some of the notable successes of the project in delivering solutions that are now being deployed across Europe, offering benefits both to the economy and passengers.

### **Digitalising Europe's aviation infrastructure, 7-8 November, Tallinn**

Against the backdrop of the Estonian EU Presidency, European aviation leaders gathered on 7-8 November in Tallinn to show their support for the digital transformation of their industry, and SESAR as the vehicle to achieve this ambitious goal. The meeting followed a declaration by industry underlining the urgent need to act now in order to enable more connected aviation and ultimately seamless travel and transport for all.

An in-depth stakeholder-wide consultation will now begin on the modernisation of Europe's aviation infrastructure and ATM system. The results of this consultation will be published in the fourth edition of the European ATM Master Plan, due for publication next year.

The event took place against the backdrop of the [Digital Transport Days](#), organised by the European Commission and the Estonian EU Presidency, where the SESAR JU presented its work on an exhibition stand as well as several panel sessions.

### **European High-Level Conference on Drones, 21-22 November, Helsinki**

From 21-22 November, the SESAR JU had the pleasure of taking part in the [High-Level Conference on Drones](#) organised by the Finnish Ministry of Transport in collaboration with the European Aviation Safety Agency (EASA). Against the backdrop of the event, the [Helsinki Declaration](#) was published 'seizing digital technologies to deliver advanced drone operations safely and securely', which is a rallying call for the European drone community to turn the vision [for U-Space blueprint delivered by SESAR](#) into a reality. The SESAR JU also took part in the exhibition at the event with a small stand and an Augmented Reality tool, demonstrating the U-Space system of the future. A 3D video outlining a scenario contained in the U-Space blueprint can be found [here](#).

### **SESAR Innovation Days, 28-30 November, Belgrade**

From 28 – 30 November 2017, the SESAR JU held its annual SESAR Innovation Days (SIDs) event, which was kindly hosted by the University of Belgrade (Faculty of Transport and Traffic Engineering) in Serbia. Now in its 7th year, the 2017 SIDs is Europe's largest ATM research focused event. This year, more than 250 participants attended the event from both the academic and industrial ATM community, bringing together a very strong pool of scientific expertise in order to share research experiences, foster innovation and ultimately to accelerate the pace of change in ATM. The SIDs is also the main vehicle for the SESAR JU to share progress and disseminate results of its exploratory research programme, funded by the European Commission's Horizon 2020 initiative. SESAR 2020 ER1 projects (see section 1.1.1 above) were actively engaged in the event in a number of ways including a specific workshop organised by the AUTOPACE project, a tutorial on PACAS, 15 papers were presented by SESAR ER projects in the main conference as well as 14 ER projects providing demonstrations or poster sessions. The event also plays host to the annual SESAR Young Scientist Award, which went to Ramon Dalmau Codina for his new algorithms for optimal planning during continuous descent operations.

### **SESAR Showcase, 30 November – 1 December, EUROCONTROL, Brussels**

Representatives from EUROCONTROL member states got a taste of the digital transformation that is underway thanks to SESAR during a dedicated exhibition, which took place from 30 November to 1 December in Brussels. The exhibition showcased a number of solutions that have already been delivered by the SESAR JU and its members in the area of airports, air service navigation services and the network. The exhibition was also an opportunity for member states to find out more about the role that SESAR JU founding member, EUROCONTROL, and its Experimental Centre in Brétigny have played in developing and delivering many of the SESAR Solutions contained in the Solution Catalogue.

### **ACI Exchange, 5-7 December, Oman**

Airports are important nodes in the European air traffic management system and therefore critical in the digital transformation of aviation. This was the main message conveyed by SESAR in its participation at the 2017 ACI Airport Exchange, which took place from 5-7 December in Muscat, Oman. The conference is a flagship event in the aviation calendar attracting 1,500 industry leaders representing 50 countries and 65 airports to discuss how to improve passengers' experience through enhanced airport management. Through a keynote address and a dedicated stand, the SESAR JU presented how it has been working closely with airports of all sizes to deliver improved airport operations and with that greater network performance. Visitors to the SESAR JU stand had a chance to find out more about the catalogue of more than 60 SESAR Solutions many of which targeting airports' operational and business needs.

### **ICAO global and safety air navigation symposia (GANIS/SANIS), 11-15 December, Montreal**

The SESAR JU with other Single European Sky (SES) partners demonstrated the strong collaboration between stakeholders in Europe during ICAO's global and safety air navigation symposia, which took place from 11-15 December 2017, in Montreal, Canada. The first event, Second Global Air Navigation Industry Symposium (GANIS/2), provided a platform for global and regional industry partners to share their latest developments, thus identifying commonalities/differences between the systems to ensure interoperability and facilitating the harmonisation of air navigation systems. Meanwhile, the second event, the First Safety and Air Navigation Implementation Symposium (SANIS/1), showcased the safety and air navigation implementation strategies with ICAO's Global Aviation Safety Plan (GASP) and Global Air Navigation Plan (GANP) as complementary global plans and therefore drivers for performance improvements and promoted collaboration among all stakeholders. SES partners were represented by the European Commission, EUROCONTROL, also in its role as Network Manager, European Aviation

Safety Agency, European Defence Agency and <https://www.eurocae.net> as the European leader on industry standards in aviation, as well as the SESAR JU and SESAR DM.

#### 1.4.7.2 Publications

A number of publications were prepared throughout the year for dissemination via online channels and at key events (see above):

SESAR 2020 factsheet	The factsheet provides an overview of the SESAR 2020 programme, in terms of budget, strands (exploratory research, industrial research and demonstrations) and the expected performance gains for Europe and its citizens.
SESAR 2016 Highlights	The SESAR highlights brochure combines the milestones achieved in 2016 of the SESAR JU and SESAR Deployment Manager and gives a taste of what's coming up for the project in 2017. The brochure reflects the spirit and determination of both the SESAR JU and SESAR Deployment Manager to deliver together a modernised ATM system for Europe.
SESAR Solutions Catalogue – Second Edition	<p>The SESAR JU published a second edition of the SESAR Solution Catalogue, which embeds the final list of 60 plus SESAR Solutions delivered by the SESAR 1 programme. This edition brings together the full range of solutions, which are essential for improving performance either at network or local level, subject to local business cases. To ensure their uptake, the solutions have been developed taking into account existing ICAO and industry standards and also have contributed to the definition or refinement of these standards.</p> <p>In addition, the catalogue gives an overview of what is next in terms of the research and development (R&amp;D) activities planned under SESAR 2020. Covering all key areas of air traffic management, these activities will support the delivery of new solutions to enable a more flight-centric approach to ATM as well as the integration of all vehicles, including remotely-piloted aircrafts or drones, in addition to important established users such as business aviation, general aviation and rotorcraft. As solutions become mature, they will be introduced into the main body of the catalogue.</p>
U-space Blueprint	Following a request by the European Commission, the SESAR JU published its blueprint to make drone use in low-level airspace safe, secure and environmentally friendly. This "U-space" covers altitudes of up to 150 metres and will pave the way for the development of a strong and dynamic EU drone services market. Registration of drones and drone operators, their e-identification and geo-fencing should be in place by 2019. The vision paper is part of the Commission's drive to deliver on its ambitious Aviation Strategy and unleash the full economic potential of drones. This requires an effective legislative framework that can foster European leadership and competitiveness, while addressing a number of legitimate concerns, the first of which is safety.
Digital transformation discussion paper	This paper was prepared within the context of European ATM Master Plan 2018 update campaign in order to prompt discussions among European aviation stakeholders on the digital transformation of the sector. The paper makes use of recent EU and global studies on digitalisation in aviation, taking into account challenges and trends, and the value at stake for the European economy. The paper summarises questions that will need to be answered, as well as actions to be taken in order to move forward with the transformation process. This short paper is only the starting point for a much more in-depth stakeholder-wide consultation on the modernisation of European air traffic management (ATM). The results of this consultation will be published in the fourth edition of the European ATM Master Plan (December 2018).

Digitalising Europe's aviation infrastructure - factsheet	This factsheet presents the rationale for digitalisation of Europe's aviation/air traffic management infrastructure and the role that SESAR plays in delivering a hi-tech ecosystem for a smarter, safer and sustainable air transport system for Europe and its citizens.
SESAR 2020: now boarding	This factsheet presents the role that airports play in air traffic management and their contribution to the research programme. The factsheet also spells out how airports can get involved in the activities of the SESAR 2020 programme.

**Table 8: SESAR publications in 2017**

In addition to these publications, the SESAR JU supported SESAR members by validating the content of dedicated project brochures and flyers.

### 1.4.7.3 Online communications

#### 1.4.7.3.1 Digital media

The SESAR JU dedicates significant resources to developing short animations and videos about the work of the programme. In 2017, the SESAR JU produced the following digital material which is disseminated through various online communications channels, as well as at several events and exhibitions.

#### SESAR virtual experience

This 3D virtual tool gives users the opportunity to step into the shoes of an air traffic controller and manage traffic at a busy airport using a range of digital solutions delivered by SESAR to date. The 5-minute experience shows how the digital transformation of ATM can improve the efficiency and safety of airport operations, while also reducing the fuel consumption and emissions of aircraft. The tool was extensively showcased at events across Europe and internationally with aviation stakeholders, policy and decision makers, and citizens.

#### U-space augmented reality experience

With this interactive tool, users can learn more about the type of drone operations that will be enabled by U-space – Europe's initiative for ensuring safe and secure access to airspace for drones. The tool was extensively showcased at events across Europe and internationally with both aviation stakeholders, as well as policy and decision makers.

#### U-space teaser animation

This animation illustrates how U-space will enable complex drone operations with a high degree of automation to happen in all types of operational environments, particularly in an urban context. The animation was just by SESAR representatives to animate their presentations a number of drone-related conferences.

#### 1.4.7.3.2 Website and e-news

The SESAR website was revamped in 2017 in order to make the SESAR Solutions the main focus of the content and to give greater visibility to SESAR 2020 projects and achievements. In 2017, the SESAR JU maintained its online readership with an average of between 25,000 and 30,000 visitors to its public website on a quarterly basis. A monthly e-news was sent to external audiences (nearly 25,000 contacts), as well as dedicated event mailshots and press releases attracting further readers to the SESAR JU website. Among the most popular items are the U-space Blueprint and drone developments, the digital agenda and calls notices.

#### 1.4.7.3.3 Social media

The SESAR JU continued to make significant use of social media in 2017, in particular Twitter (2,540 followers), which proved to be an effective means to engage with stakeholders at events and promote validation and demonstration activities. The SESAR JU also continued to engage with stakeholders through LinkedIn (Company page: 3.247 followers and 5.817 members) through regular postings. Peaks in engagement rate and view (impression) in both channels were reported for several events: Paris Air Show, 10th anniversary, Digital Transport Days and Drone 2017. The SESAR JU also conducted dedicated campaigns, such as [#digital aviation](#) and [#EU60](#), and developed sponsored content to coincide with these events. The SESAR YouTube channel continued to maintain good audience interaction with over 30,000 views for the reporting period.

#### 1.4.7.4 Press

In 2016, SESAR JU continued its outreach to trade press and member/partner media channels, with featured articles and interviews in a range of magazines and online media:

- Trade or specialised press, including International Airport Review, IHS airports, Airport Business, Avionics Week, Air Traffic Management, Horizon, etc.;
- Brussels-based press such as the Parliament Magazine, European Files and Politico;
- Member/partner media (NATS, EBAA, CleanSky, EUROCONTROL's Skyways, ERA, ACARE etc.).

Over the year, the SESAR JU issued press releases on the following: European ATM Master Plan, SESAR 2020, cooperation agreements.

The SESAR JU also hosted a dedicated press briefing during the Tallinn Master Plan kick-off event, which resulted (combined with a press release) in coverage by trade press, such as Air Traffic Management Magazine, Airport World, Airport Suppliers, Politico, Aviation Week, Agence Europe, Aviation Intelligence Reporter.

#### 1.4.7.5 Metrics and monitoring

In 2017, the SESAR JU reviewed the metrics and monitoring of its online communications in order to evaluate the value of this area of work and identify where best to concentrate its efforts. The reporting, which is done on a quarterly basis, provides hard data on the SESAR JU online channels, cross references social media with events and publications, benchmarks the SESAR JU against similar organisations, and offers recommendations on how improve communications in this area. In 2017, The SESAR JU Communications Sector also participated in hands-on workshops to develop more meaningful content for social media channels.

## 1.5 Strategic Area of Operations 5: Deliver effective financial, administrative and corporate management

### *Objectives and target achievement status at the end of 2017:*

- *Effective support for EU's interim review of H2020 implementation: the interim review of H2020 took place with active contribution from SJU staff members*
- *Compliance with EC reporting requirements: full alignment with regular calendar for the programming and reporting documents*
- *Improve SJU's corporate, financial, HR & programme reporting & management information: implementation of a corporate information and document management system; alignment of internal planning and reporting system from strategic planning to operational planning and reporting*
- *Balancing payments to members & beneficiaries: the SJU managed to execute its budget in line with the budget adopted by the ADB*
- *Administrative and financial closure of SESAR1 delivered on time*
- *SESAR1 material archived: while the operational closure of SESAR 1 was done in 2016, the financial one was completed in 2017 in due time (pending of course the ex-post audits that will continue in 2018 and 2019)*

In 2017, the SESAR JU continued to fulfil its management, financial, legal and administrative obligations effectively, and implemented measures related to efficiency gains and cost control. These activities are presented in the following paragraphs.

### 1.5.1 Financial management & budget implementation

#### 1.5.1.1 Execution of the 2017 budget

The final Budget, i.e. the amendment 2 of the Budget approved by the Administrative Board (written procedure) on 08/11/2017, included revenue (cash forecasted to be received) and payment appropriations (forecasted cash to be spent) of EUR 191.813.383. The actual revenues received amounted to EUR 162.522.424 (84,7% of the budget) and the actual cash spent amounted to EUR 144.784.881 (75,5% of the budget). The breakdown of these figures per revenue source appears in section 2.3.1.

In terms of expenditure, the final Budget as defined above included commitment appropriations for EUR 113.346.265 and payment appropriations of EUR 191.813.383. The actual (consumed) overall commitments amounted to EUR 105.068.948 (92,7% of the budget) and overall payments to EUR 144.784.881 (75,5% of the budget).

The SESAR JU has made a continuous effort over the past years, and has continued that effort in 2017, to have budget planning as accurate as possible and budget implementation as close as possible to 100% for both payments and commitment appropriations. The above-mentioned budget implementation figures (92,7% and 75,5% respectively) are a consequence of the financial and regulatory framework in which the SESAR JU operates, in relation to the financial closure of SESAR 1 that took place in 2017 and the SESAR2020 operations carried out in 2017. In particular:

- The SESAR JU had to set up a provision to ensure correct closure of SESAR 1 (an 8-year long research and innovation programme), including the payment of late invoices and financial statements. The total amount of the Provision that was established represents 3% of the overall value of the total SESAR 1 program which ran for a total of 8 years. The provision was established on the basis of the overall value of SESAR 1, the forecasted budget at completion as presented regularly to the SESAR JU Administrative Board, the obligations set by articles 13 and 25 of the Statutes taking into account that the completion of the ex-post audits would occur only in 2018, and the ‘final date of implementation’ of the remaining FP-7 and TEN-T set to July 2018. That provision was at the end 2017 partly cancelled for unused appropriations (EUR 23 million). The amount of recoveries stemming from SESAR 1 was unknown: at the time of the request for funds in October 2017, the SESAR JU was still treating the Interim Financial Statements and Final Financial Statements. The exact final amount of recoveries (EUR 16 million) was known only in December 2017;
- Regarding the SESAR 2020 final budget for 2017, it should be noted that despite the multi-annual nature of SESAR 2020 programme, the SESAR JU is not allowed to use multi-annual commitments<sup>33</sup>. Therefore, the SESAR JU has to proceed according to its Single Programming Document with yearly grant budget amendment as mentioned in paragraph 1.2.1.2. This process is dependent on the availability of the “Annual Financial Implementation Agreement” from the EC, which enables the SESAR JU to commit funds for the year ahead (the SJU received the Annual Financial Implementation Agreement for 2017 in early July 2017).

The detailed breakdown of budget planning and implementation rate figures per Title appears in section 2.3.1.

With the SESAR JU being a multi-annual programme of a limited life-time and with fixed total budget ceilings, unused payment appropriations at the end of one budgetary year are not cancelled but inscribed as Budget Result in the revenues of the subsequent budget, to be presented to and adopted by the SESAR JU Administrative Board in accordance with the SESAR JU Financial Rules. The provisional Budget Result 2017 (i.e. total revenues of EUR 162.522.424 minus EUR 144.784.881 total payments) amounted to EUR 17.737.543. The 2017 surplus that remains within the Joint Undertaking amounts to EUR 14.918.244 (EUR 17.737.543 gross payment surplus minus EUR 2.819.299 carry-over for Titles I & II).

#### **1.5.1.2 Financial closure of SESAR 1**

Furthermore, in 2017, the SESAR JU proceeded with the financial and administrative closure of SESAR 1.

##### **1.5.1.2.1 Programme execution**

The actual overall programme execution rate is at 89,7% and 92,6% for Title 3 only. With the remaining open obligations and adjustments derived from the 2018 ex-post audits, the overall programme execution rate will be at 90% (92,8% for Title 3 only):

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<sup>33</sup> No provision or derogation from H2020 Rules for Participation is embedded in SJU basic regulation

**Current Situation:**

	<b>Commitment made</b>	<b>Payments made</b>	<b>Total programme</b>	<b>% Payments execution</b>
<b>Title 1</b>	46.629.036	40.596.070	55.000.000,00	73,8%
<b>Title 2</b>	28.010.735	24.669.524	42.824.088,75	57,6%
<b>Title 3</b>	778.627.622	735.967.638	795.000.000,00	92,6%
<b>Total</b>	<b>853.267.393</b>	<b>801.233.232</b>	<b>892.824.088,75</b>	<b>89,7%</b>

**Closure forecasts:**

	<b>Commitment made</b>	<b>Payments made</b>	<b>Total programme</b>	<b>% Payments execution</b>
<b>Title 1</b>	46.629.036	40.596.070	55.000.000,00	73,8%
<b>Title 2</b>	28.010.735	24.919.524	42.824.088,75	58,2%
<b>Title 3</b>	778.627.622	738.068.776	795.000.000,00	92,8%
<b>Total</b>	<b>853.267.393</b>	<b>803.584.370</b>	<b>892.824.088,75</b>	<b>90,0%</b>

**Table 9: SESAR 1 programme budget execution (current situation and closure forecast)**

The level of execution of the budget for Titles 1 and 2 reflects the optimisation of expenditure related to staff expenditure and administrative expenditure by the SESAR JU.

**1.5.1.2.2 Payment appropriations**

With the 2017 carried forward appropriations, the inscriptions of 2017 unused appropriations (EUR 20.995.293) following adoption of an amendment to the 2018 budget, the payments already executed in 2018 and the revenues received, the current available payment appropriations is the following:

	<b>PA available</b>
<b>Title 1</b>	34.017,68
<b>Title 2</b>	251.487,35
<b>Title 3</b>	38.657.225,85
<i>Of which</i>	
3.1	3.731.464,59
3.3	34.925.761,26
<b>Total</b>	<b>38.942.730,88</b>

**Table 10: SESAR 1 current available payment appropriations**

The expected movements until year end (or at the latest till first quarter 2019) are:

- Remaining open obligations -EUR 2.243.858
  - Archiving of SESAR 1 Extranet Content EUR 250.000
  - Airbus (Boeing) correction on IFS2016 EUR 22.209
  - External Audit costs of IFS2015+IFS2016 EUR 928.930
  - DEMO projects (RISE, NASCIO & DLR) EUR 1.042.719
- Adjustments on ex-post audits +EUR 1.768.447
  - Recoveries following audit findings EUR 1.875.726
  - Payments following audit findings EUR 107.279
- Miscellaneous recoveries +EUR 105.627
  - DSNR recovery for ISTREAM EUR 44.055
  - DSNR recovery of pre-financing (FFS) EUR 44.863
  - ALENIA recovery of open pre-financing (FFS) EUR 16.709

These payments and recoveries lead to a remaining payment appropriation of EUR 38.572.947:

	PA available	Recoveries	Payments	PA remaining
<b>Title 1</b>	34.017,68			34.017,68
<b>Title 2</b>	251.487,35		-250.000,00	1.487,35
<b>Title 3</b>	38.657.225,85	1.981.353,02	-2.101.137,38	38.537.441,49
<i>Of which</i>				
3.1	3.731.464,59		-1.971.649,02	1.759.815,57
3.3	34.925.761,26	1.981.353,02	-129.488,36	36.777.625,92
	38.942.730,88	1.981.353,02	-2.351.137,38	38.572.946,52

**Table 11: SESAR 1 remaining payment appropriations**

### 1.5.1.2.3 Cash situation

The SESAR JU currently has an amount of EUR 25.624.443 on its virtual bank account to cover all future obligations related to the SESAR 1 programme:

	Actual revenue received	Cash used during the year	Cash at year end 2017
			24.672.360,54
Payments		(798.407,83)	
	-		
Recovery	1.750.490,70		
	<b>1.750.490,70</b>	<b>(798.407,83)</b>	<b>25.624.443,41</b>

**Table 12: SESAR 1 available cash**

With all the foreseen cash movements and the potential reimbursement to the members of their excess cash contribution:

	SESAR 1	
Contribution to running costs (T1+T2)	EU	23.989.919
	ECTL	21.816.835
	Members	25.478.171
	TOTAL	71.284.925
Running costs (T1+T2)	65.265.594	
Percentage of use	92%	
Excess of contribution members	2.151.388	

**Table 13: SESAR JU members excess cash contribution related to SESAR 1**

The SESAR JU will close the SESAR 1 programme with a cash surplus of EUR 23.103.271:

	Actual revenue received	Cash used during the year	Outstanding revenue cumulative at year end	Cash at year end 2017
				24.672.360,54
Actuals		(798.407,83)		
Forecasts		(2.351.137,38)		
Reimbursement Cash Contribution	-	(2.151.388,02)		
2018 Actuals	1.750.490,70			
2018 Forecasts	1.981.353,02			
	<b>3.731.843,72</b>	<b>(5.300.933,23)</b>		<b>23.103.271,03</b>

Table 14: Cash surplus estimate at the end of SESAR 1

#### 1.5.1.2.4 Conclusion

With the remains of cash (EUR 23.103.271) and payment appropriations (EUR 38.572.946) the SESAR JU will be able meet all its obligations and close smoothly the SESAR 1 programme.

#### 1.5.2 Human Resources management

The SESAR JU staff consists of 39 positions + 3 SNEs, as per the Single Programming Document 2017. Moreover, for the period 2016-2017, the SESAR JU has been authorised 2 additional CA positions to support administrative transition from SESAR 1 to SESAR 2020, hence 44 positions were planned for the year 2017. The Staff Establishment Plan and its realisation are presented in part IIa section 2.4.

The effective allocation of staff resources also remained a priority for the SESAR JU during 2016. Efforts were focused on the professional and career development of its staff, in addition to ensuring that allocated staff resources are used in the most economic, efficient and effective way. For the third year, in 2017 the SESAR JU conducted its Career Development Review exercise and was able to conduct the reclassification of 7 staff members.

The vacancy rate at the end of 2017 was of 10,26%. This is explained by the fact that the SESAR JU Staff Establishment Plan only has 39 positions plus 3 SNEs positions, therefore each move in staff counts for 2,5%. During the last quarter of 2017, there were two resignations which represent an exceptional increase of 5 points to the usual vacancy rate. For one position, filled internally, the recruitment of the candidate was finalised in January 2018. The selection process for one of the three vacant positions, Financial Officer, was launched in December 2017 with a view to concluding the internal process in January 2018. A letter of offer was signed end January 2018 by the SESAR JU Executive Director. Therefore the vacancy rate is expected to be 7,7% in early 2018.

Other recruitments in 2017 were in fields related to Grant Management, Administration Affairs and Digitalisation (2 Grant Managers, 1 Head of Finance & Budget, 1 Legal and Procurement Officer and one Manager of Digital Transformation & Innovation).

### 1.5.3 Legal advice in 2017

Over 2017, specific legal expertise was provided to the organisation to contribute to:

- the regularity and legality of all SESAR JU's binding agreements, contracts, H2020 and non-H2020 grants, SESAR JU decisions, processes, measures,
- the respect of the PPP principles agreed with SESAR JU members (Membership Agreement) and their development (such as the implementation of the "additional contributions" concept for secondment of staff from SESAR JU members approved through an ADB decision in May 2017 – see in section 2.1 below);
- the closure of SESAR 1 and, in particular, to the finalisation of the SESAR 1 "IP audit process" consisting in reviewing all the IP assets generated under the Programme (exclusively limited to the "Programme deliverables") and clarifying with the SESAR JU members the ownership of each deliverables in collaboration with the technical departments;
- the development of two new Delegation Agreements with the European Commission for U-Space and Airspace Architecture Study as introduced in paragraphs 1.3.3.1 and 1.4.3.1 respectively; it should be noted that these two new Delegation Agreements have been concluded under frameworks which are new to the SESAR JU and with a number of derogations which brings a significant level of complexity;
- the respect of the agreements concluded with SESAR JU's founding members (EC Delegation agreements, ECTRL agreement);
- the development of terms and conditions for the use of the U-Space logo and of the STELLAR platform,
- the development of a procedure for the definition of needs of procurement and required budget assessment,
- the development of terms and conditions for a budget deliverable committee for the approval of invoices above EUR 250.000.

### 1.5.4 Procurement activities in 2017

Over 2017, the SESAR JU Procurement Plan was effectively implemented and 8 procurement procedures were launched, leading to 14 Framework and Direct Service Contracts. In terms of implementation of existing contracts, SESAR JU placed 29 Specific Contracts and 13 amendments. The total value of SESAR JU procurement activities finalised in 2017 exceeds EUR 5.540.000. All procedures were carried out in compliance with the SESAR JU's Financial Rules to ensure the respect of transparency, fair competition amongst suppliers and the most efficient use of SESAR JU funds. The procurement procedures supported transversally the SESAR JU objectives.

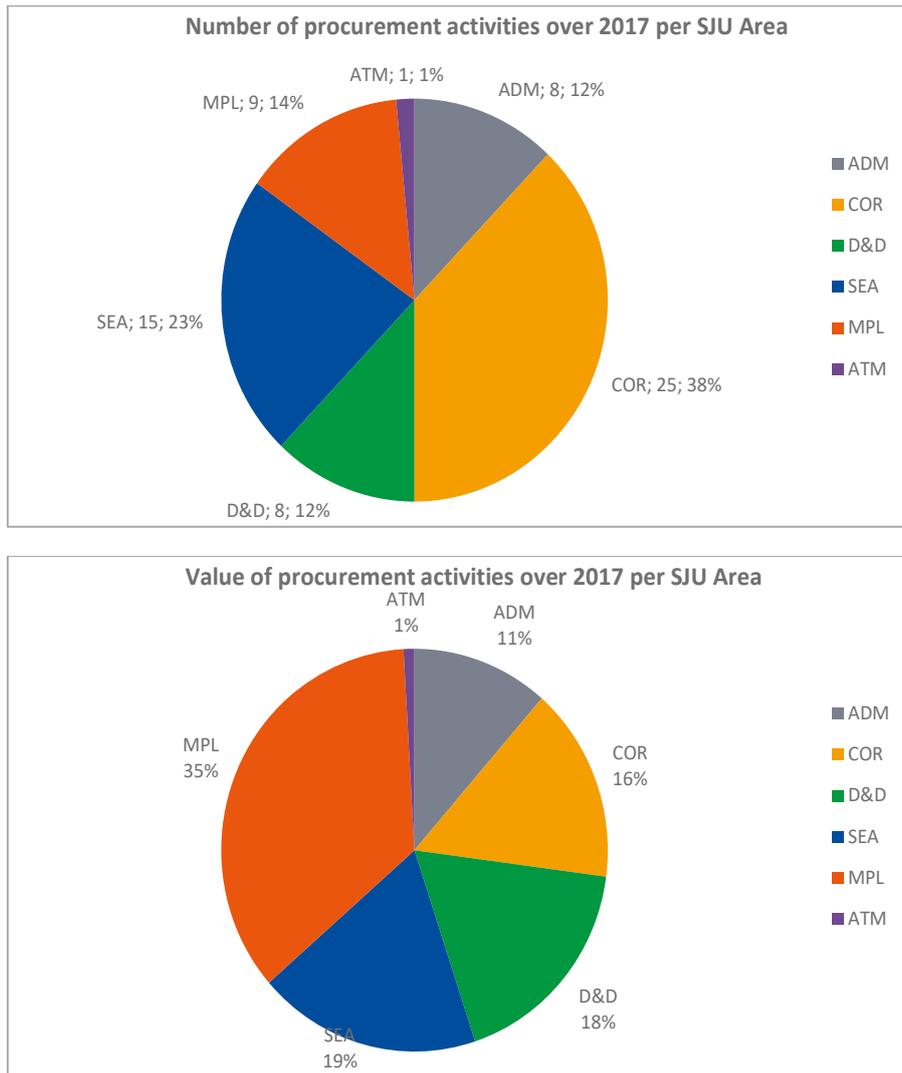


Figure 10: Number and overall value of procurement activities over 2017 per SESAR JU Area

A list of procurement procedures concluded during the reporting period is included in Annex I.4.

### 1.5.5 Corporate Planning and Reporting

In 2017, the SESAR JU released its Consolidated Annual Activity Report for 2016, which was approved by the Administrative Board by written procedure on the 30 June 2017.

Furthermore as per requirements of the Framework Financial Regulation, the SESAR JU further developed its Single Programming Document for 2018-2020 which was adopted by the Administrative Board on 14 December 2017. This adoption includes the approval of the 2018 work programme, the financing decision for the launch of the call for proposals on U-space demonstration activities (see 1.3.3.1), the financing decision of the adoption of the 2018 Budget, the approval of the Staff Establishment Plan for 2018 and the approval of the Procurement Plan for 2018. The SESAR JU also started off the drafting of its Single Programming Document for 2019-2021, in view of the submission of this document (in draft version) to the Authority by 30 January 2018.

### 1.5.6 Corporate Quality Management

In 2017, the SESAR JU further implemented its Quality Management System following a continuous improvement approach.

The focus this year was on the strengthening of the corporate information and document management process, and materialised with the development of a set of practices, standards and guidance and with the implementation of a new central tool to manage all SESAR JU corporate information and documentation: the Information & Document Management System (IDMS). The IDMS went live on 20 October 2017, it will replace the current tools used by the SESAR JU with a view to facilitate collaboration within and across teams, to secure the use of relevant and up-to-date corporate information and documents, and to increase SESAR JU business process efficiency by leveraging most modern technology (MS SharePoint 2016).

In addition, in 2017 analysed the EC revised Internal Control Framework and initiated the assessment of its internal control against that revised framework. Further information on this is provided under section 4.2.

Furthermore, following the closure of the SESAR 1 programme, the SESAR JU initiated the archiving of all SESAR 1 information, which will be completed in the first half of 2018.

### 1.5.7 Information & Communication Technologies (ICT)

In 2017, the SESAR JU ICT started using the support services delivered by EUROCONTROL following the migration of the whole infrastructure in 2016 towards the SESAR JU founding member. Although the network availability remained of high quality throughout the year, the level of quality of the support services was lower during the first weeks of 2017 compared to the levels reached during the year before. The SESAR JU ICT identified the areas of concern and collaborated with the service supplier in order to increase the quality level. The improvement of the support service could be noticed as from the second part of Q2 when some continuous improvement measures were adopted.

Next to the coordination of the support service improvement actions, the SESAR JU ICT participated in the implementation of several Transformation projects resulting from obsolescence, addressing risk mitigation or leading to the delivery of new functionalities and services to the users. Those projects were all approved by the SESAR JU QICT Committee, involving all the SESAR JU sectors who confirmed the benefits of the projects for the whole organisation. The most important initiatives where the delivery of the first building block of the SYSPER project interfacing SESAR JU HR with the European Commission platform, the replacement of the legacy remote access facility (migration to Pulse Secure) and the implementation of a new vaulting solution for the tapes used to back-up the systems running locally at the SESAR JU. Although they were not completed before the end of the year, several other Transformation projects were started, such as the replacement of the UPS system allowing some remote monitoring (risk mitigation in case of unexpected power cut), the deployment of the Windows 10 on the SESAR JU computers, the replacement of the obsolete Avaya telephony platform, the implementation of a redundant email platform avoiding a single point of failure in the SESAR JU infrastructure.... Those initiatives should be delivered in the course of 2018.

SESAR JU ICT was also involved in some major corporate initiatives like the IDMS project implementing the new MS SharePoint 2016 platform and the SYSPER project between SESAR JU HR and the European Commission.

In 2017, the SESAR JU implemented a new printing system controlled by badging. The level of consumption and waste has much reduced since its implementation - paper consumption reduced

from 600 packs in 2016 to 437 packs in 2017. This represents a saving of 27% over the year. Furthermore, the paper used is sustainably/responsibly sourced and accredited (FSC), and is also EU Ecolabel marked. A recycling basket is placed in the printer rooms and so any waste paper is also recyclable. The paper quality used also helps reduce toner consumption and therefore also has a secondary eco-benefit.

### 1.5.8 Facilities Management

In 2017, in terms of facilities management, work continued on a number of initiatives in SESAR JU's premises in Brussels to improve the productivity, safety & efficiency of the working environment and facilities offered to SESAR JU staff.

An open call for tender was published during the Q1 of 2017 for Security Services which lead to the signature of two service contracts in Q3: Lot 1 related to guarding and Lot 2 related to monitoring of alarm signals/messages, intervention on premises after the alarm signals and maintenance of the security systems.

In 2017, the SESAR JU's insurance contracts were renewed with coherence and respect of coverage.

Finally, in Q3 2017 the stocktaking was concluded successfully.

### 1.5.9 Experts Coordination

The Experts Coordination was transferred to D&D during the course of the year. This resulted from an evaluation leading to the conclusion the transfer would generate an improvement of efficiency for the whole organisation.

In 2017, 44 external experts assisted the SESAR JU for the evaluation of the calls for proposals H2020-SESAR-2016-1, H2020-SESAR-2016-2 and Geo-fencing.

The external experts were selected in a way to ensure a high level of skills, experience and knowledge in the areas of the call (including project management, innovation, exploitation, dissemination and communication).

Special attention was given to achieve an appropriate balance composition, in terms of skills, experience, and knowledge, geographical diversity and gender balance.

As a result, 14 out of the 44 experts were women. Out of the 44 invited experts, 10 came from universities and public or private research organisations, whereas 16 were from private commercial firms.

Also, experts were contracted in the framework of the Scientific Committee.

### 1.5.10 Travel Coordination

In 2017, the SESAR JU staff have achieved a total of 267 missions (not including missions related to the activities managed by the Programme Management Unit in the context of the SESAR JU – EUROCONTROL agreement). This represents a significant investment of time and money to ensure the SESAR JU plays an active role in steering the activities conducted with the support of its stakeholders. It has to be noted that the SESAR JU has made an extensive use of web conferences, especially for recurring monitoring activities such as project reviews. Typically, for meetings related 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 by preference, which represents a

significant benefit in terms of environmental footprint, efficiency and work-life balance. This is the reason why, out of the 267 missions, 196 are for Strategic Area of Operation #4 ('Deliver Transversal Steering & SESAR Outreach'). The split and allocation per Strategic Area of Operation, and, within SAoO #4, by topic, is depicted in the following figure:

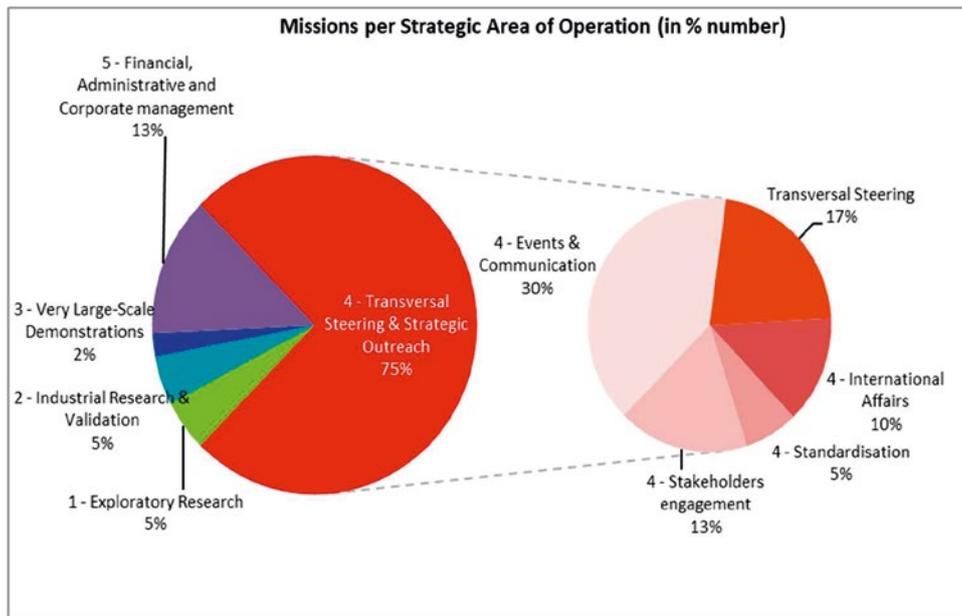


Figure 11: Breakdown of SESAR JU missions per Strategic Area of Operation (in percentage)

Missions were executed on time and in line with the rules of the EC Mission Guide.

Furthermore, the successful transfer to new Travel Provider took place in Q4 2017.

### 1.5.11 Internal Control, Risk Management and Audit

#### 1.5.11.1 Risk management and internal control

Activities related to risk management and internal control framework are presented in part III.

#### 1.5.11.2 Audit

Activities related to audits are presented in part II.

#### 1.5.11.3 Anti-fraud

In March 2016, the SESAR JU Board adopted the “SESAR JU Anti-Fraud strategy 2016-2018”. Since then, the SESAR JU has worked on implementing the related action plan, focusing on maintaining a culture of integrity, building capacities, ensuring a high level of reactivity and preventing and detecting fraud. The SESAR JU has notably

- Ensured an ethical and anti-fraud tone at the top.
- Raised awareness and systematic focus on ethics at the governance bodies of the SESAR JU.
- Developed detailed guidance for staff on red flags, whistleblowing, how to react and how to report fraud.
- Built capacities through various training sessions on fraud awareness, prevention and detection.
- Defined clear roles and responsibilities ensuring appropriate management level involvement.

- Developed and distributed to all staff a practical leaflet on Anti-fraud.

The following 5 indicators report on the prevention and detection activities in 2017 at the SESAR JU:

	KPI 2017
Number and value of contracts/grant agreements subject to close monitoring or additional controls due to an assessment of a high risk of fraud	0
Number (and trend in number) of files sent to OLAF for investigation	0
Time elapsed between receipt by staff or management of first information on alleged internal fraud and transmission to OLAF	n.a.
Time elapsed between receipt of an OLAF report and the decision on recovery or disciplinary sanctions by the SESAR JU	n.a.

**Table 15: Anti-fraud indicators for 2017**

It is expected that the “SESAR JU Anti-Fraud strategy 2016-2018” will be reviewed in 2018 and that the action plan will be updated notably in function of the anti-fraud action plan of the Research Family.

### 1.5.12 Data protection

The upcoming data protection reform, which will enter into force in May 2018, presents a challenge common to all EU Institutions and bodies; the future amendment of current Regulation 45/01<sup>34</sup>, still under legislative process, will bring the General Data Protection Regulation<sup>35</sup> into the legal base for processing personal data within the European institutions and bodies.

The new legislation will bring new obligations for the SESAR JU. With a view for readiness, the SESAR JU put in place in July 2017 an Action Plan. The Action Plan focuses on the following topics:

- Three level accountability at the SESAR JU, shift of responsibilities and further involvement of the SESAR JU Data Protection Officer (DPO);
- Privacy by design and by default; and use of EDPS’s guidelines;
- System of records replacing notification and update of privacy statements;
- Awareness rising.

The following individual actions have been conducted in implementation of the Action Plan:

- Update of templates for records, privacy statements and register;
- Include data protection requirements, including the guidelines of the EDPS for reference, in the call for tender for Web services;
- Presentation to different teams.

Due to the evolving nature of the Action Plan, the DPO will report to the Controller by March 2018 on the level of compliance and, when relevant, need for reinforcement.

<sup>34</sup> Regulation (EC) No 45/2001 of the European Parliament and of the Council of 18 December 2000 on the protection of individuals with regard to the processing of personal data by the Community institutions and bodies and on the free movement of such data, (“Regulation 45/01”)

<sup>35</sup> Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation, (the “GDPR”)

### 1.5.13 Participation to support and coordination groups in 2017

SESAR JU staff also participated in a number of Horizon 2020 coordination groups:

- H2020 Common Support Centre Executive Meeting;
- H2020 Network of Lawyers;
- H2020 Single Point of Contact meetings;
- H2020 Participant Portal committee;
- H2020 Grant Management Steering committee and Key user group
- H2020 SEP Evaluation and submission Key user groups
- H2020 CORDA Steering group
- H2020 Dissemination and Exploitation Practitioners Platform (DiEPP);
- H2020 Coordination of Audits in the Research family (CAR);
- H2020 Fraud and Irregularity in Research Committee (FAIR).

In addition, the SESAR JU is a regular participant to the meetings of the EU Agencies Network (EUAN) and other Inter-Agency Networks (in particular the IALN (Legal network), the NAPO (Procurement network), the IAAN (Accounting network)).

The SESAR JU also maintained a regular relationship with the EC DG MOVE-DG ENER Shared Resource Director with that aim.



### 1.6 Overall risk level of SESAR JU activities at end 2017

In 2017, the SESAR JU executed its risk management process which has been updated following the new SESAR JU Risk Management Policy (SESAR JU/ED/613). The update of the risk management process is described in chapter 4.1.

According to this process, while maintaining the overseeing of all risk areas potentially affecting the achievement of the SESAR JU objectives (corporate risks), the Corporate Management focuses on critical risks. A risk should be considered significant if it falls within at least one of the following impact categories:

- jeopardises the achievement of strategic goals or effective implementation of the mandate of SESAR JU,
- causes serious damage to SESAR JU's stakeholders or partners,
- results in critical intervention at political level (e.g. Council/Parliament) regarding the SESAR JU's performance,
- results in the infringement of laws and regulations,
- results in significant material and/or financial loss,
- jeopardises the safety of staff or,
- seriously damages the Joint Undertaking's image and reputation.

At the end of 2017, the corporate risks and related response actions are:

Ref.	Risk description	Risk owner	Summary of mitigation/response actions in 2017
CORP01	R&D activities do not deliver solutions allowing to reach expected ATM performance	SESAR JU	- ATM Master Plan update to identify clear priorities for future investments with a focus on solutions that hold the potential to provide a step-change in ATM performance. - Prepare wave 2 projects for launch in 2019 accordingly.
CORP02	Transition between Wave 1 and Wave 2 may lead to inefficiencies within the entire SESAR programme	SESAR JU	- Define a transition plan W1/W2 taking into account <ul style="list-style-type: none"> <li>• The preparation of the call ER4 and the VLD in the same timeframe</li> <li>• The adequate involvement of the governance bodies</li> </ul> - Leverage the Master Plan to set up des priorities for Wave 2

Ref.	Risk description	Risk owner	Summary of mitigation/response actions in 2017
CORP03	Some solutions supporting the PCP and developed in SESAR 2020 are not delivered on time for deployment (IOP, FRA and EPP)	SESARJU	- Close monitoring of the progress of these solutions by the PC and specific actions are put in place when necessary
CORP04	Ineffective bridging between development and deployment activities may put industrialisation at risk and delay deployment	SESARJU	- Execute first wave of SESAR VLD activities R&D with deployment - Strengthen cooperation arrangements with Standardisation Bodies to ensure alignment of their respective work programme with the needs identified in the ATM Master Plan - Strengthen current engagement of the regulatory authorities in the development phase to prepare for deployment.
CORP05	The SESAR JU may not be able to take up new challenges due to limited HR capabilities	SESARJU	- Leverage existing contracts/framework to get additional support during peaks of workload - Assess gaps in required skills linked to new or known coming tasks and plan actions sufficiently in advance to let time to acquire new skills.
CORP06	The BREXIT may have an impact on SESAR JU objectives	EC	- EC to provide mitigation actions through their negotiation task force

Table 16: SESAR JU Corporate risks and mitigation plan summary at 31/12/2017

## 1.7 Overall conclusion on the SESAR JU achievements in 2017

In 2017, the SESAR JU continued the development of the SESAR 2020 programme with 2 calls under which 53 projects are in execution, three additional calls for which 19 grant agreements were signed and 9 are in preparation and one new call in preparation ready for launch in early 2018. Furthermore, in 2017, the SESAR JU started off the process of planning the next series of calls for proposals, with a view to reaching the full funding amount of close to EUR 540 million by the end of 2020. The 53 projects in execution delivered results and especially the SESAR JU was in a position to run the first Release (Release #7) under the SESAR 2020 programme and to plan for the next Release (Release #8); in this context, validation exercises were conducted by the SESAR JU members and allowed to evaluate the maturity level of 11 new SESAR Solutions.

Additionally, the SESAR JU received two new mandates and developed its ability to operate under different legal frameworks.

At the end of 2017, the Single Programming Document 2018 was approved, with a work programme structured in 6 Strategic Areas of Operation:

- Strategic Area of Operation 1: Provide Strategic Steering to the SESAR programme,
- Strategic Area of Operation 2: Deliver Exploratory Research (ER),
- Strategic Area of Operation 3: Deliver Industrial Research & Validation (IR),
- Strategic Area of Operation 4: Deliver Very Large-Scale Demonstration Activities (VLD),
- Strategic Area of Operation 5: Deliver SESAR Outreach,
- Strategic Area of Operation 6: Deliver effective financial, administrative and corporate management.

The 2018 budget was adopted, as were the Staff Establishment Plan and the Procurement Plan for 2018.

## 2 Part IIa. Management Evaluation

### 2.1 Administrative Board

In 2017, the Administrative Board discussed and approved a standard suite of documents related to the annual programming and reporting cycles (Single Programming Document for the period 2018-2020, Consolidated Annual Activity Report 2016, and review of the draft Single Programming Document for the period 2019-2021). In addition, specific matters addressed by the Administrative Board in 2017 included, *inter alia*: the extension of the mandate of the Executive Director, an amendment procedure based on budgetary grounds, the adoption of the final list of SESAR JU Foreground from 1 January 2014 to 31 May 2017.

The Administrative Board made the following 20 decisions during meetings or through written procedures:

Subject	Type of decision	Date of adoption
IAC Work Programme 2017	Written procedure	13.02.2017
SESAR JU ED extension mandate	Ad-hoc meeting ADB(M)039-2017	7.03.2017
Request for the Commission's agreement on the non-application of Commission rules (HR)	Written Procedure	4.04.2017
Specific amendment procedure based on Budgetary grounds for SESAR 2020 IR-VLD Wave 1 Actions	Written Procedure	5.05.2017
Voting rights allocation	ADB(M)040-2017	5.05.2017
Appointment of the Vice Chairperson	ADB(M)040-2017	5.05.2017
SESAR JU Rules on secondment of staff	Written Procedure	31.05.2017
SESAR JU foreground generated under SESAR 1 (status at 31.05.2017)	Written Procedure	28.06.2017
CAAR 2016	Written Procedure	28.06.2017
Delegating the power to make non-substantial amendments to the Single Programming Document (SPD) to the authorising officer of the SESAR JU	Written Procedure	11.09.2017
Measures concerning unpaid leave	Written Procedure	11.09.2017
Non-application of the Commission Decision on the maximum duration for the recourse to non-permanent staff in the Commission services	Written Procedure	11.09.2017
General provisions for implementing Article 43 of the Staff Regulations and implementing the first paragraph of Article 44 of the Staff Regulations for temporary staff	Written Procedure	11.09.2017

Subject	Type of decision	Date of adoption
General provisions for implementing Article 87(1) of the Conditions of Employment of Other Servants of the European Union and implementing the first paragraph of Article 44 of the Staff Regulations	Written Procedure	11.09.2017
Final Accounts 2016 and budget results	Written Procedure	30.06.2017
SESAR JU policy on protecting the dignity of the person and preventing psychological harassment and sexual harassment	Written Procedure	11.09.2017
Amended consolidated SESAR JU Single Programming Document 2017-2019	Written Procedure	15.09.2017
Amendment to Annex XII "Budget 2017" of the amended consolidated SESAR JU Single Programming Document 2017-2019	Written Procedure	8.11.2017
Approval of SESAR JU Annual Accounts 2016	Written Procedure	8.12.2017
Single Programming Documents 2018-2020	ADB(M)042-2017	14.12.2017

Table 17: Administrative Board decisions in 2017

## 2.2 Major developments

The SESAR JU receives funds of various origins from the European Commission in order to execute the SESAR 2020 programme. Originally delegated through the Horizon 2020 framework, a first Assigned Revenue mandate was assigned to the SESAR JU in 2016 for the action on Active Geo-fencing.

In 2017, adding to these two existing legal frameworks, funds have been delegated to the SESAR JU through two other legal frameworks: CEF (Connecting Europe Facility) and a second type of Assigned Revenues. Therefore, at the end of 2017, the **SESAR JU operates under four different sources of funding**, each referring to the execution of grants (following calls for proposals) or studies (following calls for tender). This diversity of applicable legal frameworks under which the SESAR JU operates, with each its own templates and obligations, also comes with a high degree of complexity due to the number of derogations to the legal frameworks which have been defined in the corresponding delegation agreements.

## 2.3 Budgetary and financial management

### 2.3.1 Budgetary implementation

#### 2.3.1.1 Revenue

Further to the information provided in section 1.5.1.1, the table below provides the breakdown of revenues per revenue sources:

<i>all figures in EUR</i>	1	2	3=2/1	4	5	6=5/4	7	8
<u>Type of revenue</u>	<u>Commitment appropriations</u>	<u>Actual Revenues established</u>	<u>% of budget</u>	<u>Payment appropriations</u>	<u>Actual Revenues received</u>	<u>% of budget</u>	<u>Outstanding (from 2016 only)</u>	<u>Outstanding (Total)</u>
Contribution from the European Union	103.240.000	217.158.808	0,0%	138.057.397	113.147.252	82,0%	24.910.145	518.447.349
Contribution from Eurocontrol	6.682.000	32.605.112	488,0%	16.992.920	32.605.112	191,9%	(15.612.192)	42.470.997
Contributions from other Members	0	0		(4.944.920)	0	0,0%	0	0
Other sources of contribution and revenue	1.470.005	18.626.177	1267,1%	8.069.737	16.770.060	207,8%	0	0
Budget surplus previous year	1.954.260	0	0,0%	33.638.248		0,0%	0	0
<b>TOTAL REVENUE</b>	<b>113.346.265</b>	<b>268.390.097</b>	<b>236,8%</b>	<b>191.813.383</b>	<b>162.522.424</b>	<b>84,7%</b>	<b>9.297.953</b>	<b>560.918.346</b>

Table 18: Actual vs. budget revenue in 2017

### 2.3.1.2 Expenditure

Further to the information provided in section 1.5.1.1, the table below provides the breakdown of expenditures per Title:

<i>all figures in EUR</i>	1	2	3=2/1	4	5=9+10	6=5/4	8	9	10
<u>Type of expenditure</u>	<u>Final Commitment appropriations</u>	<u>Commitments</u>	<u>% of budget</u>	<u>Payment appropriations</u>	<u>Payments</u>	<u>% of budget</u>	<u>Commitments still to be paid (Total)</u>	<u>Payments (against commitments of the year)</u>	<u>Payments (against previous years' commitments)</u>
Staff Expenditure	6.160.000	5.278.238	85,7%	6.249.530	5.047.521	80,8%	0	4.825.616	221.905
Administrative Expenditure	4.180.351	3.795.736	90,8%	4.180.351	3.321.466	79,5%	250.000	1.429.060	1.892.406
Operating Expenditure	103.005.914	95.994.973	93,2%	199.121.153	136.415.895	68,5%	130.140.065	136.415.895	0
1. Studies/Development conducted by the SJU	2.029.808	1.229.808	60,8%	45.002.360	34.136.219	75,9%	76.533.016	34.136.219	0
2. Studies/Development conducted by Eurocontrol	0	0		0	0		0	0	0
3. Studies/Development conducted by other Members	100.976.106	94.765.165		154.118.793	102.279.675	66,4%	53.607.049	102.279.675	0
<b>TOTAL EXPENDITURE</b>	<b>113.346.265</b>	<b>105.068.948</b>	<b>92,7%</b>	<b>209.551.034</b>	<b>144.784.881</b>	<b>69,1%</b>	<b>130.390.065</b>	<b>142.670.570</b>	<b>2.114.310</b>
<b>TOTAL REVENUE</b>					<b>162.522.424</b>				
<b>BUDGET RESULTS</b>					<b>17.737.543</b>				

Table 19: Actual vs. budget expenditure in 2017

Explanations on the budget implementation rate are provided in section 1.5.1.1.

## 2.3.2 In-Kind contributions

### 2.3.2.1 Annex I of the SESAR JU Budget - In Kind contributions (Revenue) SESAR 1

<i>all figures in EUR</i>	<b>1</b>	<b>2</b>	<b>3=2/1</b>
<u>Type of revenue</u>	<u>Commitment appropriations</u>	<u>Actual Revenues established</u>	<u>% of budget</u>
Contribution from the European Union	0	0	
Contribution from Eurocontrol			
Contributions from other Members	49.518.505	5.769.056	11,7%
Other sources of contribution and revenue	0	0	
Budget surplus previous year	0	0	
<b>TOTAL REVENUE</b>	<b><u>49.518.505</u></b>	<b><u>5.769.056</u></b>	<b>11,7%</b>

Table 20: In-kind revenues in 2017

## 2.3.2.2 Annex I of the SESAR JU Budget - In Kind Expenses SESAR 1

<i>all figures in EUR</i>			
	1	2	3=2/1
<u>Type of expenditure</u>	<u>Commitment appropriations (Final budget)</u>	<u>Actual Commitments</u>	<u>% of budget</u>
Staff Expenditure	0	0	
Administrative Expenditure*	0		
Operating Expenditure	49.518.505	5.769.056	11,7%
1. Studies/Development conducted by the SJU**	0		
2. Studies/Development conducted by Eurocontrol**			
3. Studies/Development conducted by other Members	49.518.505	5.769.056	
<b>TOTAL EXPENDITURE</b>	<b>49.518.505</b>	<b>5.769.056</b>	<b>11,7%</b>
<b>TOTAL REVENUE</b>		<b>5.769.056</b>	
<b>BUDGET SURPLUS</b>		<b>0</b>	

Table 21: In-kind expenditure in 2017

2.3.2.3 Annex I of the SESAR JU Budget - In Kind contributions (Revenue) SESAR 2020

<i>all figures in EUR</i>	1	2	3=2/1
<u>Type of revenue</u>	<u>Commitment appropriations</u>	<u>Actual Revenues established</u>	<u>% of budget</u>
Contribution from the European Union	0	0	
Contribution from Eurocontrol to be recognized	71.232.598	49.451.619	69,4%
Contributions from other Members to be recognized	45.412.193	33.163.971	
Other sources of contribution and revenue	0	0	
Budget surplus previous year	0	0	
<b>TOTAL REVENUE</b>	<b><u>116.644.791</u></b>	<b><u>82.615.590</u></b>	<b>70,8%</b>

Table 22: In-kind revenues in 2017

## 2.3.2.4 Annex I of the SESAR JU Budget - In Kind Expenses SESAR 2020

<i>all figures in EUR</i>			
	1	2	3=2/1
<u>Type of expenditure</u>	<u>Commitment appropriation s (Final budget)</u>	<u>Actual Commitments</u>	<u>% of budget</u>
Staff Expenditure	0	0	
Administrative Expenditure*	0		
Operating Expenditure	116.644.791	82.615.590	70,8%
1. Studies/Development conducted by the SJU**	0		
2. Studies/Development conducted by Eurocontrol**	71.232.598	49.451.619	69,4%
3. Studies/Development conducted by other Members	45.412.193	33.163.971	
<b>TOTAL EXPENDITURE</b>	<b>116.644.791</b>	<b>82.615.590</b>	<b>70,8%</b>
<b>TOTAL REVENUE</b>		<b>82.615.590</b>	
<b>BUDGET SURPLUS</b>		<b>0</b>	

Table 23: In-kind expenditure in 2017

2.3.2.5 Annex II of the SESAR JU Budget - In Kind contributions (Revenue) SESAR 1 + SESAR 2020

<i>all figures in EUR</i>			
	1	2	3=2/1
<u>Type of revenue</u>	<u>Commitment</u>	<u>Actual</u>	
	<u>appropriations</u>	<u>Revenues established</u>	<u>% of budget</u>
Contribution from the European Union	0	0	
Contribution from Eurocontrol to be recognized	71.232.598	49.451.619	69,4%
Contributions from other Members to be recognized	94.930.698	38.933.027	41,0%
Other sources of contribution and revenue	0	0	
Budget surplus previous year	0	0	
<b>TOTAL REVENUE</b>	<b>166.163.296</b>	<b>88.384.646</b>	<b>53,2%</b>

Table 24: In-kind revenues in 2017

## 2.3.2.6 Annex II of the SESAR JU Budget - In Kind Expenses SESAR 1 + SESAR 2020

<i>all figures in EUR</i>			
	1	2	3=2/1
<u>Type of expenditure</u>	<u>Commitment appropriation s (Final budget)</u>	<u>Actual Commitments</u>	<u>% of budget</u>
Staff Expenditure	0	0	
Administrative Expenditure*	0		
Operating Expenditure	166.163.296	88.384.646	53,2%
1. Studies/Development conducted by the SJU**	0		
2. Studies/Development conducted by Eurocontrol**	71.232.598	49.451.619	69,4%
3. Studies/Development conducted by other Members	94.930.698	38.933.027	
<b>TOTAL EXPENDITURE</b>	<b>166.163.296</b>	<b>88.384.646</b>	<b>53,2%</b>
<b>TOTAL REVENUE</b>		<b>88.384.646</b>	
<b>BUDGET SURPLUS</b>		<b>0</b>	

Table 25: In-kind expenditure in 2017

## 2.3.3 Budget Outturn

The Budget Outturn for 2017 amounts to EUR 57.976.338, composed of EUR 30.883.826 for SESAR 1 and EUR 27.092.511 for SESAR 2020. The 2017 surplus that remains within the Joint Undertaking amounts to EUR 55.157.039 (EUR 57.976.338 gross payment surplus minus EUR 2.819.299 carry-over for Titles I & II). The table below presents these figures in detail:

<i>all figures in EUR</i>	2017	2016
<b>REVENUE RECEIVED FOR THE YEAR</b>		
Contribution from the European Union SESAR1	37.000.000	75.000.000
Contribution from the European Union SESAR2020	76.147.252	56.519.225
Contribution from Eurocontrol SESAR1	25.923.112	
Contribution from Eurocontrol SESAR2020	6.682.000	
Contributions from other Members SESAR1	0	
Contributions from other Members SESAR2020	0	
Other sources of contribution and revenue SESAR1	16.745.356	1.293.989
Other sources of contribution and revenue SESAR2020	24.704	0
<b>TOTAL REVENUE (1)</b>	<b>162.522.424</b>	<b>132.813.214</b>
<b>TOTAL PAYMENTS MADE FOR THE YEAR</b>		
Staff Expenditure	(5.047.521)	(5.018.626)
Administrative Expenditure	(3.321.466)	(2.711.600)
Operating Expenditure SESAR1	(80.144.695)	(45.323.509)
Operating Expenditure SESAR2020	(56.271.199)	(49.919.493)
<b>TOTAL EXPENDITURE (2)</b>	<b>(144.784.881)</b>	<b>(102.973.228)</b>
<b>BUDGET SURPLUS of the year (3)=(1)-(2) SESAR1</b>	<b>(2.755.236)</b>	<b>23.240.254</b>
<b>BUDGET SURPLUS of the year (3)=(1)-(2) SESAR2020</b>	<b>20.492.779</b>	<b>6.599.732</b>
<b>Total</b>	<b>17.737.543</b>	<b>29.839.986</b>
Total Budget Surplus previous year (4) SESAR1	33.639.062	10.398.808
Total Budget Surplus previous year (4) SESAR2020	6.599.732	0
<b>NEW TOTAL BUDGET SURPLUS (5)=(3)+(4) SESAR1</b>	<b>30.883.826</b>	<b>33.639.062</b>
<b>NEW TOTAL BUDGET SURPLUS (5)=(3)+(4) SESAR2020</b>	<b>27.092.511</b>	<b>6.599.732</b>
<b>Total</b>	<b>57.976.338</b>	<b>40.238.794</b>
<b>COMMITMENTS STILL TO BE PAID (6)</b>		
<b>(Carry Forwards from year Title 1&amp;2 only) SESAR1</b>	<b>(2.819.299)</b>	<b>(3.194.962)</b>
<b>TOTAL BUDGET OUTTURN (7)=(5)+(6) SESAR1</b>	<b>30.633.826</b>	<b>30.444.099</b>
<b>TOTAL BUDGET OUTTURN (7)=(5)+(6) SESAR2020</b>	<b>24.523.212</b>	<b>6.599.732</b>
<b>Total</b>	<b>55.157.039</b>	<b>37.043.832</b>

Table 26: Budget Outturn for 2017

### 2.3.4 Budget implementation allocation per Area of Operation

The figures below indicate the budget allocation per Area of Operation:

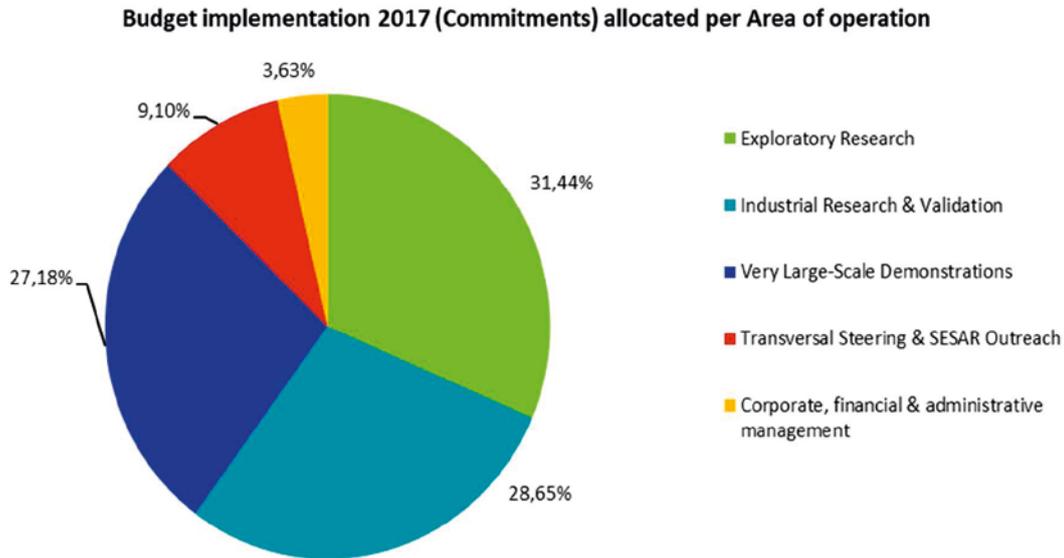


Figure 12: The 2017 Budget allocation per Area of Operation (Commitments)

## 2.4 Human Resources management

Main activities in the field of HR are explained in section 1.5.2.

The Staff Establishment Plan appears in Annex IV. Based on this Staff Establishment Plan (and including in addition 3 Seconded National Experts), at the end of 2017 the benchmarking result is the following.

Job Type (sub) category	2016 (%)	2017 (%)
<b>Administrative Support and Coordination</b>	<b>30%</b>	<b>30%</b>
Administrative Support	16%	16%
Coordination	14%	14%
<b>Operational</b>	<b>62%</b>	<b>60%</b>
General operational	30%	28%
Programme management	18%	18%
Top-level operational coordination	10%	10%
Evaluation & Impact assessment	4%	4%
<b>Neutral</b>	<b>8%</b>	<b>10%</b>
Finance and Control	8%	10%
Linguistics	0%	0%

Table 27: Benchmarking on Human Resources

The slight difference observed for job type categories 'Administrative Support & Coordination' and 'Neutral' is explained by the temporary staff increase of 2 Contract Agents (Function Group IV) in order

to reinforce the resources in the Financial and in the Legal and Procurement Sectors, during the 2016 and 2017 exercises. This temporary staff increase was defined in the SPD 2017.

The allocation of human resources per Area of Operation appears in the following figure:

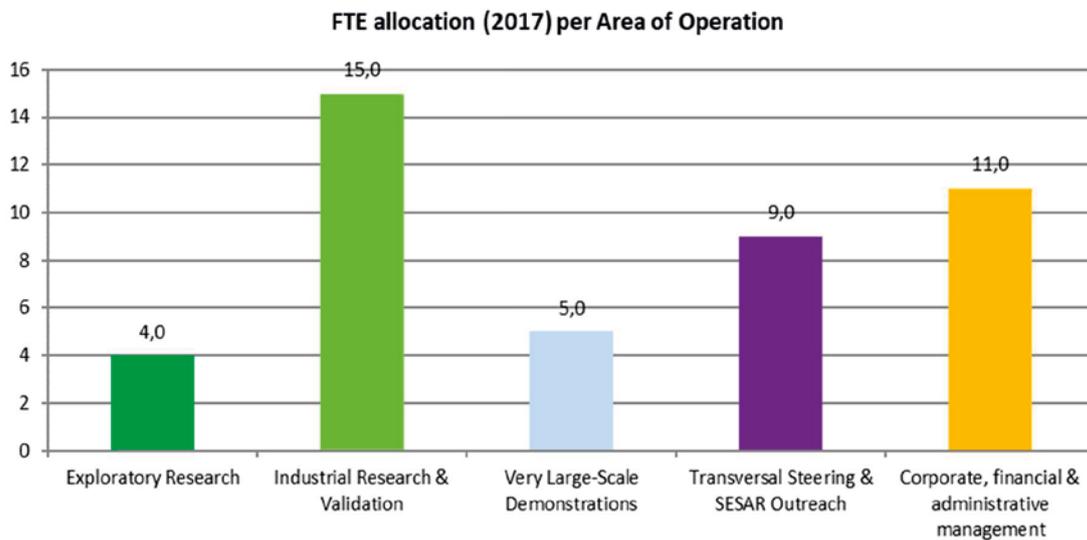


Figure 13: Human resources allocation per Area of Operation

## 2.5 Assessment by Management

Based on the procedures performed by staff of the SESAR JU, a **positive conclusion on the effectiveness, legality and regularity of transactions** can be drawn.

This conclusion takes into consideration the following factors:

### Overall Budget Implementation Rate

As a result of year budget monitoring throughout the year, budget execution rate is at 92,7% for revenue commitment execution and at 75,5% for expenditure commitment (see also paragraph 1.5.1.1).

### Legality and regularity

Based on the control procedures performed by staff of the SESAR JU, a positive conclusion on the legality and regularity of transactions can be drawn. This conclusion takes into consideration the need for SESAR JU to maintain a high level of efficiency of its internal control environment and to constantly assess and strengthen the existing controls in order to maintain compliance with the 17 Internal Control Standards and to ensure the achievement of objectives in its annual work plan.

In order to ensure the sound financial management, legality and regularity of the underlying transactions, all transactions are submitted to the four eyes principle in the preparation phase as well as in the payment phase. The ex-ante control function is exercised at operational level, to verify the work performed during the initiation of the transaction to ensure that the required results are achieved, and at financial level to verify the application of the rules.

The extensive ex-ante controls allowed for avoidance of material errors and formal errors, detected at different levels of the authorisation process (initiation, verification, authorization and payment).

### Procurement procedures

Eight procedures were run and all completed in 2017. More details can be found in section 1.5.3.3 and Annex I.2.

### Registration of exceptions

The SESAR JU has established an “exceptions’ register” to manage and monitor possible exceptions to rules, and all exceptions are submitted to the AO with a justification for endorsement. Over 2017, no exceptions of material value have been recorded. A new process internal process for the management of the SESAR JU Exception Register is under development and should be adopted early 2018.

### Audit results and recommendations

In 2017, no critical recommendations were issued as a result from audits, and recommendations from previous years have been worked upon.

This is presented in sections 2.7 and 2.8.

*Although substantial progress has been achieved, the SESAR JU’s staff is committed to continue its efforts to reach the highest standards for management and control systems.*

## 2.6 Budget implementation tasks entrusted to other services and entities

This section is not applicable for the SESAR JU in 2017.

## 2.7 Assessment of audit results during the reporting year

### 2.7.1 Internal Audit Service (IAS)

#### 2.7.1.1 Audit on H2020 Grant process from the identification of the call topics to the signature of the grant agreements

In October 2016, the IAS performed an audit at the SESAR JU which aimed to assess the adequacy of the design and the efficient and effective implementation of the internal controls in place in the SESAR JU for the preparation of calls for proposals (including topic definition), the submission, evaluation and selection of grant proposals and the grant agreement preparation under the H2020 rules.

The IAS conducted a detailed review of applicable rules and guidelines and analysed the implementation of the process to identify and develop call topics, the process to select and manage independent experts and the controls in place to guarantee consistency and equal treatment during the submission, selection and evaluation process up to the signing of the grant agreement.

The final report was published in March 2017 and included the following 5 recommendations:

Recommendation title	Criticality
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Selection and use of experts in the evaluation process	Very Important
Management of documentation of conflict of interest declarations and assessments	Important
Guidance to potential participants and experts	Important
Grant preparation	Important
Topic definition process	Important

**Table 28: Recommendations of the 2016 Audit on H2020 Grant process**

Consequently, the SESAR JU set up a detailed action plan to address the risks underlying these recommendations. By the end of 2017, the SESAR JU was able to confirm that the action plan related to 4 out of 5 of these recommendations was implemented, and as a result, SESAR JU has submitted all of these recommendations except the last one as ‘proposed for closure’ to the IAS in November 2017, meaning that SESAR JU management considers that the actions related to these recommendations are implemented. It is expected that the last recommendation will be ‘proposed for closure’ in the course of Q2 2018.

### 2.7.1.2 Audit on Coordination with the CSC<sup>36</sup> and implementation of CSC tools and services

In October 2017, the IAS performed an audit at the SESAR JU which aimed to assess the adequacy of the design and the efficiency and effectiveness of the SESAR JU governance, risk management and internal control processes for coordination with the CSC and the implementation of the CSC tools and services. The scope of the audit included the coordination between the SESAR JU and the CSC on all levels of governance and the sub-processes directly supported by the CSC, in particular the ones that have a direct impact on the SESAR JU operations and on the SESAR JU internal control system.

The final report was published in April 2018 and included the following three recommendations:

Recommendation title	Criticality
Internal Governance of the SESAR JU in its Cooperation with the CSC	Important
Documentation of Decisions by SESAR JU Management	Important
Alignment of the Anti-Fraud Action Plan to the changed Control Environment	Important

**Table 29: Recommendations of the Audit on Coordination with the CSC and implementation of CSC tools and services**

The SESAR JU will set up a detailed action plan to address the risks underlying these recommendations. It is expected that these recommendation will be ‘proposed for closure’ in the course of 2018.

<sup>36</sup> Under the SESAR JU Regulation, the SESAR JU receives the Union financial contribution from the H2020 Framework Programme to implement the SESAR 2020 Work Programme via calls for proposals. Horizon 2020 (H2020) is directly managed by Commission Directorates-General, Executive Agencies and other implementing bodies such as Joint Undertakings. In order to ensure that they apply the H2020 legislation consistently, the Commission created the Common Support Centre (CSC), administratively part of DG RTD, which is in charge of providing centralised support in the following areas: legal advice, ex-post audits, information technology systems and operations, business processes and programme information and data.

Key to the successful implementation of the part of the H2020 programme entrusted to the SESAR JU and to the achievement of its objectives are: the adequacy of the coordination process with the CSC and the effective implementation by the SESAR JU of the CSC tools and services. The IAS therefore decided to conduct an audit on the coordination with the CSC and implementation of CSC tools and services.

## 2.7.2 Internal Audit Capability (IAC)

In 2017, the IAC issued a report on the Validation of ABAC Workflow authorisations which led to no major recommendations.

Furthermore, the activity of the IAC in 2017 focused on fraud prevention training for staff, consulting missions and ad-hoc advice on efficient and effective management to SESAR JU management. The IAC liaised with relevant audit actors relating to the five audits/evaluations that were ongoing in 2017 at the SESAR JU<sup>37</sup> and monitored the implementation of the SESAR JU action plan related to two past audits.

A detailed annual report on IAC and general audit activities at the SESAR JU in 2017 will be presented to the SESAR JU Board in Q2, 2018.

## 2.7.3 European Court of Auditors (ECA)

### 2.7.3.1 Annual Audit of the Accounts

On November 13 2017, the European Court of Auditors published the final report on the annual accounts of the SESAR JU for the financial year 2016.

The report concluded the following:

- the SESAR JU accounts present fairly, in all material respects, the financial position of the SESAR JU, the results of its operations, its cash flows, and the changes in net assets for the year then ended, in accordance with its Financial Regulation and with accounting rules adopted by the Commission's accounting officer.
- the revenue underlying the accounts is legal and regular in all material respects.
- the payments underlying the accounts are legal and regular in all material respects.

The Court made comments in the field of in-kind contributions to SESAR 2020 projects, assessment of the financial capacity of applicants under calls for proposals and the cost-effectiveness of service contracts. All items were immediately addressed by the SESAR JU.

The full report including the reply of the SESAR JU can be found here: <https://www.eca.europa.eu/en/Pages/DocItem.aspx?did=42111>.

### 2.7.3.2 Performance Audit of the Single European Sky

In 2017, the European Court of Auditors performed a Performance Audit of the Single European Sky evaluating the outcome and value for money of the SES. The audit scope comprised 3 components: the construction of the SES, the regulatory components and SESAR. The auditors sampled 16 SESAR projects which were audited in 5 different countries. Furthermore various stakeholders were involved such as National Supervisory Authorities, ANSPs, Political level, User community and SESAR users.

The final report was published on 30 November 2017. Overall, the Court concluded that the SES initiative addressed a clear need and has led to a greater culture of efficiency in ATM. The Court set out a total of 9 recommendations to the European Commission and the Member States to help improve the effectiveness of the SES.

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<sup>37</sup> In 2017, the SJU was subject to five audits: the IAS audit on H2020 grant process, the IAS audit on CSC coordination, the ECA Performance Audit of the SES, the ECA Audit on the accounts 2016, the Final Evaluation of the SJU operating under the SESAR 1 Programme (FP7) and the Interim evaluation of the SJU operating under Horizon 2020

These recommendations are the following:

Recommendation 1 – Review High Level Goals
Recommendation 2 – Analyse other policy options targeting fragmentation
Recommendation 3 – Ensure full independence and capacity of NSAs
Recommendation 4 – Ensure inspection coverage of the charging scheme
Recommendation 5 – Streamline the performance scheme
Recommendation 6 – Review certain key performance indicators
Recommendation 7 – Review the EU’s support structure to ATM R&D in light of its objectives
Recommendation 8 – Reinforce the accountability of the SESAR JU
Recommendation 9 – Prioritize EU support to R&D solutions that promote defragmentation and a competitive environment

**Table 30: Recommendations of the Performance Audit of the Single European Sky**

It has to be noted that among these 9 recommendations, only the three last ones are addressed (in)directly to the SESAR JU. The SESAR JU intends to set up, together with the EC, an action plan in 2018 to address these recommendations.

The full report can be found here: <https://www.eca.europa.eu/en/Pages/DocItem.aspx?did=43538>.

## 2.8 Follow-up of recommendations and action plans for audits and evaluations

During 2017, no critical recommendations were issued or closed and on 31 January 2018, no critical recommendations were still open.

### 2.8.1 IAS audits

In January 2018, the IAS performed a follow-up engagement to assess the progress made in implementing the open recommendations that resulted from two past IAS audits: the Audit on Risk Management and the Audit on Operational governance and Master Plan update.

The IAS concluded that the recommendations related to both audits were adequately and effectively implemented by the SESAR JU and these have therefore been formally closed.

As a consequence, all former recommendations set out by the IAS before 2017 are now closed.

### 2.8.2 Overview of all current open recommendations

The table below summarises the status of the recommendations that are currently not formally closed.

Author	Topic and date of final report	Recommendation	Criticality	Current Status
EC	Final Evaluation of the SESAR JU operating under	Strengthen the “partnership approach” including links to deployment	n.a.	

Author	Topic and date of final report	Recommendation	Criticality	Current Status
	the SESAR 1 Programme (FP7) <b>June 2017</b>	Strengthen the “architecture” of the Master Plan to enable the Commission to streamline deployment planning and monitoring.	n.a.	Action plan under implementation
		Strengthen the links to academia to ensure the innovation pipeline is fed with new ideas	n.a.	
EC	Interim evaluation of the SESAR JU operating under Horizon 2020 <b>June 2017</b>	Resolve issues with application of H2020	n.a.	Action plan under implementation
		Take steps to further close the industrialisation gap	n.a.	
IAS	Audit on Coordination with the Common Support Centre and implementation of CSC tools and services <b>February 2018</b>	Internal Governance of the SESAR JU in its Cooperation with the CSC	Important	Waiting for final report
		Documentation of Decisions by SESAR JU Management	Important	
		Alignment of the Anti-Fraud Action Plan to the changed Control Environment	Important	
IAS	Audit on H2020 Grant process from the identification of the call topics to the signature of the grant agreements <b>April 2017</b>	Selection and use of experts in the evaluation process	Very Important	Proposed for Closure in November 2017
		Management of documentation of conflict of interest declarations and assessments	Important	
		Guidance to potential participants and experts	Important	
		Grant preparation	Important	
		Topic definition process	Important	Action plan under implementation
ECA	Performance Audit of the Single European Sky <b>December 2017</b>	Review the EU’s support structure to ATM R&D in light of its objectives	n.a.	Action plan to be set up
		Reinforce the accountability of the SESAR JU	n.a.	
		Prioritize EU support to R&D solutions that promote defragmentation and a competitive environment	n.a.	
IAC	IAC Audit Report Human Resources	Ensure that personal documents of candidates are collected in the sealed envelope.	Important	Proposed for Closure – follow up audit

Author	Topic and date of final report	Recommendation	Criticality	Current Status
	April 2014	Ensure that the 'key accountabilities' in the vacancy notice are revised prior to publication.	Important	planned in March 2018
		Make certain that all paper selection process documents are stored securely.	Important	

**Table 31: Recommendations previous audits from the IAS not formally closed yet**

These recommendations were either issued by the ECA, the IAS or the SESAR JU IAC. For ease of reading and in order to provide the reader a full overview, the recommendations issued by the EC in the context of the interim and final evaluations that took place in 2017 (as described in section 3. II.b. below) have been included too.

The SESAR JU expects to implement the large majority of these recommendations by year end 2018.

## 2.9 Follow-up of observations from the discharge authority

In April 2017<sup>38</sup>, the European Parliament granted discharge to the SESAR JU regarding the financial year 2015. In its resolution, the European Parliament made observations regarding the implementation of the budget for the financial year 2015, notably on budget and financial management, budget transfers, procurement and recruitment procedures, prevention and management of conflicts of interests and transparency, internal control, internal audits and call for proposals.

These observations were all acknowledged and confirmed by the SESAR JU and a written reply was sent to inform the Parliament of the measures that the SESAR JU has already adopted or intends to adopt in order to address the observations made in the context of the discharge<sup>39</sup>.

It is important to note that in its conclusions, the European Parliament highlights the vital role of the SESAR JU in coordinating and implementing research into the SESAR project, which is a pillar project of the Single European Sky.

<sup>38</sup> European Parliament decision of 27 April 2017 on discharge in respect of the implementation of the budget of the SESAR Joint Undertaking for the financial year 2015 (2016/2195(DEC)).

<sup>39</sup> Letter of the Executive Director dated 28 November 2017 with reference SJU D-2017-780

### 3 Part IIb. External Evaluations

The SESAR JU was subject to two evaluations in 2017. 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 are based on the work of independent experts and the results of a stakeholder consultation.

The reports show that SESAR is delivering on its objectives, helping to overcome fragmentation and create continuity of research goals. The commitment of the members is evident and there are high expectations for its outputs. At the same time, the evaluation reports outline a series of elements on which the future work of SESAR should focus upon.

Overall, the results of the interim evaluations of all public-private and public-public partnerships supported by Horizon 2020 concluded that Research partnerships between the EU, the private sector and the Member States are on track to deliver their objectives, improving people's lives, and boosting Europe's international competitiveness.

An overview of the recommendations set out in both SESAR related reports can be found in the table below:

#### Final Evaluation of the SESAR JU operating under the SESAR 1 Programme (FP7)

Recommendation 1 - Strengthen the “partnership approach” including links to deployment

Recommendation 2 - Strengthen the “architecture” of the Master Plan to enable the Commission to streamline deployment planning and monitoring.

Recommendation 3 - Strengthen the links to academia to ensure the innovation pipeline is fed with new ideas

**Table 32: Recommendations from the Final Evaluation of the SESAR JU operating under the SESAR 1 Programme (FP7)**

#### Interim evaluation of the SESAR JU operating under Horizon 2020

Recommendation 4 - Resolve issues with application of H2020

Recommendation 5 - Take steps to further close the industrialisation gap

**Table 33: Recommendations from the Interim evaluation of the SESAR JU operating under Horizon 2020**

Both full reports can be found here:

[https://ec.europa.eu/transport/transport-modes/news/2017-10-10-transport-join-undertakings-are-delivering-expected-results\\_en](https://ec.europa.eu/transport/transport-modes/news/2017-10-10-transport-join-undertakings-are-delivering-expected-results_en)

The full H2020 evaluation can be found here:

[http://ec.europa.eu/research/evaluations/index\\_en.cfm?pg=h2020evaluation](http://ec.europa.eu/research/evaluations/index_en.cfm?pg=h2020evaluation)

## 4 Part III. Assessment of the effectiveness of the internal control systems

### 4.1 Risk Management

Top critical SESAR JU risks managed at corporate level are reported in section 1.6 of part I of this document.

Within the context of the overall internal control framework described below, throughout 2017 the SESAR JU made some significant steps in stabilising the appropriate framework for effective and efficient risk management.

Apart from a certain number of activities covering the review, monitoring and mitigation of risks, there were two significant achievements in relation with risk management: the adoption of the new risk policy and the closure of all remaining action from the action plan on Risk Management following the IAS audit conducted in 2014. In addition, the risk management has been inserted in the corporate information and document management system (IDMS) and requirements are being finalised to allow a daily management of SESAR JU risks through that tool.

In particular, in 2017, the following tasks were conducted and achieved in view of both managing the risks and providing an appropriate set up:

- In February 2017, the SESAR JU Executive Director adopted the new “SESAR JU Risk Management Policy” (SESAR JU/ED/613). This decision repeals the “Internal Control Framework and Risk Management Policy” (SESAR JU/ED/ 64) and the “Risk, Issue and Opportunity Management Process” (SESAR JU/ED/305). The new policy focuses the SESAR JU risk management effort on critical risks and addresses the 4 threads of risks: Corporate risks, Master Plan risks, SESAR JU internal risks and SESAR 2020 Programme Risks.
- In addition to this new Risk Management Policy, in May 2017, the SESAR JU formalised in the context of its Quality Management System “the Corporate Risk Management Process” (SESAR JU Business Process nr 14.2). The updated process was approved by the SESAR JU management in May 2017.

Within these 2 activities, care has been taken to streamline the current approach and increase the focus on the management of critical risks. Globally speaking, this new policy and its associated process reinforce

1. The **focus put on the management of critical risks**, as emphasised in the new risk policy, where it is specified that the SESAR JU shall focus on a limited number of “top” risks. The policy also specifies which risks should be considered as critical at programme level;
2. The set-up of **one single SESAR JU Risk Management Policy and one single Risk Register** that captures and consolidate all 4 treads of risks;
3. The set-up of a dedicated space in the SESAR JU corporate platform IDMS, supporting the daily management of the risks;
4. The **alignment with H2020 requirements** as the SESAR JU uses the mandatory H2020 tools to capture risks identified at the level of the projects of the SESAR 2020 Programme;
5. The definition of **roles and responsibilities** and the appointment of **one single Corporate Risk Manager** who is responsible towards the Executive Director and has the overall responsibility for measuring, monitoring, assigning actions to owners, securing their acceptance and reporting on risks across risk types and organisational units;

6. The **reporting** on key developments and implementation status of the Action Plans of the Corporate Risk Manager to the Corporate Management at least twice a year during the risk management workshops in addition to the reporting integrated in the Consolidated Annual Activity Report (CAAR) and in the Single Programming Document (SPD) as part of the report to the Administrative Board.

After the settlement of this new framework, the following tasks and actions were performed:

- In early July, a questionnaire was sent to all SESAR JU staff with a large set of questions with the objective of identifying new risks and associated actions: it served as a major input for Corporate risk management workshop held end of July 2017;
- On the 24<sup>th</sup> of July, a corporate risk management workshop was organised in view of approving the list of top critical risks (strategic risks and risks escalated from internal, Master Plan and programme threads composing the corporate thread) and updating the risk register. As a result, the Corporate Management Team approved a list of 6 top risks (see section 1.6) managed at its level. Other critical risks will be managed within SESAR JU teams depending on the thread;
- After the workshop, the risk management team took the following initiatives:
  - Some actions to complement information related to some risks (status of actions, additional information for new risks);
  - The risk register has been updated accordingly;
  - Feedback to staff: the Risk Management Coordinator sent an email to all staff providing the status of risks and related mitigation actions;
- There was no other Corporate risk management in 2017 as the second part of year was focused on implementing the results from the summer workshop, working on the user requirement for the IDMS and supporting the reporting on the Action Plan following IAS audit on risk management in SESAR JU;

As a result of these activities,

- The risk register was updated and frozen on the 31<sup>st</sup> of October,
- The stabilised information from the Risk register has been incorporated in the SPD 2018,
- The 2 remaining recommendations from the IAS Audit on risk management at the SESAR JU were proposed for closure.

Lastly, concluding this process, in December 2017, the reporting on Risk Management to the Administrative Board was done.

## 4.2 Compliance and effectiveness of Internal Control Standards

The Management Team is reviewing the Internal Control Standards on a yearly basis, by assessing each of the 35 requirements composing the 16 Standards<sup>40</sup>, materialised with a rating (3 = full compliance; 2 = partial compliance requiring improvement; 1 = non-compliance requiring action plan). This assessment leads to the definition of action plans, where required.

At the end of 2017, the assessment of the Internal Control Standards by the SESAR JU management is the following:

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<sup>40</sup> As per the Internal Control Standards framework updated in 2014

**Assessment of the Internal Control Standards at end 2017**

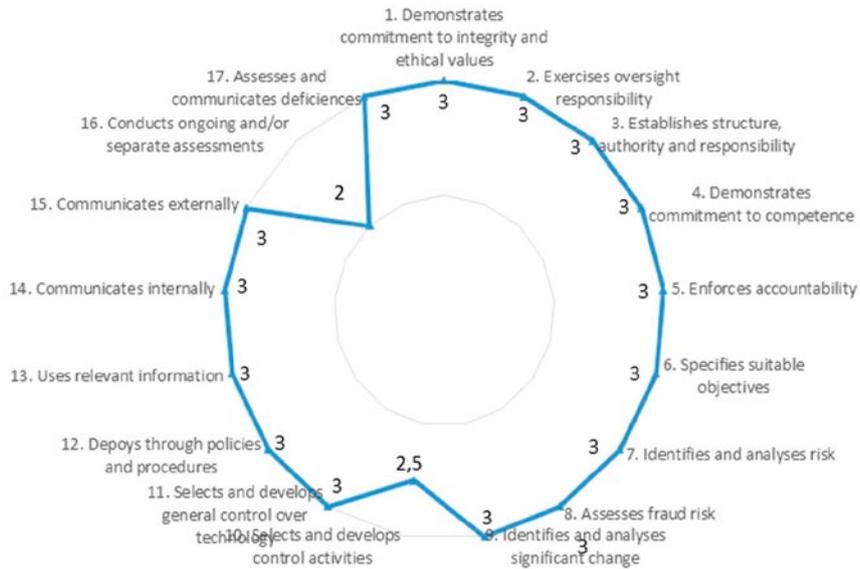


**Figure 14: ICS assessment by SESAR JU Management team at end 2017**

As is shown in the figure, the SESAR JU fully complies with 15 out of the 16 Standards and partly with 1 other. No non-compliance is identified. For the ICS10 Business Continuity, partial compliance is due to the size of the organisation, its objectives, its priorities, the SESAR JU staff currently does not attend training related to BCP and the BCP is not reviewed yearly. However, the SESAR JU has a BCP and is able to activate it when required. Therefore, this partial compliance requires no action plan to be put in place. A complete report on the assessment of the 16 Standards is available in annex VII.

Furthermore, as in 2017 a new Internal Control Framework was introduced by the Commission, anticipating on guidance which should be provided by the Commission services, the SESAR JU has conducted an assessment against the new principles, which is summarised in the figure below, and a complete report can be found in annex VII:

**Assessment of the SJU Internal Control Framework at end 2017**



**Figure 15: Assessment by SESAR JU Management team against the renewed Internal Control Framework at end 2017**

**4.3 Project Audits**

**Control results for FP7 and H2020**

In 2017 two Programmes, SESAR1 (FP7 & TEN-T) and SESAR 2020 (H2020), run in parallel with the last payments of SESAR 1 and the first payments of SESAR 2020, taking place simultaneously.

**4.3.1 Results for the ex-post audit SESAR1 (FP7 & TEN-T)**

The audit work for SESAR1 is almost completed. On the basis of the ex-post audit strategy applicable to SESAR1 as adopted by the SESAR JU Administrative Board, the 4<sup>th</sup> cycle of audits was launched in 2017, consisting of 20 audits in 7 SESAR JU members. 18 of these audits have been finalised or their results are not expected to be challenged during the contradictory procedure. The remaining 2 are in the draft stage and are expected to be finalised in the first semester of 2018.

**4.3.2 Overview**

The total amounts of Costs declared in the Interim Financial Statements 2015 (IFS 2015) by all 15 members (excluding EUROCONTROL) of the SESAR JU amounted to EUR 164.945.399.

Based on the methodology described in the SESAR JU Ex-post audit strategy, Batch 7 was composed of cost claims on IFS2015 and it was reinforced by follow-up audits of Cost Breakdown Forms of previous

periods in order to ensure that after the first audits, errors have been corrected, recommendations have been implemented and therefore the IFSs of previous periods are free from systematic errors and material misstatements. The audits confirmed that this was the case in 10 out of 15 audited entities.

### 4.3.3 Coverage

The Interim Financial Statements received by the 7 members included in Batch 7 – EUR 117 million – were examined at the level of Projects; 105 CBFs were selected, representing EUR 58 million (i.e. 35% of the IFSs of the 15 selected members and 50% of total costs accepted for the 7 members).

Based on the work performed and after the adjustments made by the concerned members as a result of the findings of the audit work, the Project Audit function is of the opinion that

1. the cost claims submitted for the IFS2015 of the audited members, are not any longer affected by systematic errors, and
2. nothing appeared to the attention of the auditors concerning the respect of the principles of regularity and legality of the underlying expenditure and sound financial management.

Furthermore, the members audited in the course of 2017 demonstrated their willingness to adopt the Project Audit Reports' recommendations to avoid in the future similar mistakes to those detected.

### 4.3.4 Results

#### 4.3.4.1 Representative Error Rate

Based on 93 cost statements for which the audit is completed (or almost completed as no changes are expected during the contradictory procedure), the results of the finalised audits indicate a representative error rate of 0,74%.

Where systematic errors are detected, audited members are requested to take immediate actions to correct them and implement recommendations made by the auditors in the audit reports. The errors found mainly concerned the incorrect calculation of labour costs, by using wrong number of productive hours or inclusion of ineligible items in the pool of indirect costs. The amounts to be recovered from the members were identified and were recovered from the co-financing paid for the IFS 2016 as well as with recovery orders issued.

#### 4.3.4.2 Residual Error Rate

The residual error, defined as the error remaining in the population after the corrections and recoveries are made, for the year 2017 was calculated to 0,36%.

As this figure results from the sample audits of only 7 out of 15 members (in compliance with the SESAR JU Ex-Post Audit Strategy), it cannot be considered a representative value for the entire Programme's residual error.

#### 4.3.4.3 Cumulative Error Rates

Given the multiannual nature of the Programme which is closed per Member at the last deliverable accepted within the Programme (i.e. in 2016), the cumulative error rate of the previous years gives the global and representative view of the error on the entire population of the SESAR JU. For this calculation the following factors are taken into account: (1) the method is based on the assumptions that representative errors are corrected and recovered, therefore the costs claimed by a Member the periods subsequent of an audit are assumed to be free from error and material misstatements and (2)

the residual error is assumed to be affecting all the non-audited cost claims of previous and subsequent un-audited periods.

Based on a total amount of costs claimed of EUR 884 million, of which 476 cost statements were audited representing all 15 members amounting to EUR 120 million of (i.e. 14%), after the 2017 audit exercise the new representative error rate is 5,01% and the **new residual error rate is 1,09%**.

#### 4.3.4.4 Implementation of audit results

Implementation of the audits which resulted in an adjustment at cost level in favour of the SESAR JU are mainly recovered through offsetting against subsequent payments. For 2017 netting off was done with payment of FFS2016 and recovery orders were issued.

#### 4.3.4.5 Extension of audit findings

The extension of audit findings is an on-going procedure, which stems from systematic errors identified in audited participations of a Member and subsequently corrections of the non-audited participations of the same Member are required, with the submission of the corrected cost claims in the subsequent reporting period.

#### 4.3.4.6 Risk-based audits

No risk-based audit was performed during 2017.

#### 4.3.4.7 Desk Control

One of the representative audits of Batch 4 was transformed to Desk Control because of the fact that the Member is based in Melbourne-Australia. The control is currently on-going and is expected to be finalised in the first semester of 2018.

#### 4.3.4.8 Other budget lines

No contracts have been audited on other budget lines.

#### 4.3.4.9 Resources

During 2016, 9 audits were performed by E&Y, 10 audits were carried out by PKF and for 1 audit the Framework Contract of DG BUDG had to be used because of identified conflict of interest of the three firms in the SESAR JU Framework Contract.

The resources devoted to the audits outsourced and those done by the SESAR JU are shown in the table below.

Resources devoted to audits in 2017		
Year	2016	2017
Internal Resources EPA (FTE)	1	1
Cost of outsourced auditing (in EUR)	457.000,00	513.000

**Table 34: Resources for project audits in 2017**

No material issue has been identified in the audits performed to date that would require the attention of the Administrative Board.

#### 4.3.5 Results of the ex-post audits and expectations for Horizon 2020 (figures 31/12/2017)

Given the stage of the programme lifecycle, a limited number of cost claims totalling 4.1 billion euros of requested funding had been received by the services by the end of 2017. The first Horizon 2020 audits were launched in the middle of 2016 and further audits were launched in 2017. The first Common Representative Sample (CRS), a Common Risk Sample and an Additional Sample<sup>41</sup> have been selected. In total, by December 2017, 625 participations had been selected for audit, covering all the services signing grants in Horizon 2020.

In total, the audit of 392 participations has been finalised (385 on 2017 selection of 625 participations and 7 on the 2018 selection). This includes 110 out of 142 selected in the first CRS. The error rate on 31/12/2017 is:

Overall detected error rate based on 392 participations: 1,54%.

The detected error rate based on 110 out of 142 participations selected in the first CRS is 1,6%. However, if we take into account the draft audit reports then the expected representative error rate for the full sample will be around 2,82% .

Residual Error Rate for the research family: 1,44 %, expected to rise to around 2.24% when taking into account the draft audit reports.

#### 4.3.6 Comments on the control results

The error rates set out above can only be a preliminary estimation and must be treated with care. The CRS is not yet complete, and so is not yet fully representative of the expenditure that it covered. In addition, the first CRS was taken at an early stage of the programme in order to provide an early indication of the error rate and, also, whether the simplifications introduced in Horizon 2020 had been effective. The nature of expenditure in the first years of the programme may not be totally representative of the expenditure across the whole period of expenditure. And the programme is in any case multi-annual, so the error rates, and especially the residual error rate, must be considered over time. In particular, the cleaning effect of audits over time will tend to increase the difference between the representative/detected error rate and residual error rate, with the residual error rate finishing at a lower rate.

There is nevertheless evidence that the simplifications introduced in Horizon 2020, as well as the increased experience of major beneficiaries, are reducing the number and level of errors made by beneficiaries. However, beneficiaries still make a number of errors, sometimes because of a lack of understanding of the rules, sometimes because of a non-respect of the rules.

Considerable efforts have been made to ensure clear communication of the rules and guidance to participants and their auditors. By the end of 2017 a total of 75 communication events had been organised in 26 different countries with a total of 6.600 participants.

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<sup>41</sup> This last sampling accommodates special needs of certain stakeholders with regard to audit coverage and selection method. In addition, top ups, which are participations of selected beneficiaries which are added to the selected participations, are included in the total participations selected.

Trials of lump sum funding will be undertaken in the 2018 work programme to evaluate if this form of entitlement funding, which would avoid errors of legality and regularity, is appropriate to achieving all the objectives of research policy.

The first audit results, from the CRS and other audits, suggest that, over the multiannual period, and especially considering the high level of audit coverage of Horizon 2020 expenditure that can be expected, the residual error rate will be below 2%. Additional evidence to support this conclusion will arrive in 2018. However, there are today no indications that the residual error rates identified in FP7 – below 2% - will rise in Horizon 2020.

#### **4.3.7 Results for the ex-post SESAR-specific audits**

As there were no SESAR cost claims paid at the time of drawing the CRS sample, the SESAR JU has requested the CAS to perform SESAR-specific audits, in order to provide assurance to the AO for the H2020 expenditure. Even though only a limited number of audits have been carried out on SESAR JU, however, results so far show that they are in line with the overall results.

For the SESAR JU, in 2017 a total amount of EUR 8.077.628 of cost claims has been received and paid. Two snapshots of the population have been taken on 01/03/2017 and 03/07/2017 which resulted in two audit samples drawn from the CAS on a total amount of EUR 5.505.141. The two samples represent 11 beneficiaries, 24 participations and audit coverage of 24% of the H2020 expenditure. By 31/05/2018 four audit reports in 10 participations were finalised resulting in a detected error rate of 4,78% with systematic errors of 3,29% and a Residual Error Rate of 2,8%. This high error was caused by a single audit in an SME, recipient of SESAR JU Grant for the first time and related to a misunderstanding of the provision for SME owners' salary.

In line with the H2020 FP, it remains the ultimate objective of the SESAR JU to achieve a residual error rate of less than 2% of total expenditure over the lifetime of the programme. However, the AO charged with the implementation of the research and innovation budget will establish a cost-effective internal control system that will give reasonable assurance that the risk of error over the course of the multiannual expenditure period is, on an annual basis, within a range of 2-5 %, with the ultimate aim to achieve a residual level of error as close as possible to 2 % at the closure of the multi-annual programme, once the financial impact of all audits, correction and recovery measures have been taken into account.

## 5 Part IV. Management assurance

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### 5.1 Review of the elements supporting assurance

The aim of this section is to provide information on the current set of 'building blocks' that enable the Executive Director to obtain a full picture of the state of play of the SESAR JU, underpinning the reasonable assurance given by the Authorising Officer in his declaration of assurance of the Annual Activity Report and allowing him to give adequate assurance to the Management Board.

These building blocks are composed of the following elements:

***Building block 1 – Assessment by management:***

This assessment is provided in section 2.5.

***Building block 2 – Register of exceptions:***

This assessment is provided in section 2.5.

***Building block 3 – Audit results during the reporting period:***

Audit results and recommendations are presented in sections 2.7, 2.8 and 2.9.

### 5.2 Reservations

No reservation is made on the SESAR JU's activities in 2017.

### 5.3 Overall conclusions on assurance

No qualification is to be made on SESAR JU's activities.

There are also no reservations on the procedures relating to the selection of participants for SESAR 2020 projects in 2017 and the corresponding underlying financial operations (legal and financial commitments). This is also the case for SESAR JU payments relating to administration and procurement.

On the basis of the above elements, the Management provides a reasonable assurance that all necessary control procedures are in place to guarantee the legality and regularity of the SESAR JU's activities, in line with the principles of economy, efficiency and effectiveness.

## 6 Part V. Declaration of Assurance

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I, the undersigned, Executive Director of the SESAR Joint Undertaking,

In my capacity as Authorising Officer,

Declare that the information contained in this report gives a true and fair view.

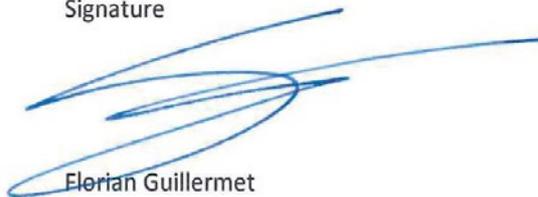
State that I have reasonable assurance that the resources assigned to the activities described in this report have been used for their intended purpose and in accordance with the principles of sound financial management, and that the control procedures put in place give the necessary guarantees concerning the legality and regularity of the underlying transactions.

This reasonable assurance is based on my own judgement and on the information at my disposal, such as the results of the self-assessment, ex-post controls, the work of the Internal Audit Service, the work of the Internal Audit Capability and the lessons learnt from the reports of the Court of Auditors for years prior to the year of this declaration.

Confirm that I am not aware of anything not reported here which could harm the interests of the agency.

Brussels, 27 June 2018

Signature



Florian Guillermet

Executive Director

SESAR Joint Undertaking

## 7 Annexes

### 7.1 Annex I. Core business statistics

In this annex, we provide further detail on the information which is provided in Part I of this document.

Information on the projects complements the overview provided in figure 4 and the information provided in Part I.

#### 7.1.1 Annex I.1: SESAR 2020 project activity

##### 7.1.1.1 Strategic Programme Steering

Strategic Programme Steering is addressed through projects awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2) and the ER1 call (with reference H2020-SESAR-2015-1).

The IR-VLD Wave 1 call resulted in the following projects related to ‘Transversal Activities’ (Coordination and Support Actions):

Ref.	Project title	Short Topic/Project Description	Type of Action	Max. total co-financing value (in EUR)
PJ.19	Content Integration	“Content Integration” (CI) activities will 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 CONOPS.	CSA	7.395.142
PJ.20	Master Plan Maintenance	The ATM-MP has three levels (Executive, Planning and Implementation) that require synchronised monitoring and alignment. The work shall consist in maintaining, updating and publishing as and when necessary the ATM-MP. It shall also consist in managing the ATM-MP update campaigns.	CSA	3.327.676
PJ.22	Validation & Demonstration Engineering	Development of the Validation & Verification Infrastructures (V&VI) and Platforms (V&VP) development required for supporting SESAR Validation Exercises.	CSA	2.051.356

**Table 35: IR Projects focusing on Transversal Activities resulting from Wave 1 call H2020-SESAR-2015-2 and their max. co-financing value**

The ‘**Work Area 2 – ATM Applications oriented research**’ of Exploratory Research 1 call (with reference H2020-SESAR-2015-1) resulted in the following projects related to ‘Innovative ATM Architecture, Performance & Validation’:

Topic Description	Projects	Max. total co-financing value (in EUR)
Innovative ATM Architecture,	<b>PACAS</b> will model and analyse changes at different layers of the ATM system to support change management, while capturing	998.355

Topic Description	Projects	Max. total co-financing value (in EUR)
Performance & Validation	how architectural and design choices influence the overall system.	
	<b>INTUIT</b> will explore the potential of visual analytics, machine learning and systems modelling techniques to improve our understanding of the trade-offs between ATM KPAs.	998.125
	<b>AURORA</b> will propose advanced metrics to assess the operational efficiency of the ATM system.	829.313
	<b>APACHE</b> proposes a new framework to assess European ATM performance based on simulation, optimization and performance assessment tools that will be able to capture complex interdependencies between KPAs at different modelling scales.	783.838

**Table 36: Exploratory Research “ATM Applications oriented research” projects selected for ‘Innovative ATM Architecture, Performance & Validation’ as a result of the call H2020-SESAR-2015-1 in 2016**

Further to the high-level results provided in Part I of this document, the paragraphs below provide update information on the objectives and 2017 achievements of these projects. Projects are sorted by Key Feature/topic and then by increasing order of their acronym.

#### **7.1.1.1.1 Project PJ.19 CI ‘Content Integration’**

The content integration project provides steering guidance and serves the purpose of coordinating and integrating the SESAR Solutions. It does this by supporting and guiding the architectural processes, it brings the SESAR Solutions together and it assesses their completeness, consistency and coherency from a holistic perspective as represented in the SESAR 2020 Concept of Operations. The Content Integration activities also cover the maintenance and support of the performance framework and ensure its applicability by the projects.

PJ.19 was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2).

PJ.19 was launched in November 2016. The first months in 2017 were dedicated to the set-up of the project, internally between the 4 main PJ.19 work packages and externally with the SESAR 2020 Projects / Solutions and the SESAR 2020 Governance (SESAR JU). PJ.19 developed the first version of the Project Management Plan (PMP) and initiated the regular (monthly) Project Management Board (PMB) and the (yearly) extended PMB (EPMB).

PJ.19 has been strongly involved in the SESAR 2020 ramp-up phase with the major contribution to the SESAR 2020 ramp-up briefing sessions, the set-up of the maturity gate and the provision of lot of Architecture, Modelling and Performances trainings.

By mid of 2017, PJ.19 and the Content Integration process was running full speed with tools, method, process and coaching to support the working together set up within PJ.19, with the SESAR 2020 Projects/Solutions and other transversal activities (ATM Master Plan (PJ.20) and Requirement Management (PJ.22)).

The first Content Integration cycle was completed by mid of 2017 with the provision of the first update of the SESAR 2020 CONOPS, the SESAR Operational, Technical, Service and Information architecture (via the European ATM Architecture – EATMA framework) in EATMA V9, the SESAR Architecture Document (ADD) and associated Service Roadmap and Portfolio.

The first performance consolidation was made by the end of 2017 based on the early validation results of the SESAR 2020 Projects/Solutions (via the SESAR Performance framework) and the Performance Targets defined early 2017.

After this first Content Integration cycle, PJ.19 defined the baseline for the second Content Integration cycle with the update (when need be) of the working together processes, architecture and performance frameworks and the definition of the validation targets 2018.

During 2017, the PJ.19 contribution to the ATM Master Plan 2018 was reinforced with the definition of the common change management process, the management of the Integrated Roadmap (DS17 and DS17b) and the direct contribution to the ATM Master Plan Key Focus teams (ATM Vision, Drone and Performances).

During 2017, PJ.19 contributed to the Cyber-Security Task Force launched by SESAR JU. Results of the task force were handed over to PJ.19 in October 2017. Also, PJ.19 contributed to the Operational and Technical Sub Committee (OTSC) and to the Management Sub Committee (DMSC).

#### **7.1.1.1.2 Project PJ.20 AMPLE ‘Master Plan Maintenance’**

PJ.20 supports the Master Planning process. In particular, according to the Grant Agreement, it:

- defines the priorities for both R&I and deployment based on performance ambition levels;
- consolidates Business Case information;
- establishes the link between development and deployment phases by providing the high-level roadmap for the evolution of the ATM system in terms of performance, technical aspects and architecture, standardisation and regulatory activities as well as the business implications
- Supports Master Plan update campaigns (every three years) and provides yearly updates of Levels 2 (Planning) and Level 3 (implementation) of the Master Plan.

PJ.20 was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2).

To perform its planning activities and access relevant project information, PJ20 operates in close coordination with the Content Integration and Supporting Transversal Activity (PJ19), the integration interface for SESAR ATM and Technological Solutions validation results emanating from the SESAR Projects of the R&I Programme.

PJ20 added-value resides first in its wide ranging consortium of about 20 active Partners bringing together key European ATM expertise from air navigation service providers, airports, airborne and ground system industry, and EUROCONTROL including the network manager and inter alia civil-military expertise.

PJ.20 was launched in November 2016. In 2017, the project worked under significant pressure, in particular on two major tasks, planned as optional but which were activated almost simultaneously as a consequence of EC mandates / delegations:

- the support to the SESAR JU on the preparation of a Roadmap for drone integration into all categories of airspace,
- the support to the SESAR JU on the development of a recommendation on a second common project (CP2).

These tasks had to be carried out simultaneously and in parallel, which exercised a lot of pressure on available resources and generated delay in the production of other deliverables. On the other hand, the production of the Drones roadmap and of the CP2 recommendation were utmost priorities and were expected as a crucial inputs for the Master Plan update campaign, which was kick-started in a high-level event in Tallinn on 8 November 2017 and will continue all over 2018.

#### **7.1.1.1.3 Project PJ.22 SEabird ‘Validation, Verification and Demonstration infrastructure’**

PJ.22 “System Engineering for Validation and Demonstration” (SEabird) was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2) and kicked-off in 01 October 2016. During 2017 the project has been focused on:

- The set-up, definition and maintenance of processes, methods and tools for System Engineering Data Management in the SESAR programme and operationally set-up the SE-DMF (System Engineering Data Management Framework). The activities included the analysis and specification of the SE-DMF and the overall service, set up and maintenance of the implementation plan, pre-service verification, pilot phase with selected SESAR solutions, set-up of the SE-DMF cloud service, the provision of training and coaching to the solution projects, SE-DMF annual maintenance, set up of help desk service and monitoring of SE-DMF adoption at programme level.
- Support to SESAR Solution Maturity Lifecycle and Gates e.g. traceability matrix.
- Maintenance of Platforms Catalogue: internal coordination activities have been carried out among contributing partners in order to progress with technical activities, and with WP3 to build and share a common view about the implementation of Platform Catalogue.
- Maintenance of the V&V and Demonstration platform development methodology, including the creation of V&VPs, V&VIs and Demonstration Platforms Development Methodology Compliance Check List (CCL).
- Elaboration of the V&V and Demonstration platform development methodology training plan and supporting material, and preparation of questionnaires for collection of solution project’s feedback on the use of the methodology.
- Identification of validation tools and interoperability solutions required by the other Solution Projects and the development of specifications. In particular:
  - To develop a questionnaire supporting the identification of Solution Project needs
  - To establish contact with the Solution Projects and request the questionnaire feeding and analyse the outputs of the questionnaire
  - To develop interoperability solutions specifications
  - To coordinate the integration of solutions in the ED-147 developed by EUROCAE Working Group 81

#### **7.1.1.1.4 Innovative ATM Architecture, Performance & Validation**

##### **7.1.1.1.4.1 ER project ‘APACHE’**

APACHE was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

The APACHE project aims at providing advanced simulation, optimisation and assessment tools with the objective to measure ATM performance and capture the complex interdependencies among different KPAs. Enhanced and new metrics will be developed to assess not only current ATM operations, but also aiming to future operational contexts in line with SESAR 2020+ activities.

In 2017 the project made progress by baselining its definition of the Concept of operations for the project and that defines the operational context which encompasses the evaluation studies that will be carried out.

It also reviewed current applicable KPIs and do this different performance frameworks were thoroughly reviewed. In particular, a survey of key performance areas (KPA) and key performance indicators (KPI) was done by analysing different organizations worldwide, including the International

Civil Aviation Organisation (ICAO), the Civil Air Navigation Services Organisation (CANSO), the Single European Sky (SES) Performance Scheme, EUROCONTROL, and the SESAR 2020 performance framework.

In follow up, it proposed new KPIs, devoting a significant effort to enhance current indicators or even proposing new ones aiming at better capturing ATM performance. Across 9 key performance areas (KPAs), a total of 40 new, or enhanced, performance indicators (PIs) were proposed, with a total of 18 PIs variants (making a total of 58 proposed indicators).

The APACHE System developed implements a total of 25 new (or enhanced) PIs and 17 PI variants. To implement the framework five main tasks were done:"

- A "Trajectory planning" module has been developed, based on previous background from UPC. This module is able to generate trajectories at ECAC level simulating some SESAR solutions
- A "Traffic and capacity planning" module is being developed simulating the most important functions of the Network Manager. A demand and capacity balance algorithm, similar to current air traffic flow management practices, has been implemented together with an advanced demand and capacity balance algorithm, in line with SESAR 2020 solution PJ09.
- An "Airspace planning" module has been developed, based on previous background from ENAC. The module has been implemented based on current air navigation service provider practices. A dynamic sectorisation algorithm, in line with SESAR 2020 solution PJ08, has also been developed.
- A "safety and risk assessment framework" to compute several safety related metrics.
- A "performance analyser" implementing new defined performance indicators and providing tools for benchmarking and visualisation of ATM performance.

#### 7.1.1.1.4.2 ER project 'AURORA'

AURORA was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

The project AURORA addresses the gaps of the efficiency indicators which are used today to evaluate the performance of the European ATM system. Flight efficiency is a generic term that varies depending on the agent's viewpoint. Whereas Air Navigation Service Providers (ANSPs) take a wider look at efficiency, considering components such as sector capacity, air traffic controller's interventions, emissions and noise; airlines are mainly concerned on costs, i.e. fuel consumption and schedule adherence. It is relevant to bring these two agents' viewpoints together in new advanced indicators that capture airlines' needs without leaving out the inefficiencies of the entire net.

AURORA is proposing new metrics to assess the operational efficiency of the ATM system and to measure how fairly the inefficiencies in the system are distributed among the airlines. These new indicators are encapsulating the airspace users' operational objectives, considering fuel consumption, schedule adherence and cost of the flights, and they require the design of user-preferred trajectories as the main references for performance comparison purposes. Second, AURORA is exploring and testing techniques borrowed from the big data, data science, and information management fields for the on-line calculation of the new efficiency indicators through the collection and exploitation of massive on-line amount of data. This will allow AURORA to propose a new framework for ATM decision-making based on real-time performance monitoring.

In 2017 AURORA assessed the state-of-the-art of current performance indicators to measure flight efficiency (i.e. Horizontal Flight Efficiency indicator). Based on previous state-of-the-art, a gap analysis of the current indicators was performed in coordination with the airspace user representatives.

This was the starting point for the definition of enhanced efficiency and equity indicators and associated methods to obtain them based on the design of user-preferred trajectories (e.g. optimum trajectory in terms of fuel consumption taking into consideration the weather conditions).

AURORA tested that the methods to obtain the new indicators is technologically feasible through the use of historical surveillance data (ADS-B), flight plans and weather forecasts. Three different days with all flights arriving and departing at the ECAC area were considered. AURORA's Airspace Users Group participated in the analysis of results and conclusions on the added value of the new indicators. In parallel to the calculation of indicators based on historical data, AURORA has developed a model for the on-line calculation of the state of the indicators during the flight execution.

#### 7.1.1.1.4.3 ER project 'INTUIT'

INTUIT was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

The ongoing ATM modernisation programmes, including SESAR, build on ICAO Global ATM Operational Concept, one of whose cornerstones is performance orientation. A performance-based approach is defined by ICAO as one based on: (i) strong focus on desired/required results; (ii) informed decision making, driven by the desired/required results; and (iii) reliance on facts and data for decision making. While a lot of effort has traditionally been devoted to the development of microscopic performance models, there is a lack of useful macro approaches able to translate local improvements or specific regulations into their impact on high-level, system-wide KPIs.

The goal of the project INTUIT is to explore the potential of visual analytics, machine learning and systems modelling techniques to improve our understanding of the trade-offs between ATM KPAs, identify cause-effect relationships between indicators at different scales, and develop new decision support tools for ATM performance monitoring and management. The specific objectives of the project are to propose new metrics and indicators providing new angles of analysis of ATM performance; and to develop a set of visual analytics and machine learning algorithms for the extraction of relevant and understandable patterns from ATM performance data; to investigate new data-driven modelling techniques able to provide new insights about cause-effect relationships between performance drivers and performance indicators; and to integrate the newly developed analytical and visualisation functionalities into an interactive dashboard supporting multidimensional performance assessment and decision making

In 2017 the project has defined quantitative indicators to assess access and equity; new KPIs for future SES reference periods; and new forms of KPI visualisation. It used a combination of visual analytics and machine learning techniques to study interdependencies between KPAs/KPIs. The work has been structured in the form of 3 case studies that address one or more of the research questions outlined above:

- Case study 1. Modelling of airline route choices and the influence of unit rates on performance. The goal is to develop new models able to predict airline route choices between different airport pairs in order to evaluate the performance trade-offs arising from these decisions (e.g., cost efficiency vs environment). The proposed approach has shown significant potential to improve the understanding of route choices, and it is of potential application to the problem of pre-tactical traffic forecast.
- Case study 2. Multi-scale representation of performance data. This case study aims to disaggregate traffic data and performance indicators at sector and/or traffic volume level, with different levels of temporal disaggregation, and later on model the relationship between these

variables at different scales (e.g., what is the influence of individual sector characteristics on the aggregated performance of a certain ANSP?).

- Case study 3. Identification of sources of en-route flight inefficiency. The case study aims to investigate the causes of inefficient routes in the European Network and their effects on performance.

#### 7.1.1.1.4.4 ER project 'PACAS'

PACAS was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

The PACAS project is about supporting change management in ATM systems from an architectural point of view, relying on the active participation of ATM domain stakeholders through gamification. The project constructs a platform that facilitates understanding, modelling and the analysis of changes in the ATM system at different layers of abstraction. To accommodate the expertise of the various domain stakeholders PACAS provides a multi-view, model-based approach, in order to represent and analyse different objectives, specifically economical, organizational, security, and safety concerns. The PACAS process relies on automated reasoning techniques to find optimal solutions (trade-off) among the various objectives.

In 2017 the PACAS project progressed well to almost achieve all the project's objectives set:

- released the second stable version of the PACAS platform, which is the result of several iterations, starting from gap analysis and interactions with ATM domain stakeholders performed
- established the PACAS scenario so to focus on particular decision points
- It redefined the participatory change management process including roles involved and this to help users understand the status and take actions in case of deviations or focus the effort in specific tasks
- It defined gamification elements, including the avatar and incentives, which have undergone evaluation too
- It released the modelling notations for the four expert views, with the security and safety ones being quite stable from the first release, and the organizational and economic views undergoing some customizations being more domain-dependant.
- It released and evaluated with external users automated reasoning techniques for impact propagation in the form of a web service that is integrated in the platform

### 7.1.1.2 Exploratory Research

Exploratory Research is addressed through projects awarded under the calls

- ER1 (with reference H2020-SESAR-2015-1), resulting in projects related to ‘ATM Excellent Science & Outreach research’ and to ‘ATM Applications oriented research’,
- ER2 (with reference H2020-SESAR-2016-1), resulting in projects related to ‘ATM Applications oriented research’,
- ER3 (within the call with reference H2020-SESAR-2016-2), resulting in projects related to ‘ATM Applications oriented research’.

Further to the high-level results provided in Part I of this document, the paragraphs below provide update information on the objectives and 2017 achievements of these projects resulting from calls ER1 and ER2<sup>42</sup>. Projects are sorted by Key Feature/topic and then by increasing order of their acronym.

#### 7.1.1.2.1 ATM Excellent Science and Outreach

The ‘Work Area 1 – ATM Excellent Science & Outreach research’ of the Exploratory Research 1 call (with reference H2020-SESAR-2015-1) resulted in the following projects:

Topic Description	Projects	Max. total co-financing value (in EUR)
Automation, Robotics and Autonomy	<b>AUTOPACE</b> proposes research on a Psychological Model to quantitatively predict how automation would impact on human performance based on cognitive resources modelling, tasks characteristics (automation) and psychological factors modelling.	599.868
	<b>TACO</b> aims to define an automated system sufficiently powerful to both accomplish complex tasks involved in the management of surface movements in a major airport and self-assess its own ability to deal with non-nominal conditions.	599.993
	<b>AGENT</b> presents traffic alert and collision avoidance system and proposes the development of an Adaptive self-Governed aerial Ecosystem by Negotiated Traffic that provides mechanisms and tools for induced collision avoidance while dynamically creating virtual Ecosystems of aircrafts as soon as a conflict is forecasted.	598.750
	<b>STRESS</b> project will address various elements HP envelope, the real-time neurophysiological indexes, the guidelines and methods to match the HP envelope status with the highest possible level of automation, the monitoring of the controllers’ mental status during automation failure.	596.875

<sup>42</sup> As ER3 call award and grant agreement preparation process was completed in the end of 2017, no information on the activities of the related projects is provided in the annex

Topic Description	Projects	Max. total co-financing value (in EUR)
	<b>MINIMA</b> will research new human-automation interaction design concepts. This project will develop solutions to mitigate these effects. As an example a highly automated arrival management task in which the aircraft follow their predefined 4D-trajectories will be investigated. As neither the automatic detection and resolution of all conflicts, nor the ability of all aircraft to follow their trajectories with the required precision can be guaranteed all the time, a human operator is needed to monitor and handle situations in which automation fails.	582.780
Complexity, Data Science and Information Management	<b>BigData4ATM</b> will investigate how ATM and Aviation data can be analysed and combined with more traditional demographic, economic and air transport databases to extract relevant information about passengers' behaviour and use this information to inform ATM decision making processes.	599.733
	<b>DART</b> (Data-driven AiRcraft Trajectory prediction research) explores the applicability of data science and complexity science techniques to the ATM domain. DART will deliver understanding on the suitability of applying big data techniques for predicting multiple correlated aircraft trajectories based on data driven models and accounting for ATM network complexity effects.	598.524
	<b>MALORCA</b> project develops a multi-modal, state-of-the-art, automatic learning system for Assistant Based Speech Recognition to be applied for ATC tasks, taking advantage of the large amount of speech data available in the ATM world.	538.104
	<b>BEST</b> will determine how semantic technologies can be used effectively to maximise the benefits of adopting SWIM, one of the major results of SESAR. SWIM offers an "information sharing" approach to ATM information management and its adoption offers advantages for better situational awareness and information management. But the full benefits of SWIM can only be achieved if advanced support can be provided for developing smart SWIM-based applications that manage information effectively, and semantic technologies offer a promising way to do that. BEST identifies a set of focused research questions about how to exploit semantic technologies in a practical way in an ATM setting, and will produce concrete results that help address these.	593.129
Environment & Meteorology	<b>TBO-MET</b> project addresses the problem of analysing and quantifying the effects of meteorological uncertainty in Trajectory Based Operations.	488.750
	<b>ATM4E</b> is to explore the scope for the potential reduction of air traffic environmental impacts in European airspace on climate, air quality and noise through optimization of air traffic operations.	599.625
	<b>PNOWWA</b> project will produce methods for the probabilistic short-term forecasting of winter weather and enable the	597.500

Topic Description	Projects	Max. total co-financing value (in EUR)
	assessment of the uncertainty in the ground part of 4D trajectories.	
Economics & Legal Change in ATM	<b>COCTA</b> project proposes coordinated economic measures aiming to pre-emptively reconcile air traffic demand and airspace capacity, by acting on both sides of the inequality. In performing demand-capacity balancing COCTA primarily aims to reduce the cost arising from lack of coordination in the ATM system, stemming both from divorced planning horizons of ANSPs and aircraft operators (AOs), and from an inadequate pricing of navigation services.	534.158
	<b>Vista</b> will examine the effects of conflicting market forces on European performance in ATM, through the evaluation of impact metrics on four key stakeholders and the environment.	599.188
	<b>COMPAIR</b> will investigate how to introduce competitive incentives in the ATM sector so as to best contribute to the achievement of the European high-level policy objectives for aviation.	599.804

**Table 37: Exploratory Research “ATM Excellent Science and Outreach” projects selected as a result of the call H2020-SESAR-2015-1 in 2016**

The paragraphs below provide update information on the objectives and 2017 achievements of these projects.

#### 7.1.1.2.1.1 ER project ‘AGENT’

AGENT was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

In Q1 2016, the AGENT project kicked off, ramped up and initiated execution.

AGENT aims at contributing to an enhancement of the overall performance of the air transport system, mainly targeting the separation management layer of air traffic and its connections with Trajectory Management and Collision Avoidance. The overall performance of the system shall increase primarily by increasing safety, and improving the efficiency for all agents of the system.

AGENT addresses the following key objectives:

- To propose an innovative automation-based future system design supporting a shift from a nowadays centrally controlled ATM system to a distributed system, in which aircraft and ATC collaborate to form adaptive aerial ecosystems, to find an optimal compromise accounting for safety, capacity and cost-efficiency aspects.
- To develop ATC- and Pilot-side Decision Making Tools to transform aircraft and ATC into Intelligent Agents that can communicate with each other using machine-to-machine interfaces with the aim to safely make best use of existing airspace capacity.
- To build ontology for knowledge representation, reasoning and machine-to-machine communication between intelligent agents.
- To verify the AGENT DMT's using real traffic information and validate results by means of the scenarios in a simulated environment with traceable and transparent information.
- To demonstrate and quantify the potential for the innovative ATM design to provide benefits in safety, capacity and efficiency of ATM operations, ensuring a wider acceptance of the

research results and conducting demonstration activities used to build confidence in the effectiveness of the concept.

During 2017, AGENT main efforts have been made towards the development of the Air Traffic Control (ATC) smart monitoring and analytics tools, the design of the AGENT Open Demonstrator, and the definition and development of the airborne decision making tools, ontology concept, and communication protocol and mechanisms for interaction between the ecosystem Agents. The basic concept of the Multi-Agent Simulation tool for analysis of ecosystems has been defined as well as procedure for the modules integration into the Open Demonstrator (OD).

One of the most important tasks was the design and development of the Open Demonstrator and of the two AGENT airborne tools: the Multi-objective state space analysis tool, intended for generation of the ecosystem resolution trajectories, complemented by the Multi-Agent Simulation (MAS) tool, aimed at representing the negotiation process between the ecosystem aircraft, within the tracking phase, before the resolutions have been initialized.

The Open Demonstrator (OD), the Multi-Objective State Space Analysis Tool (MSSAT) and the Multi-Agent Simulation (MAS) tool were delivered and integrated.

#### 7.1.1.2.1.2 ER project 'ATM4E'

ATM4E was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

In Q3 2016, the ATM4E project kicked off, ramped up and initiated execution.

Systematic and simultaneous consideration and optimization of environmental impacts, comprising climate impact, air quality and noise issues, are currently lacking. ATM4E addresses this gap and explores the feasibility of a concept for a multi-dimensional environmental assessment of ATM operations working towards environmental optimization of air traffic operations in the European airspace.

The project has the following objectives:

- To establish a multi-dimensional environmental change function (ECF) concept, which includes air quality impact (for key pollutants) and perceived noise in addition to climate impact. This will constitute a new metric for an environmental assessment.
- To plan flight trajectories which mitigate the environmental impact for characteristic meteorological situations based on different ATM constraint assumptions and optimization strategies and investigate to what extent the resulting changes in traffic flows lead to particular challenges for air traffic management when such optimization is performed.
- To evaluate environmentally-optimized routes in a future atmosphere in a comprehensive climate-chemistry modelling allowing a proof of concept of climate-optimisation with daily route analysis.
- To develop, in collaboration with aviation stakeholders, a roadmap including an implementation strategy and recommendations for the environmental optimization of aircraft trajectories.

During 2017, the algorithm-based Environmental Change Functions (ECFs), which can be calculated using routinely available meteorological data, were developed.

For the planning of optimized flight trajectories, air traffic data for Europe was selected and processed. The environmental impact of the selected air traffic was determined with a trajectory calculator and simulating engine emissions (carbon dioxide, water vapor and nitrogen oxides). The potential forming of contrails caused by these flights was estimated. Data preparations and advancements of the

Trajectory Optimization Module for processing large air traffic scenarios and meteorological data were finalized.

Progress was achieved in the verification of the algorithm-based Environmental Change Functions and in the evaluation of environmentally-optimized routes in a future atmosphere by using a comprehensive climate-chemistry modelling.

#### **7.1.1.2.1.3 ER project ‘AUTOPACE’**

AUTOPACE was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

In Q1 2016, the ‘AUTOPACE’ project kicked off, ramped up and initiated execution.

The project performs fundamental research on psychological modelling to predict how future automation would impact on air traffic controller performance and to identify competences and training to cope with the effects of automation on humans. It performs analytical studies to estimate cognitive demanded resources in a 2050 environment based on the multiple resource theory. Later on, Psychologists, ATM Experts, Controllers and Training experts will set the hypothesis to build a Psychological Model of the ATCo cognitive resources based on the attentional theories. Finally, the project will look at the future use of this Psychological Model to support the identification of future competences and training strategies.

During 2017, AUTOPACE focused on the identification of the effects of automation on the cognitive processes and the research on the psychological model elements based on the assessment of AUTOPACE scenarios, while addressing safety risks and ensuring performance benefits. The key deliverables were the proposed ATCo Psychological Model, the identification of the required competences and training strategies to address the effects of automation on the ATCo performance, a Preliminary Hazard of AUTOPACE scenarios, the assessment the benefits of the future automation scenarios and the evaluation of the usefulness of AUTOPACE Psychological Model.

#### **7.1.1.2.1.4 ER project ‘BEST’**

BEST was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

In Q3 2016, the BEST project kicked off, ramped up and initiated execution.

The main objective of BEST is to determine how semantic technologies can be used effectively to maximise the benefits of adopting SWIM.

BEST will evaluate the use of semantic technologies in several realistic ATM use cases. Semantic technologies are advanced tools and techniques enabling flexible information management, including information extraction and integration from multiple sources. The aim is to support the new paradigm for ATM information management envisioned by SWIM. The project will use practical experience gained in the project to produce guidelines for practitioners about how these technologies can be used in innovative yet scalable ways in order to support the mission of SWIM.

During 2017, work on producing the ontology infrastructure for BEST was completed, including running of experiments to evaluate and fine-tune it. The concept of “semantic container” was defined, and a structure for administrative metadata was developed. The suitability of different ontology languages was assessed, including aspects related to performance issues. Work started on developing an abstract data model of semantic containers that accounts for logical and physical containers. Operational scenarios for demonstrating how BEST could support SWIM were defined. The scenarios include flight re-routing, failure of a data provider and quality of ATM information. The scenarios will support the development, configuration and deployment of prototype applications.

#### 7.1.1.2.1.5 ER project 'BigData4ATM'

BigData4ATM was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

In Q2 2016, the BIGData4ATM project kicked off, ramped up and initiated execution.

ATM operations have so far lacked a passenger-oriented perspective, with performance objectives not necessarily taking into account the ultimate consequences for the passenger. There is a lack of understanding of the impact of passengers' behaviour on ATM and vice versa. Research in this area has so far been constrained by the limited availability of behavioural data. The pervasive penetration of smart devices in our daily lives and the emergence of big data analytics open new opportunities to overcome this situation: for the first time, we have large-scale dynamic data allowing us to test hypotheses about travellers' behaviour.

The goal of BigData4ATM is to investigate how these data can be analysed and combined with more traditional demographic, economic and air transport databases to extract relevant information about passengers' behaviour and use this information to inform ATM decision making processes. The objectives of the project are:

- to integrate and analyse multiple sources of passenger-centric spatio-temporal data (mobile phone records, data from geolocation apps, credit card records, etc.) with the aim of eliciting passengers' behavioural patterns;
- to develop new theoretical models translating these behavioural patterns into relevant and actionable indicators for the planning and management of the ATM system;
- to evaluate the potential applications of the new data sources, data analytics techniques and theoretical models through a number of case studies, including the development of passenger-centric door-to-door delay metrics, the improvement of air traffic forecasting models, the analysis of intra- airport passenger behaviour and its impact on ATM, and the assessment of the socio-economic impact of ATM disruptions.

During 2017, the project focused on the analysis of door- to-door mobility based on mobile phone records, Twitter data, and other data from personal mobile devices (e.g., public transport smart card data). Four case studies were selected:

- Analysis of airport catchment areas, competition/complementarity of air transport with ground transport, and competition between airports.
- Improvement of traffic forecasting methodologies thanks to a more detailed characterization of passenger choices.
- Development of new door-to-door delay metrics.
- Analysis of the impact of ATM disruptions, including the development of new indicators such as the impact of disruptions on travellers' expenditure.

The following tasks have been carried out:

- Development of methodologies and algorithms to infer activity-travel patterns at different scales. Due to their worldwide coverage, Twitter data have been used to reconstruct international passenger flows at a more aggregated level. Mobile phone records, which provide bigger samples and higher temporal granularity, have been used to reconstruct in a more detailed manner the airport access/egress legs in those countries where mobile phone data are available.
- Development of statistical approaches and data fusion algorithms to upscale the observed behaviour to the total population.
- Comparison of the information extracted from non-conventional data with that available from other sources (e.g., surveys), in order to validate the newly developed methods.

- Development of methodologies to extract information from credit card transactions data. This information includes passenger expenditure (both inside and outside the airport), comparison between different airports and seasons, and the impact of disruptions in ATM on airport non-aeronautical revenues.
- Development of a tool to visualise and calculate airport accessibility indicators both by public transport and private car.

#### 7.1.1.2.1.6 ER project 'COCTA'

COCTA was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

In Q2 2016, the COCTA project kicked off, ramped up and initiated execution.

If ATM capacity exceeds demand, costs for providing ATM services and consequently ATM charges are above the inevitable level. In case of capacity shortages, airlines and other aircraft operators are forced to deviate from their optimum flight plans, leading especially to delays and additional fuel burn. The COCTA project aims at increasing efficiency by better matching ATM capacity and demand. This will be achieved by a structural redesign of the ATM value chain as well as by several innovations within the system. On the demand side, aircraft operators will be incentivized to reveal their preferences at an earlier stage and to also signal their degree of flexibility with respect to flight times and routes. On the supply side, capacity provision by different Air Navigation Service Providers (ANSPs) in neighbouring regions should be better coordinated by the Network Manager (NM), who serves as an intermediate institution between capacity supply and demand within the COCTA framework.

The redesign of the ATM value chain is conceptual research, i.e. the numerous possible options for the changed institutional environment will have to be identified and analysed within the project. The COCTA project thereby links the results of recent research on ATM economics with an innovative modelling approach and a conceptual design which has not been analysed before.

During 2017, the project prepared data for COCTA modelling, by using EUROCONTROL Demand Data Repository (DDR), and by analysing data of aggregated traffic and ATFCM regulations in SPSS.

A conceptual framework for the COCTA mechanism was developed in cooperation with the Advisory Board (comprising NM, AUs and ANSPs), specific roles were assigned to the different stakeholders in the Value Chain, and the process of capacity planning as well as the use of incentive schemes was described. The delivered process was designed aiming to minimize the overall costs of capacity provision as well as costs resulting from insufficient capacity supply, to provide flexibility in case of changing traffic patterns, and to introduce incentives within the charging scheme that contribute to an overall efficient outcome.

The project delivered the COCTA model and progressively increased its complexity. As a foundation for model improvement, the project proposed a new ATM value-chain redesign, as recommended by the Advisory Board, followed by the development of the COCTA Capacity and Demand Management process. The improved COCTA model was evaluated using a small-scale case study using simulated data. The project started developing a final model suitable to tackle large flight networks and preparing a large-scale case study based on real data for a final proof-of-concept.

#### 7.1.1.2.1.7 ER project 'COMPAIR'

COMPAIR was awarded under the ER1 call (with reference H2020-SESAR-2015-1). In Q1 2016, the COMPAIR project kicked off, ramped up and initiated execution.

The main goal of the COMPAIR project is to increase insight into potential institutional and market structures that may lead to an uptake of new technologies and more performance based business

models. The main research question of COMPAIR is “how to introduce competitive incentives in the ATM sector so as to best contribute to the achievement of the European high-level policy objectives for aviation.”

The project pursues the following objectives:

- Propose a set of new institutional market designs for the introduction of competition in the European ATM sector.
- Define a framework allowing a comprehensive assessment of the impact of different institutional market designs on ATM stakeholders and society at large.
- Develop a variety of economic and network models for the evaluation of the proposed regulatory approaches.
- Assess the feasibility and acceptability of proposed institutional changes for various market actors.
- Propose a vision and derive policy recommendations for the implementation of those new institutional structures identified as most beneficial for the European ATM system.

During 2017, the project assessed the potential for unbundling by illustrating the main economic mechanisms using tower control as an example.

Furthermore, the project developed a game theory modelling approach to analyse the ATM market existing in 2014 and ask what-if questions as to how the market may change were an auctioning system to be introduced. It assumed that each country will organize their own auction or tender specifying the minimum level of service desired, and undertook an analysis of six countries, that represents approximately 50% of the European aircraft movements. The models were applied to 2014 and were then run in order to analyse potential ATM markets in 2035 and 2050.

Finally, the project developed an Agent-based model to simulate the auctioning of licenses to operate ANS. It started the specification of a second model which will be used to explore a hypothetical, more futuristic sector-less scenario in which air navigation services are provided on an origin-destination basis.

#### 7.1.1.2.1.8 ER project ‘DART’

DART was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

In Q3 2016, the DART project kicked off, ramped up and initiated execution. The main research objective of DART project is to explore the application of different data-driven techniques to the aircraft trajectory prediction, also accounting for complexity ATM network effects. DART will deliver understanding on the suitability of applying data-driven techniques both for predicting single aircraft trajectories without considering traffic, as well as for predicting multiple correlated aircraft trajectories.

During 2017, the project performed the following activities:

- Acquisition and validation of all needed data sources including Flight Plans, Weather data, Surveillance data, Airspace Structure and NM data.
- Exploration of state of the art approaches for data-driven single trajectory predictions, training, testing and evaluation of these methods towards improving scalability, reducing dimensionality, while exploiting the appropriate features for the prediction process.
- Implementation of hybrid approaches (mixture of data-driven with model-based ones), reinforcement learning approaches, trajectory prediction using Hidden Markov Models (HMMs), and trajectory clustering approaches for the trajectory prediction process.
- Delivery of visualizations methods for analysing single trajectory prediction algorithms.

- Description of the project operational context, towards resolving Demand-Capacity Balance (DCB) problems at the pre-tactical stage, and contribution towards an envisioned collaborative decision making process involving all ATM actors.
- Formulation of the DCB problem as a multi-agent Markov Decision Process to assess delays on flights, w.r.t. operational constraints, also including strategic delay cost indicators.
- Implementation of three collaborative reinforcement learning algorithms aiming towards resolving DCB problems efficiently and effectively by exploring hierarchical collaborative reinforcement learning methods.

#### 7.1.1.2.1.9 ER project 'MALORCA'

MALORCA was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

In Q2 2016, the MALORCA project kicked off, ramped up and initiated execution. The ATM world is interested in deploying Assistance Based Speech Recognition (ABSR) applications to provide more sophisticated assistant systems. ASR is a potential extension of many existing systems where speech is the primary mode of communication, such as Arrival Managers (AMAN), Surface Managers (SMAN), and Departure Managers (DMAN). The goal of MALORCA is to progress the development and validation of Assistance Based Speech Recognition (ABSR) systems for ATC, to facilitate the transition from laboratory to the real world. MALORCA main objective, therefore, is to develop machine learning tools to automatically learn controller behavior and speech recognition models from data, recorded day by day by the Air Navigations Service Providers (ANSPs). This will replace much of manual adaptation effort and reducing costs needed by standard deployment. Cheaper tools enhance market penetration of controller assistance tools, which will enable increased capacity, less fuel burn and reduced CO2 emissions.

Applying machine learning to adaptation of automatic speech recognition is a first show case. In Air Traffic Control instructions are usually still given via voice communication to the pilots. But modern computer systems in Air Traffic Control, to be safe and efficient, need up-to-date data. Therefore, it requires lots of inputs from the air traffic controllers (ATCOs), which are done today via mouse, to keep the system data correct. Modern technologies like Air-Ground data link, which in some cases can replace the voice communication, will require even more inputs from the ATCOs.

During 2017, an initial basic Assistant Based Speech Recognition (ABSR) was first set-up for Prague and for Vienna. The project achieved a command recognition rate of about, respectively, 80% and 60%. In order to improve the command recognition rate, an full-fledged Assistant Based Speech Recognition was developed by MALORCA, which uses the output of an Arrival Manager to predict a set of controller commands which are possible in the current situation (i.e. called as situational context), where radar data is used as a second sensor. This approach significantly reduces the search space of the speech recognizer, correct the ASR hypotheses and can also be used for plausibility checking of the output of the speech recognizer. For Prague approach, the developed ABSR yields the command recognition error rates below 0.6% and for Vienna below 3.8%. Prague results are generally better than Vienna results due to better audio quality.

Results of MALORCA were discussed during two Stakeholder workshops respectively with 58 and 38 stakeholders from industry, research and ANSPs from Europe and US. The performance of the trained ABSR system was evaluated on proof-of-concept trials by nine controllers in Vienna and Prague in January 2018. MALORCA proved for Prague and Vienna approach area that unsupervised learning is able to notably improve command recognition rate and that automatic learning from radar data and voice recordings can reduce costs of data, speeds up development and reduce manual adaptation effort.

#### 7.1.1.2.1.10 ER project 'MINIMA'

MINIMA was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

In Q2 2016, the MINIMA project kicked off, ramped up and initiated execution. The monitoring role of human operators results in negative effects, such as lack of attention, loss of SA (Situation Awareness) and skill degradation. It is expected that a monitoring task reduces controller's ability to detect problems (e.g., conflicting aircrafts), to determine the current state of the system, to understand events, and to react to situations. Therefore, new forms of automation, including Adaptive Automation (AA), should be taken into account to moderate the operator workload while preserving his SA. As a result, a better match between the task demands and the controller cognitive resources will be achieved. In any case, one must avoid keeping the controller 'out-of-the-loop'.

MINIMA will develop an automated system capable of providing substantial and verifiable capacity and efficiency benefits while fully addressing safety concerns by developing adaptive automation to prevent the risks associated with assigning a monitoring role to the human operator, such as dissatisfaction, lack of attention, loss of SA and de-skilling. Based on the developed automation, MINIMA will provide guidance for the future design of fail-safe complex human-machine environments in the presence of high levels of automation.

MINIMA's State of the Art report provides an overview of methods that can be applied to measure vigilance and attention of human operators. These results allowed developing the Vigilance and Attention Controller and the task environment used for the validation trials. This adaptive automation system is designed to avoid Out of the Loop in ATC, and could have important implications to increase safety and diminish fatigue of humans in highly automated systems.

During 2017, the project prepared and conducted the evaluation trials of the MINIMA concept at ATC Training Centre in Forlì, with the participation of fifteen ENAV Air Traffic Controllers. During the two week experiment, the controllers completed several ATC scenarios with either a continuously high level of automation or MINIMA's vigilance and attention-based adaptive automation concept.

#### 7.1.1.2.1.11 ER project 'PNOWWA'

PNOWWA was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

In Q3 2016, the PNOWWA project kicked off, ramped up and initiated execution.

In ATM; the 4D trajectory management is a necessary concept to meet future growth in air traffic. However, aircraft always deviate from the planned 4D trajectory due to uncertainties during flight, departure and arrival airport. Therefore, there is a clear need to move to probability forecasts both in the local operational user environment and en-route.

PNOWWA concentrates in quantifying the uncertainties related to delays at ground operations due to winter weather situations. The overarching objectives of using probabilistic forecasts in ATM applications are to support the timely operations in surface management and ATM decision making, to increase airport capacity, as well as to shorten delays and promote safety. PNOWWA will provide the scientific basis for these ground-braking improvements in the 4D trajectory management.

PNOWWA objectives are to:

- Develop a method for probabilistic 0-3h forecasts (nowcasts) of snowfall and freezing rain at airport, in steps of 15 minutes.
- Improve our understanding, and hence predictability, of changes in snowfall intensity caused by underlying terrain, e.g., mountains and sea.

- Identify and promote the potential for use of probability forecasts in variety of airport activities.
- Make research demonstration of probabilistic winter weather product to show its potential for increasing the resilience of ATM system to winter weather.

During 2017 the project studied the effect of precipitation areas crossing Alps in winter weather conditions with radar images. Behaviour of the precipitation area has been linked to properties of the weather situation. The studies revealed that in contrast to the observations made with the moderate Scandinavian hills, the Alps show a major influence on the controlling synoptical systems which results in a more complex behaviour of the flow properties.

User feedback was collected after PNOWWA winter 2017 demonstration campaign in Finnish and Austrian airports. Two cases studies suggested by users were provided as demonstration example. A training event with stakeholders took place at two Austrian and two Finish airports for different user groups.

#### 7.1.1.2.1.12 ER project 'STRESS'

STRESS was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

In Q3 2016, the STRESS project kicked off, ramped up and initiated execution.

The roles and tasks of air traffic controllers (ATCOs) will change in the future and it is vital to enhance the comprehension of human responses to their role changing, from active control to monitoring of complex situations and managing unexpected system disruptions. The main goal of the project is to generate knowledge to support the design of the technologies which will be used by future controllers to manage the future air traffic scenarios in a fully automated ATC environment. The project will in particular provide guidelines for the future automated systems that are compatible with human capabilities and limitations, ensuring that the right balance between humans and automations is obtained.

STRESS is aiming in particular to improve the knowledge on:

1. Human Factors, described in terms of specific cognitive processes and mental states.
2. Neurophysiological characterization of stress, attention, cognitive control and workload phenomena.
3. Combination of the indexes to test the possibility to simultaneously measure such mental states along the execution of tasks.
4. Testing of Automation and its impact/relationship to Human Performance

STRESS selected Stress, Attention, Mental Workload and Cognitive Control as the most relevant Human Factors aspects for the envisaged future ATC automated environments. The project designed four indexes for assessing these factors using electroencephalography (EEG), eye-tracker and skin-conductance-response measurement tools. These Human Factors aspects were investigated during the validation trials held in June 2017 at Anadolu University. Sixteen ATC students were involved in the trials. They were asked to manage the traffic in a realistic operational scenario designed to induce different levels of Attention and Stress. The user's neurophysiological signals were recorded continuously. Besides neurophysiological data, behavioural and performance data (how controllers handled the traffic) as well as subjective data (the perception of stress and attention) were collected.

During 2017, the project also delivered the validation scenarios that will be used during the final validation trials planned at ENAC in February 2018, in order to simulate the conditions of future highly automated systems in a Free Route Airspace context. Tools were developed with ENAC simulator for supporting the controllers' tasks in a semi or totally automated way, including decision making (e.g.

how to solve conflicts) and the implementation of decisions (e.g. giving orders to aircraft). The radar environment in Anadolu and the En-route environment in ENAC were chosen as the operational environments to be simulated. During the final trials, the neurophysiological indexes will be used to evaluate the impact of these automations on controllers' performance.

#### 7.1.1.2.1.13 ER project 'TACO'

TACO was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

In Q3 2016, the TACO project kicked off, ramped up and initiated execution. TaCo aims to define an automated system sufficiently powerful to both accomplish complex tasks involved in the management of surface movements in a major airport and self-assess its own ability to deal with non-nominal conditions. When needed, such system should be sensitive enough to transfer responsibilities for traffic management back to the controller, in a timely and graceful manner and in way that makes him/her comfortable with the inherited tasks.

The main objectives of TaCo are the following:

- Defining algorithms and solutions to automate and optimize both the decision making and implementation tasks for the controller involved in the ground movement of airport vehicles and aircraft.
- Identifying and providing the controller with suitable and usable tools to supervise (monitor, tune and re-program) the system.
- Studying the interaction between the human actors and the automation. Main focus will be on the identification of sensitive state transaction from a (fully) automated management system to conditions where the human is brought into the loop to handle situations where his/her cognitive resources are essential.

During 2017, TaCo project has been devoted to the definition and preliminary analysis of the airport environment. The beneficiaries put a main focus on the tools, operational conditions, procedures and working methods contributing to the definition of the current working environment for ground Air Traffic Controllers working in Malta International Airport.

More in details, four operational scenarios, with different levels of complexity, have been defined, taking into account all the procedures, operational limitations and performance characteristics of the most significant traffic configurations occurring in Malta International Airport. The complexity factors specific of Malta International Airport have been elicited, analysed and categorised. Identified scenarios and complexity factors are the grounding for the definition of suitable automation strategies to support ground ATCOs' work. The definition of such strategies started in the reference period and is supposed to be the main outcome of the following stages of the project.

Finally, the state of the art of user programming techniques and tools has been collected. User programming is the paradigm chosen by TaCo's consortium to drive design and prototyping of automation strategies since the earliest phases of the project.

#### 7.1.1.2.1.14 ER project 'TBO-MET'

TBO-MET was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

In Q3 2016, the TBO-MET project kicked off, ramped up and initiated execution.

The project addresses the problem of analysing and quantifying the effects of meteorological uncertainties in Trajectory Based Operations. In particular, two problems are considered: 1) trajectory planning under meteorological uncertainties and 2) sector demand analysis under meteorological uncertainties, which correspond to two different scales: trajectory (micro) scale and sector (meso)

scale. In each problem two types of meteorological uncertainties are considered: wind uncertainty and convective zones (including individual storm cells). Weather predictions will be based on Ensemble Probabilistic Forecasts and Nowcasts.

During 2017, the trajectory planning problem at pre-tactical level (up to three hours before departure) has been addressed by developing a methodology for planning efficient trajectories with low levels of uncertainty. In particular, two problems have been analysed: On one hand, the trade-off between predictability (measured by the flight-time dispersion) and cost-efficiency (flight time or fuel consumption) considering only uncertain winds, and, on the other, the trade-off between exposure to convective risk and cost-efficiency considering now uncertain winds and convection risk. As part of this work, a tool has been developed that provides the probability of convection from the information contained in the EPS.

At tactical level (during the flight), a methodology has been developed to re-plan trajectories that are efficient, so that they are safe in the sense of avoiding the convective cells, considering that the cells evolution is uncertain. Robust trajectories (computed at the pre-tactical phase) are used as reference trajectories. When a trajectory overflies a volume of airspace with thunderstorm activity, a deviation trajectory is generated that avoids the individual cells (modelled as stochastic no-fly zones) and reattaches to the original reference trajectory. An already existing deterministic tool for generating the deviation trajectories (DIVMET) has been adapted to account for the uncertainty in the cell evolution. As part of this work, a tool has been developed that provides the uncertainty in the evolution of the cells (because the nowcasts considered are deterministic).

For the sector demand problem, the objective has been to quantify the impact of trajectory planning under weather uncertainty (as performed at the trajectory scale) on sector demand. A methodology has been developed to analyse the uncertainty of sector demand (probabilistic sector loading) in terms of the uncertainty of the individual trajectories. The approach is based on the statistical characterization of the entry and occupancy counts, and is quite general, not depending on the specific tools developed in the project. At pre-tactical level, the methodology is able to quantify the reduction of the dispersions of the entry and occupancy counts when the dispersion of the individual trajectories subject to wind uncertainty is reduced. On the other hand, the methodology is able to quantify the reduction of the dispersions of the two counts at tactical level, taking into account the uncertain evolution of the convective cells, when the convection risk of the individual trajectories is reduced in the mid-term planning phase. This analysis has provided an understanding of how weather uncertainty is propagated from the trajectory scale to the sector scale.

#### **7.1.1.2.1.15 ER project 'Vista'**

Vista was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

In Q3 2016, the VISTA project kicked off, ramped up and initiated execution.

The effects of conflicting market forces on European performance in ATM are being examined by VISTA through the evaluation of impact metrics on four key stakeholders, and the environment. Vista is also studying the relationships between three major regulatory instruments in Europe: (i) the binding targets set in the context of the Single European Sky Performance Scheme, (ii) the passenger compensation and assistance scheme (Regulation 261) and (iii) the European emissions trading system, plus the goals and targets set out in the EC's high-level vision document for aviation in 2050 (Flightpath 2050). These instruments are currently not systematically coordinated.

An expected impact of Vista is to be able to support the ATM industry to better and more reactively adapt to changes in its business, operational and policy environment, through a better understanding of the future key performance area roadmap and interactions between performance areas. This will

reduce the risk of future, performance misalignment and unforeseen consequences, and improve the potential of implementing synergistic targets and cost-efficient policy and regulatory measures.

The primary objectives of VISTA are to quantify the current and future relationships between a presently non-reconciled set of performance targets and (binding) regulations in operation in Europe, specifically:

- The trade-off between, and impacts of, primary regulatory and business (market) forces.
- The horizontal metric trade-offs within any given period.
- The vertical trade-offs between periods, particularly as many targets are not currently mapped from year to year, are discontinuous with other targets, or even entirely missing for given periods (such as, vitally, passenger performance targets).
- Whether alignment may be expected to improve or deteriorate as we move closer to Flightpath 2050’s timeframe.

During 2017, further progress has been made in the core technical work:

- Identification of relevant regulations and business factors that affect the processes/metrics;
- Definition of regulatory factors (and instruments) and business factors (and tools/technologies), based on a detailed literature review
- Selection of the foreground and background factors from the regulatory and business factors, with an indication of which phase of the ATM process (strategic, pre-tactical, tactical) is affected;
- Definition of background scenarios from the background factors;
- Identification of model variables that are affected by the background scenarios and foreground factors, and how they are affected.
- High-level model definition and platform description: the identification of key characteristics of the stakeholders to be modelled; the temporal and spatial scope; the metrics and trade-offs to be analysed and the modelling technique selected for Vista.
- Refinements to the impact trade-off and new visualisation interfaces.

As a result of the above activities, the Initial Assessment Report was delivered. This is a very elaborated report integrating the first results of the different sub-models composing the overall VISTA model.

**7.1.1.2.2 ATM application-oriented research for ‘High Performing Airport Operations’ Key Feature**

The ‘Work Area 2 – ATM Applications oriented research’ of the Exploratory Research 1 call (with reference H2020-SESAR-2015-1) resulted in the following projects related to the ‘High Performing Airport Operations’ Key Feature:

Topic Description	Projects	Max. total co-financing value (in EUR)
High Performing Airport Operations	<b>MOTO</b> will perform research on ATM Human Performance of using two senses: sight and hearing in the context of remote tower operations.	999.000
	<b>RETINA</b> project will investigate the potential and applicability of SV tools and Virtual/Augmented Reality display techniques for the Air Traffic Control service provision by the airport control tower.	949.160

**Table 38: Exploratory Research “ATM Applications oriented research” projects selected for the ‘High Performing Airport Operations’ Key Feature as a result of the call H2020-SESAR-2015-1 in 2016**

The paragraphs below provide update information on the objectives and 2017 achievements of these projects.

#### **7.1.1.2.2.1 ER project ‘MOTO’**

MOTO was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

The ‘embodied reMOte Tower’ or MOTO project kicked off in June 2016. It explores augmented multimodal solutions to support air traffic controllers in a remote tower environment. The project’s main research idea is that multisensory information sources in remote operations have the potential to enhance the controllers’ sense of presence and situational awareness.

In 2017 the project team focused their effort on preparing and starting the execution of the validation activities that should confirm the potential for the MOTO concept.

In particular, the project team designed and implemented a virtual reality head-mounted display based validation platform reproducing the remote tower environment augmented by the multisensory information required by the MOTO concept. In parallel, the project team developed an ‘embodiment index’ in order to measure the sense of presence of the air traffic controllers as objectively as possible. The project team was then able to run a first validation exercise in the virtual reality environment with ATCOs in the loop. Despite some delay due to technical difficulties the project team also progressed on the design and implementation of a remote tower platform to test the MOTO concept in an environment as close as possible to the reality. Initial measurements started in this context at the end of the year.

#### **7.1.1.2.2.2 ER project ‘RETINA’**

MOTO was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

The ‘Resilient Synthetic Vision for Advanced Control Tower Air Navigation Service Provision’ or RETINA project kicked off in March 2016. The project investigates the potential and applicability of Synthetic Vision (SV) tools and Virtual/Augmented Reality (V/AR) display techniques for the air traffic service provision from the airport control tower.

In 2017 the project finalised the conceptual design initiated in 2016, identifying the required sensing technologies and data provision standards, selecting the most suitable V/AR technologies to implement the concept in a control tower and defining the associated procedures and functionalities. Then the project team developed a proof of concept to validate the RETINA concept in an immersive interactive airport tower simulation platform. They also planned and executed the validation activities, defining scenarios where ATCOs would test the RETINA concept using a head mounted display and a simulated spatial see-through display in different traffic and visibility conditions. The initial results released at the very end of 2017 showed promising results in terms of ATCO situational awareness increase, efficiency of runway operations in low visibility conditions and safety.

#### **7.1.1.2.3 ATM application-oriented research for ‘Advanced Air Traffic Services’ Key Feature**

The ‘Work Area 2 – ATM Applications oriented research’ of the Exploratory Research 1 call (with reference H2020-SESAR-2015-1) resulted in the following projects related to the ‘Advanced Air Traffic Services’ Key Feature:

Topic Description	Projects	Max. total co-financing value (in EUR)
Advanced Air Traffic Services / Separation Management and Separation Standards	<b>SALSA</b> is an exploratory research project relating to multi-source ADS-B system.	995.064
	<b>R-WAKE</b> aims at developing a simulation framework to assess the risk and hazards of potential wake vortex encounters for the en-route phase of flight.	997.130
Advanced Air Traffic Services / Trajectory Based Operations (TBO)	<b>OptiFrame</b> will research a number of fundamental questions related to TBO, a key element of future ATM operating concepts.	727.501
	<b>COPTRA</b> aims to propose, in a TBO environment, an efficient method to build probabilistic traffic forecasts on the basis of flight trajectory predictions.	999.391
	<b>PARTAKE</b> will propose a causal model to enhance the potential synergies that could be achieved by exploiting to the maximum extend the gap provided by the strategic decision variables and the operational decision making at flight execution.	985.750

**Table 39: Exploratory Research “ATM Applications oriented research” projects selected for the ‘Advanced Air Traffic Services’ Key Feature as a result of the call H2020-SESAR-2015-1 in 2016**

**7.1.1.2.3.1 ER project ‘COPTRA’**

COPTRA was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

COPTRA proposes an efficient method to build probabilistic traffic forecasts on the basis of flight trajectory predictions within a Trajectory Based Operations (TBO) environment. Its main goal is using the improvements brought to trajectory prediction by the future TBO environment to bring measurable improvements to traffic prediction in ATC Planning.

The main concepts defined, modelled and studied by COPTRA are the notions of probabilistic trajectories and traffic situations. The central idea researched is to develop new methods to build the probabilistic traffic prediction by combining the probabilistic trajectories.

In 2017, the exploratory project COPTRA was executed according to the plan. In 2017 briefly;

- The concept of probabilistic trajectory and its prediction was defined.
- By using the definition of probabilistic trajectory, the concept of probabilistic traffic situation was defined and how probabilistic traffic situations can be built by combining probabilistic trajectories was studied.
- The probabilistic traffic situations was applied to ATC planning.

**7.1.1.2.3.2 ER project ‘OptiFrame’**

OptiFrame was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

The main objective of the OptiFrame research project is the application of principles of mathematical modelling and optimization to optimally configure and assess the performance of the Trajectory Based Operations (TBO) concept. OptiFrame will allow verifying the viability of the TBO concept, to identify the major issues that need to be addressed, and to understand whether, under which conditions, and to what extent the objectives of flexibility of airspace users and predictability of the Air Traffic Management (ATM) system can be achieved.

In 2017, the exploratory project OptiFrame was executed according to the plan. During the third reporting period the OptiFrame project focused on the following activities:

- Refinements of a Data Management Platform (DMP) and completion of the validation activity (Task 3.3);
- Refinements of the mathematical model in view of the WebEx with the PO on May 29th, 2017;
- Development and implementation of exact and heuristic algorithms;
- Qualitative assessment of the OptiFrame models.

#### 7.1.1.2.3.3 ER project 'PARTAKE'

PARTAKE was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

PARTAKE proposes a causal model to enhance the potential synergies that could be achieved by exploiting to the maximum extend the gap provided by the strategic decision variables and the operational decision making at flight execution.

The main objectives if the project PARTAKE are:

- Design a cooperative departure for a competitive ATM network service.
- Identification of trajectory interdependencies by means of the spatio-temporal causal analysis tools.
- Preserve AU's trajectory preferences.
- Minimize ATC interventions without affecting ATFCM.

In 2017, the exploratory project PARTAKE was executed according to the plan. :

- To Achieve ATC Minimum Tactical Interventions
  - Implementation of the TBO mapping tools
  - Adjustment of TBO mapping tools toward TMA environment
  - Identification of concurrence and coupling interdependencies allow defining metrics that could lead to greater clearance time.
- To identify TBO interdependencies
  - Implementation of TBO mapping tools
  - Graph based analysis
  - Identification of Concurrence
  - Coupling interdependencies
- To determine feasible departure configurations
  - TBO mapping tools
  - Implementation of the optimization model
- To develop a TBO Service Oriented "Information Management" Platform
  - Implementation of an Information System giving access to traffic real data and enabling the definition of scenarios for traffic analysis and mitigation.
  - Implementation of web services supporting the main PARTAKE functionalities (mapping, detection and filtering, analysis and mitigation)
- To maximize trajectory adherence at key waypoints
  - Identification of concurrence and coupling interdependencies allow to define metrics that could lead to greater clearance times

- To verify and validate the implemented Tools
  - Verification Concept
  - Verification of TBO mapping tools, Analysis Tool and Mitigation Tool

#### 7.1.1.2.3.4 ER project 'R-WAKE'

R-WAKE was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

The R-Wake project has been kicked off in April 2016. The overall objective of this exploratory project is to investigate the risks and hazards of potential wake vortex encounters in the En-route airspace, in current and futuristic operational scenarios, in order to assess the potential enhancements to the Separation Standards and Separation Management methods in Europe. The expected tangible outcomes of R-WAKE project are:

- Development of a WVE hazard severity baseline and tolerability matrix;
- A database of simulation results that will provide enough evidence to propose new separation standards for future R&I activities;
- An evidence-based proposal for either maintaining current separation standards or adopting new ones; and

An assessment of the feasibility and impact of the concept on ATM with an initial validation strategy and outline implementation plan.

In 2017, the R-WAKE project has developed, integrated and validated the simulation tools and scenarios necessary to conduct the targeted research. This led to the conduction of the simulations that clearly identified and preliminary quantified with enough level of confidence the ATM need (and the opportunity) for enhancing the current separation minima schemes provisioned in En-route operations.

#### 7.1.1.2.3.5 ER project 'SALSA'

SALSA was awarded under the ER1 call (with reference H2020-SESAR-2015-1).

SALSA is an exploratory research project kicked-off in April 2016. It is related to multi-source ADS-B system that combines the benefit of all possible type of relays (space, maritime, air or ground based) of ADS-B messages could provide a global surveillance system to overcome the prevailing continuous surveillance constraints in the non-radar airspace (NRA). By bringing Space based ADS-B with other sources of surveillance based on ground, air and oceanic relays, a system of system architecture is conceived; upon its benefits, new separation standards are validated through analysis using theoretical modelling for separation standard and airspace capacity, in the context of NRA. Reduction in separation minimum and in the number of standards will bring significant benefits to ATC/ATM operations with improved aircraft surveillance and airspace management. The analysis also considers different scenarios of separation minima Vs. ADS-B message update rate. The project assesses the impact of performance in the context of separation standards; it will provide an assessment of the procedural impact and impact to flight safety due to the revised minima and the system configuration.

In 2017, SALSA project has developed specific models and scenarios necessary for the exploration of a set of options addressing the surveillance coverage-gaps in the non-radar airspace (NRA). The developed models support the research on a Multi-source Automatic Dependent Surveillance-Broadcast (ADS-B) using Space-Based ADS-B and a ground based surveillance. The project has then performed various simulations, set expert workshops using simulation and traffic capacity models. Thanks to this work, the project has validated performance-requirements, potential enhancements for

the Separation Minima in the NRA. This will lead the project to a preliminary impact-analysis for the Air Traffic Control (ATC) operations and the safety.

#### 7.1.1.2.4 ATM application-oriented research for ‘Enabling aviation Infrastructure’ Key Feature

The ‘Work Area 2 – ATM Applications oriented research’ of the Exploratory Research 1 call (with reference H2020-SESAR-2015-1) resulted in the following projects related to the ‘Enabling aviation Infrastructure’ Key Feature:

Topic Description	Projects	Max. total co-financing value (in EUR)
CNS & Enabling Infrastructure	<b>NAVISAS</b> project will propose a novel concept of APNT for small aircraft that will integrate novel technologies and will merge multiple navigation avionics into one with no major impact on avionics.	584.979
	<b>SAPIENT</b> project addresses a new innovative application in the field of CNS/ATM system focusing exploitation of the synergies of Communications and Navigation technologies and the 4D trajectory management concept.	859.500 (project closed in 2017)

**Table 40: Exploratory Research “ATM Applications oriented research” projects selected for the ‘Enabling aviation Infrastructure’ Key Feature as a result of the call H2020-SESAR-2015-1 in 2016**

Furthermore, as introduced in Part I section 1.1.2 providing information on the outcome of call for proposals ER2 on RPAS (with reference H2020-SESAR-2016-1), 9 additional projects contribute to Exploratory Research on the ‘Enabling ATM Infrastructure’ Key Feature, focusing on RPAS / Drones:

Topic description	Projects	Max. total co-financing value (in EUR)
SESAR UTM Concept Definition	Building on the state-of-the-art, <b>CORUS (Concept of Operations for European UTM Systems)</b> will develop an operational concept enabling safe interaction between all airspace users in Very Low Level considering contingencies and societal issues.	800.000
Aircraft systems	The <b>AIRPASS (Advanced Integrated RPAS Avionics Safety Suite)</b> project addresses the on-board technologies for drones that are required in order to implement the Unmanned Traffic Management (UTM) concept for drone operations at Very Low Level (VLL) and within the Visual Flight Rules (VFR) environment. The project will cover Detect And Avoid (D&A) systems for cooperative and non-cooperative traffic, auto-pilot systems as well as Communication, Navigation and Surveillance (CNS) systems. This project will identify the available CNS infrastructure and on-board technologies to formulate an implementation approach. Based on this an on-board system concept will be developed and evaluated.	986.224
Ground-based technology	<b>CLASS (Clear Air Situation for uaS)</b> will mature ground based technologies for a real-time Unmanned Aerial System Traffic Management System (UTMS) to monitor and separate Unmanned Aerial System (UAS) traffic	909.973

Topic description	Projects	Max. total co-financing value (in EUR)
Ground-based technology	<b>TERRA (Technological European Research for RPAS in ATM)</b> addresses the research topic Ground-based technology, focusing on the performance requirements associated with the UTM concept, and identifying the technologies (existing and new) which could meet these requirements	937.000
Drone Information Management	The <b>DREAMS (DRone European AIM Study)</b> project aims at contributing to the definition of the European UTM Aeronautical Information Management operational concept by exploring need for and feasibility of new processes, services and solutions for the drone aeronautical information management within the new UTM concept	710.435
Drone Information Management	<b>IMPETUS (Information Management Portal to Enable the inTegration of Unmanned Systems)</b> will research on the application of the ‘micro-services’ paradigm as a flexible and cost efficient solution for lifecycle support of the expected high variety of drones and missions	899.160
Datalink	<b>DroC2om (Drone Critical Communications)</b> addresses Drone Critical Communications. The key objective of the DroC2om project is to contribute to the definition of integrated cellular-satellite data link specifications for UASs	1.270.543
Science for higher levels of automation	<b>PercEvite</b> addresses Sense and avoid technology for small drones for autonomously detecting and avoiding “ground-based” obstacles and flying objects. To avoid ground-based obstacles, we aim for a lightweight, energy-efficient sensor and processing package that maximizes payload capacity	899.008
Security & cyber-resilience	<b>SECOPS</b> deals with an Integrated Security Concept for Drone Operations. SECOPS' objective is to push drone technology forward by ensuring that security risks in the Unmanned Traffic Management (UTM) concept are mitigated to an acceptable level	909.294

**Table 41: Exploratory Research projects selected as a result of the call H2020-SESAR-2016-1 in 2017 and their max. co-financing value**

The paragraphs below provide update information on the objectives and 2017 achievements of these 2 ER1 and 9 ER2 projects – project descriptions are sorted in alphabetical order of the project acronym.

**7.1.1.2.4.1 ER project ‘AIRPASS’**

AIRPASS was awarded under the ER2 call (with reference H2020-SESAR-2016-1). The project will examine the range of technologies in the drone itself (i.e. D&A systems for cooperative and non-cooperative traffic, autopilot systems and CNS systems, including safety mechanisms as geo-fencing) that are needed, including the ones-to be developed, in order to implement U-space operations. The project has been kicked-off in October 2017.

**7.1.1.2.4.2 ER project ‘CLASS’**

CLASS was awarded under the ER2 call (with reference H2020-SESAR-2016-1). The project focuses on the tracking and surveillance service of U-space. The project has been kicked off in June 2017 to explore the combination of technologies in a way that data coming from the surveillance of both cooperative and non-cooperative vehicles are merged to enable conflict detection and resolution, and protection of restricted areas (such as airports).

The project started with a 1<sup>st</sup> workshop with the objective to gather the requirements regarding cooperative, non-cooperative surveillance for drones and the related U-Space services. To do so, the project invited attendees from different origins, elicited the needs using a scenario based ideation technique, and listed the initial key performance indicators. This led to the production of many scenarios, requirements and KPIs to drive the maturity assessment of the CLASS architecture and technologies.

#### **7.1.1.2.4.3 ER project ‘CORUS’**

CORUS was awarded under the ER2 call (with reference H2020-SESAR-2016-1). The project aims to establish a concept of operations (CONOPs) for U-space; U-space is the drone traffic management solution for Europe which enables complex drone operations with a high degree of automation to take place in all types of operational environments, including urban areas.

The project was kicked off in September 2017 and immediately started its initiation with the preparation of a 1st workshop with the Drone community including SESAR projects to explore nominal situations for managing the drone traffic in Europe and especially addresses drone operations in the vicinity of airfields and controlled airspace and for transfer between controlled and non-controlled airspaces.

#### **7.1.1.2.4.4 ER project ‘DREAMS’**

DREAMS was awarded under the ER2 call (with reference H2020-SESAR-2016-1). The project is focused on concepts for the drone aeronautical information management. The project DREAMS will analyse operational and technical aspects, environmental scenarios, technologies, safety, security and confidentiality aspects in order to identify potential U-space data (e.g. airspace structure, terrain, obstacles and weather), service providers (for authentication, flight planning, fleet management, geofencing) and facilities and how the information needs to be tailored for drone traffic management. The project will identify reference scenarios and high-level U-space services, elicit data and service requirements, analyse data and service availability, select solution scenario and validate of the results. The project has been kicked-off in October 2017.

#### **7.1.1.2.4.5 ER project ‘DroC2om’**

DroC2om was awarded under the ER2 call (with reference H2020-SESAR-2016-1). The project aims to design a hybrid architecture that combines cellular and satellite networks. This concept would ensure reliable and safe operations for drones using U-space services.

The project has been kicked off in September 2017 and will define scenarios and requirements, design a combined cellular – satellite data link communications architecture for drone command and control, perform evaluation and experiments.

#### **7.1.1.2.4.6 ER project ‘IMPETUS’**

IMPETUS was awarded under the ER2 call (with reference H2020-SESAR-2016-1). The project has been kicked-off in October 2017. It explores how to develop a cloud-based server-less environment that can respond to diverse business models from multiple users including integration with manned traffic management systems.

#### **7.1.1.2.4.7 ER project ‘NAVISAS’**

NAVISAS was awarded under the ER1 call (with reference H2020-SESAR-2015-1). The objective of the project NAVISAS was to develop a concept for small aircraft to obtain alternative positioning,

navigation and timing (APNT) information, when conventional GPS fails, while keeping the performance and efficiency consistent with the airspace requirements.

NAVISAS investigated multiple constellation satellite positioning systems with miniature atomic clocks (MAC), atomic gyroscope and vision-based navigation. The project analysed several paths for technology mergers for applications in small aircraft navigation, in particular: (i) standalone high grade inertial navigation system (INS) based on atomic gyros, (ii) hybridized multi-constellation multi-frequency system coupled with high grade INS, and (iii) vision-based navigation. The project also considered the relevance of specific PBN aspects to small aircraft operations.

The TRL of atomic gyroscope reached level 3 within the scope of NAVISAS. Envisioned performances are promising and could challenge currently used high grade laser gyros. Several solution at the system level have been developed to reduce the price of the entire Inertial Measurement Unit (IMU) system combing 3 axis gyros, accelerometers, GPS /GNSS /GLONASS and atomic clock for application in UAV and ULA.

Hybridization of multi-constellation multi-frequency GNSS coupled with high-grade INS has been assessed. It has been shown that multi-frequency receivers for A-PNT did not bring significant improvement against conventional single constellation GPS. Multi-constellation GNSS tight coupling with INS needs further research. Purely inertial performance of high-grade INS based on atomic gyros is expected to reach the one from currently used laser gyros. Vision-based navigation was also assessed in real flight and showed good performances for RPAS navigation and light aircraft as well. It is expected to become a standard for RPAS in the coming years.

The NAVISAS project will close in March 2018.

#### **7.1.1.2.4.8 ER project ‘PercEvite’**

PercEvite was awarded under the ER2 call (with reference H2020-SESAR-2016-1). The project has been kicked-off in October 2017. It is about sense & avoids technologies for small drones. Its main objective is to develop a sensor, communication, and processing suite to increase the level of drone automation in the detection of cooperative and non-cooperative obstacles on ground and flying.

#### **7.1.1.2.4.9 ER project ‘SAPIENT’**

SAPIENT was awarded under the ER1 call (with reference H2020-SESAR-2015-1). The objective of the project SAPIENT was to define a novel System architecture (the “SAPIENT” system) to monitor and control operation and configuration of air-ground communication datalinks. This system should allow strategic planning and tactical decisions about the allocation of the communication resources within a multilink environment. This system once implemented was expected to allow a more efficient use of datalink resources, a reduced amount of communication issues (reducing the need for tactical interventions for conventional aircraft and the use of RPAS safety procedures) and reduced Air Navigation Service costs

The main result of the project was the conceptual description of the “SAPIENT system” to measure, share and distribute information about the quality of terrestrial and satellite datalinks. The conceptual description is supplemented by a set of requirements. This set includes requirements regarding the 4D Tagging, the 4D-MAP Protocol and general, functional, performance and interface requirements of the SAPIENT system. It should be noted that a patent [2] was requested for this system. The Maturity Assessment of the “SAPIENT system” performed at the end of the project confirmed a maturity of TRL2. “SAPIENT system” here refers to a concept of measuring and sharing quality information and utilizing this information to decide about handovers. A link with the 4D-Trajectory concept and

predictions about datalink quality are not part of the “SAPIENT system” although the Grant Agreement could give the impression that these elements would be included. The SAPIENT project was closed in September 2017. The project is considered to have achieved its target with respect to a maturity level of TRL2.

#### **7.1.1.2.4.10 ER project ‘SECOPS’**

SECOPS was awarded under the ER2 call (with reference H2020-SESAR-2016-1). This U-space project has been kicked off in October 2017 to explore an Integrated Security Concept for Drone Operations. The objective is to push drone technology forward by ensuring that security risks in the U-space concept are mitigated to an acceptable level. An integrated security concept at TRL2 will be developed addressing resistance of drones against unlawful interference, protection of third parties and integration of geo-fencing technology; focussing on technological options (navigation, surveillance, in-flight updates, etc.) for both airborne and ground elements, considering legal, regulatory and social aspects. SECOPS will include a proof of concept of the integrated security concept, integrating Commercial Off-The-Shelf (COTS) technology of the consortium partners.

#### **7.1.1.2.4.11 ER project ‘TERRA’**

TERRA was awarded under the ER2 call (with reference H2020-SESAR-2016-1). The project has been kicked-off in October 2017 and aims to define the performance requirements associated with U-space, and to identify the technologies (existing and new) which could meet these requirements. This encompasses interaction with manned aviation.

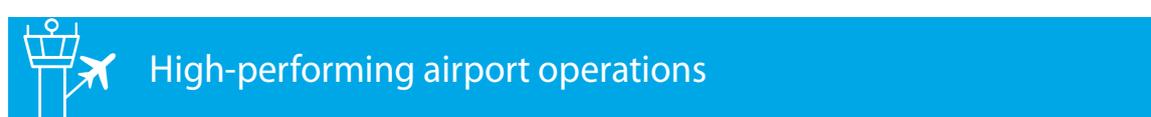
### 7.1.1.3 Industrial Research & Validation

Industrial Research & Validation is addressed through projects awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2) which resulted in 17 projects (Research and Innovation Actions) on top of the 3 Transversal Activities projects presented in section 7.1.1.1.

Further to the high-level results provided in Part I of this document, the paragraphs below provide update information on the objectives and 2017 achievements of these projects. Projects are sorted by Key Feature/topic and then by increasing order of their acronym.

#### 7.1.1.3.1 Industrial Research & Validation for the ‘High-Performing Airport Operations’ Key Feature

The IR-VLD Wave 1 call (with reference H2020-SESAR-2015-1) resulted in the following projects related to the ‘High-Performing Airport Operations’ Key Feature:



Ref.	Project title	Short Topic Description	Type of Action	Max. total co-financing value (in EUR)
PJ.02	Increased Runway & Airport Throughput	Enabling enhanced runway throughput to improve efficiency and resilience of arrival and departure operations.	RIA	15.592.783
PJ.03a	Integrated Surface Management	Further integration of ATC tools through Surface Management with other systems to enhance abilities to deliver, plan and improve the use of airport resource allocation.	RIA	12.925.436
PJ.03b	Airport Safety Nets	Addressing further improvements in SESAR 2020 to reduce the number of runway incursions prevent collisions on the apron and taxiway with traffic and fixed obstacles.	RIA	8.228.382
PJ.04	Total Airport Management	Development of performance-based ATM system as the cornerstone of future airport concept, foreseeing an integrated airport management framework.	RIA	8.909.055
PJ.05	Remote Tower for Multiple Airports	Validation of concept that effective provision of ATS to multiple remote sites is possible, and is at least as safe as current methods of service provision.	RIA	9.013.121

**Table 42: IR Projects resulting from Wave 1 call H2020-SESAR-2015-2 related to the ‘High-Performing Airport Operations’ Key Feature and their max. co-financing value**

#### 7.1.1.3.1.1 PJ.02 EARTH – Increased Runway and Airport Throughput

PJ.02 was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2).

The EARTH project kicked off in December 2016. It aims at improving runway and airport throughput considering wake vortex, weather, the environment and noise while taking account of different levels

of traffic demand, future aircraft capabilities and airport configurations. More specifically, the project is developing the following solutions:

- PJ.02-01 – **Wake turbulence separation optimization**: reduction of departure and arrival wake related separations considering weather, environment and noise constraints with a baseline minimum radar separation of 2nm;
- PJ.02-02 – **Enhanced arrival procedures**: enhanced ground and aircraft operational procedures covering double thresholds/multiple aiming points and increased/adaptive/double glide slopes;
- PJ.02-03 – **Minimum-Pair separations based on RSP**: an optimised controller decision support capability incorporating the disparate operational improvements to safely, predictably and efficiently manage runway throughput;
- PJ.02-05 – **Independent Rotorcraft operations at the Airport**: improved helicopter non-interfering simultaneous approaches through the Final Approach and Take-Off area (FATO) procedures;
- PJ.02-06 – **Improved access into secondary airports in low visibility conditions**: availability and accessibility of secondary airports in low visibility conditions;
- PJ.02-08 – **Traffic optimisation on single and multiple runway airports**: optimisation of single and multi-runway airport configurations in dependent runway operations; and
- PJ.02-11 – **Enhanced Terminal Area for efficient curved operation**: enhancing Terminal Manoeuvring Area (TMA) operations through curved approaches.

The project team refined the project management plan, the project integration in the Programme, the communication and dissemination plan and work schedule in the first months of 2017. In parallel, the project team started the developments at solution level, describing each solution's concept and, in most cases, the related technical specifications. The team also initiated the validation activities, planning the exercises and developing the prototypes and validation platforms. The first validation activities were run in solutions PJ.02-01, PJ.02-02, PJ.02-08 and PJ.02-11.

#### 7.1.1.3.1.2 PJ.03a SUMO – Integrated Surface Management

PJ.03a was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2).

The SUMO project kicked off in December 2016. The project's objectives are to improve the predictability, efficiency and safety of surface operations in all weather conditions. The project is also aiming at improving the accessibility to smaller airports in low visibility conditions. The following solutions are under development to support these objectives:

- PJ.03a-01 – **Enhanced Guidance Assistance to Aircraft and Vehicles on the Airport Surface Combined with Routing**: improving the A-SMGCS routing function to avoid potential traffic conflicts, integrating planned and actual departure and arrival information from different sources; developing dynamic virtual block control with virtual stop bar exchanges between ATCOs and flight crews. The exchange of information between ATC and vehicles/aircrafts will be supported by airport data link communications. Both pilots and vehicle drivers will be provided with a display (Airport Moving Map) of the airport layout, status of stop bars and virtual stop bars, the own ship position as well as the taxi clearance as issued by ATC;
- PJ.03a-03 – **Enhanced navigation and accuracy in low visibility conditions (LVC) on the airport surface**: improved accuracy of aircraft navigation during both take-off and landing operations, as well as improved accuracy for surface movement navigation and service vehicle positioning (using GBAS or SBAS corrections);

- PJ.03a-04 – **Enhanced Visual Operations**: improving accessibility to all airports without additional ground infrastructure requirements in low visibility conditions, as well as pilots' situational awareness due to the visual reference and / or flight guidance provided to them. The solution aims at delivering Enhanced Vision System, Synthetic Vision System or their combination that will enable more efficient approach, landing and taxi operations; and
- PJ.03a-09 – **Surface Operations by RPAS**: ensuring the safe and efficient integration of large RPAS on the airport surface. To the maximum extent possible, RPAS will have to comply with the existing rules and regulations.

The project team refined the project management plan, the project integration in the Programme, the communication and dissemination plan and work schedule in the first months of 2017. In parallel, the project team started the developments at solution level, describing PJ.03a-01, PJ.03a-04 and PJ.03a-09 concepts and the related technical specifications. Technological solution PJ.03a-03's technical specifications were also initiated. PJ.03a-01's cost benefit analysis was started. The project team also initiated the validation activities, planning the exercises and developing the prototypes and validation platforms. The two PJ.03a-09 V1 validations were performed at the end of 2017.

#### 7.1.1.3.1.3 PJ.03b SAFE – Airport Safety Nets

PJ.03b was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2).

The SAFE project kicked off in November 2016. The aim of this project is to develop additional safety barriers to mitigate the risks of runway incursion, runway excursion and more generally the risk of incidents and accidents involving aircraft at the airport. The project's work evolves around four solutions:

- PJ.03b-01 – **Enhanced Airport Safety Nets for Controllers**: providing tower air traffic controllers with means to prevent the delivery of conflicting clearances and detect non-conformance to clearances on the entire airport;
- PJ.03b-03 – **Conformance monitoring safety net for Pilots**: warning pilots when an inconsistency between the aircraft behaviour with either ATC clearance or procedure is detected;
- PJ.03b-05 – **Traffic alerts for pilots for airport operations**: providing pilots with a traffic alert if a risk of collision with another traffic on the airport surface has been detected; and
- PJ.03b-06 – **Safety support tools for avoiding runway excursions**: mitigating the risk of runway excursion, the most frequent type of runway safety accident, by on-board and ground systems that can warn pilots, controllers or both when appropriate.

The project team refined the project management plan, the project integration in the Programme, the communication and dissemination plan and work schedule in the first months of 2017. In parallel, the project team started the developments at solution level, describing each solution's concept and, for PJ.03b-01, PJ.03b-03 and PJ.03b-05, the related technical specifications. PJ.03b-01 and PJ.03b-03's cost benefit analyses were started. Some project members participated in EUROCAE and EASA activities on the basis of the ongoing PJ.03b-01 and PJ.03b-05 developments. The team also initiated the validation activities, planning the exercises and developing the prototypes and validation platforms for PJ.03b-01, PJ.03b-03 and PJ.03b-05. Finally, the PJ.03b-06 V1 data pack was submitted, approved and the maturity gate was passed in September 2017, concluding that V1 had been completed with acceptable issues. The PJ.03b-06 V2 activities then started on this basis with the refinement of the operational concept.

#### 7.1.1.3.1.4 PJ.04 TAM – Total Airport Management

PJ.04 was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2).

The TAM project kicked off in December 2016. The project is concerned with taking a ‘holistic’ view of airport operations, including all of the key processes (aircraft, passengers, baggage...) and importantly, the interaction between them, as it is the degree of synchronisation between these different processes which constitutes a significant contributory factor to punctual and predictable operations and ultimately therefore passenger satisfaction. The entire scope of the TAM project is encapsulated into two SESAR solutions:

- **PJ.04-01 – Enhanced Collaborative Airport Performance Planning and Monitoring:** improving the ‘quality’ of the Airport Operations Plan (AOP) information through the inclusion of an increased set of data, captured from a wider range of airport processes, in particular landside processes impacting airside operations. The aim is to improve the monitoring of airport operations through the inclusion of aircraft, passengers and baggage processes, to ensure the maximum degree of synchronisation between them and improve departure time predictability and stability. This solution also addresses the adaptation of airport collaborative decision making and airport operations management processes and tools such as the AOP to the needs of regional airports;
- **PJ.04-02 – Enhanced Collaborative Airport Performance Management:** providing the framework to enable airport stakeholders to efficiently conduct collaborative decision making taking into account the most up to date information available. Enhanced collaborative airport performance management will be facilitated by access to real-time information captured in the form of performance dashboards showing ‘what has happened’, ‘what is happening’ but importantly ‘what is predicted to happen’ – including the identification of trends and potential performance deviations. The importance of demand and capacity balancing across the different airport processes and infrastructure elements will be captured within the solution where work performed in SESAR 1 focussing solely on the runway will be extended. The solution will also develop tools to support the management of the airport’s environmental performance. ‘What-if’ decision support tools will also be developed and the AOP will be enriched with meteorological probabilistic forecasts.

The project team refined the project management plan, the project integration in the Programme, the communication and dissemination plan and work schedule in the first months of 2017. In parallel, the project team started the developments at solution level, describing each solution’s concept and the related technical specifications. PJ.04-01’s cost benefit analysis was started. The team also initiated the validation activities, planning the exercises and developing the prototypes and validation platforms for PJ.04-01. The first two validation activities were run for this solution in the last months of 2017. Finally, the PJ.04-02 V1 data pack was submitted at the very end of 2017, triggering confirming the V1 maturity gate meeting planned for end of January 2018.

#### 7.1.1.3.1.5 PJ.05 Remote Tower – Remote Tower for Multiple Airports

PJ.05 was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2).

The Remote Tower project kicked off in November 2016. The project aims at further developing the remote provision of air traffic service to multiple aerodromes and the remote meteorological observations at airports. The three following solutions will be researched with the objective to deliver benefits in terms of cost efficiency and accessibility while maintaining or even increasing safety of tower operations:

- PJ.05-02 – **Remotely Provided Air Traffic Service for Multiple Aerodromes:** enabling an ATCO to maintain situational awareness and provide aerodrome control service or aerodrome flight information service for up to 3 different remote airports at a time in pre-defined traffic conditions. Advanced features of the visual reproduction and additional voice services will be integrated into the Multiple Remote Tower Module (MRTM);
- PJ.05-03 – **Remotely Provided Air Traffic Services from a Remote Tower Centre with a flexible allocation of aerodromes to Remote Tower Modules:** enabling the provision of remote tower services to a large number of airports from one Remote Tower Centre (RTC), housing one or several Multiple Remote Tower Modules (MRTM), thanks to the addition of advanced automation functionalities to the MRTMs (e.g. conformance monitoring, task prioritisation), allowing one ATCO to maintain situational awareness and provide air traffic service for up to 3 or 4 different remote airports at a time in pre-defined traffic conditions. An RTC supervisor will manage the flexible and dynamic allocation of airports to the different MRTMs in order to balance ATCO workload and traffic volumes, with the support of a planning tool; and
- PJ.05-05 – **Advanced Automated MET System for Remote Airport:** enhancing current possibilities of automated weather observation (AUTOMETAR), in conditions where it is difficult or too expensive to implement and staff a conventional manned facility. AUTOMETAR from remote locations contains some weather elements reported in simplified form only and some are omitted completely. The targeted improvements are in monitoring of e.g. prevailing visibility and its directional variations especially in inhomogeneous visibility conditions, aeronautically significant weather phenomena and cloud amount in inhomogeneous cloud coverage conditions and aeronautically significant cloud types.

The project team refined the project management plan, the project integration in the Programme, the communication and dissemination plan and work schedule in the first months of 2017. In parallel, the project team started the developments at solution level, describing PJ.05-02 and PJ.05-03’s concept and the related technical specifications. Technological solution PJ.05-05’s technical specifications were also initiated. The team also initiated the validation activities, planning the exercises and developing the prototypes and validation platforms for the three solutions. The first PJ.05-02 V2 validation exercise was executed in November 2017.

**7.1.1.3.2 Industrial Research & Validation for the ‘Optimised ATM Network Services’ Key Feature**

The IR-VLD Wave 1 call (with reference H2020-SESAR-2015-1) resulted in the following projects related to the ‘Optimised ATM Network Services’ Key Feature:



Ref.	Project title	Short Topic Description	Type of Action	Max. total co-financing value (in EUR)
PJ.07	Optimised Airspace Users Operations	Evolving ATM environment through SESAR towards a Trajectory Based environment in order to improve Airports and ATM Network performance	RIA	2.247.336
PJ.08	Advanced Airspace Management	Address the definition and refinement of relevant interfaces between Advanced Airspace Management and other processes such as DCB, FRA, NOP, flight planning.	RIA	2.738.349

Ref.	Project title	Short Topic Description	Type of Action	Max. total co-financing value (in EUR)
PJ.09	Advanced Demand Capacity Balancing (DCB)	Provide building blocks to complement Network Management with Network Intelligence based on shared situation awareness, a common set of values and rules and highly interconnected local network management functions.	RIA	7.153.347

**Table 43: IR Projects resulting from Wave 1 call H2020-SESAR-2015-2 related to the 'Optimised ATM Network Services' Key Feature and their max. co-financing value**

#### 7.1.1.3.2.1 PJ.07 OAUO – Optimised Airspace Users Operations

PJ.07 was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2).

OAUO focusses on flight planning supported by improved trajectory information sharing with ATM as defined in ICAO/FF-ICE and on flight prioritisation processes in capacity constraint situations—UDPP-, and on a step-wise integration of Military operations into civil ATM collaborative processes.

OAUO validates improved Airspace Users Flight/Wings Operations Centres' processes and tools for Trajectory Definition, Fleet Prioritisation and Preferences, and Mission Trajectory. Objectives include new performance indicators reflecting AUs' business needs in the ATM performance scheme; technology that drastically reduces the need for Airspace Users to perform labour intensive coordination; and integration of ICAO/ FF-ICE concept in the Trajectory Definition and UDPP processes.

The PJ07 management processes are up and running in accordance with and the principles were described in the PJ07 PMP.

#### Solution 07.01 Airspace Users' Processes for Trajectory Definition

Solution 07.01 is about developing requirements and validating procedures and workflows for Flight Operations Centres, enabling them to interact better with other ATM stakeholders, especially with the Network Manager, with regard to (medium and short term) trajectory definition and Airspace User preference provision. This will also ensure continuity in the CDM process throughout the trajectory lifecycle.

Solution 07.01 progressed during Q4 of 2016 and in 2017 according to the delivery plan agreed in the preparation of the PMP. The solution consists of 2 parallel threads: a V1 thread and a V2 threads which both progressed in general according to the planning in the PMP.

For V1 an initial OSED was produced (mid-2017) and for the 2 planned exercises one exercise VALP was delivered.

It was decided in agreement with Solution 2 to integrate the concept of Airspace User's absolute priority for usage in DCB in this Solution, although it also covers the Airspace Users preferences related to UDPP prioritised flights (which is in Solution 2).

V1 validation activities started in Q4 2017 involving the AUs in different ways, since the preparation of the activity to the involvement of all of them in the initial phases of the validation exercises. A brainstorming session was held in Dec 2017 where topics such as User Preferences, Congestion level Indicator, Absolute Priority and expected AUs benefits. The feedback from that expert judgement session will be used as input in the design of the Role Gaming Session planned for April 2018.

An initial exercise VALP for the two V1 exercises was produced and delivered to SESAR JU for review.

The V2 concept and contents discussions about the FF-ICE planning service and the provision of Enriched DCB information to AUs are progressing in close coordination with ICAO and NM developments. A draft version of the OSED/SPR/INTEROP was ready by the end of 2017 but the provision as local deliverable of the OSED on the extranet has been delayed to the end of February to ensure full consistency with latest NM and ICAO developments and integrate AU experts' inputs.

Preparations for the joint validation exercise (07.01.02 / 9.03.02) are very well advanced and a pre-run took place in Dec 2017.

Developments prototype NM is ready

- HMI on V2 platform (AU mock-up): a first version is ready and was used on the Pre-run
- An exercise pre-run took place (first week of December 2017, together with 09.03.02: passing of DCB measures, constraints and hotspots information to AU dispatch function).

The pre-run of the exercise has demonstrated the feasibility of the prototype and the operational usefulness of the principles for the AUs.

### **Solution 07.02 Airspace Users' Fleet Prioritisation and Preferences (UDPP)**

Solution 07.02 is designed to smoothly integrate the priorities and preferences of airspace users via collaborative processes at airports and in Network DCB processes, allowing those processes to perform multi-criteria optimisation tasks involving many stakeholders. This solution will also address how UDPP can be used by airspace users that are not regular users at a given airport.

Solution 07.02 progressed during Q4 of 2016 and in 2017 according to the delivery plan agreed in the preparation of the PMP. The key tasks, such the Initial OSED, first iteration of the VALP, Initial TS, as well as the development of the prototype have been prepared, reviewed and delivered internally and on-time. There was an initial delay in the contribution of the Airspace Users which was due to the late start of the support contract.

The preparation of the concept development and the validation exercise are progressing well. The development of the UDPP prototype is well under control. Only for the APOC component there has been a late start in the developments due to contractual arrangements, but this is not expected to impact the execution of the validation in 2018.

### **Solution 07.03 Mission Trajectory Driven Processes**

Solution 07.03 will develop requirements and validate procedures and workflows for Wing Operations Centres, enabling them to interact better with other ATM stakeholders, especially with the Network Manager regarding the Mission Trajectory. In a first phase the focus will be on harmonising military flight plans and integrating military traffic intentions into the overall European ATM network. Solution 07.03 and Solution 18.01 are working together as one single project: the operational deliverables and the validation are managed by solution 07.03 and the technical and systems aspects are managed by Solution 18.01.

Solution 07.03 progressed during Q4 of 2016 and in 2017 according to the delivery plan agreed in the preparation of the PMP. The key tasks, such the Initial OSED V2 and initial VALP V2 were produced. In parallel, an Initial TS reflecting the developments needed for the validation of Solution 07.03 was delivered by Solution PJ.18.01 (as it is a joint activity) as well as all the prototype developments. No delay of any significance was encountered.

At the end of 2017 all prototyping developments of the different parties were completed and the first integration tests took place.

### 7.1.1.3.2.2 PJ.08 AAM – Advanced Airspace Management

PJ.08 was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2).

AAM Partners focus on Dynamic Airspace Configurations (DAC) and Dynamic Mobile Areas (DMA). Compared to today's airspace scenarios, which by their nature are static, DAC/DMA enable flexible solutions that can be dynamically adapted to traffic demand to respond to different regional/local performance objectives, which may vary in time and place.

AAM Partners will further elaborate the definition of DAC/DMA, the associated data models and operational processes, validate the operational feasibility and assess the performance impact. The readiness for integration of the DAC operational process in the DCB process will be as well addressed. Automated tools to generate optimum sector design and configurations, as well as DMA optimal location and volume to meet performance targets will be developed.

AAM supports the SESAR Deployment regulation and addresses European concerns on economic (more efficient use of ATM Network resources) and environmental sustainability (reduced fuel burn and emissions) of Air Transport system giving Civil and Military Users the ability to optimise their o The PJ.08 management activities were executed in accordance with the principles described in the PJ.08 PMP and the SESAR JU processes.

#### Solution 08.01 – Management of Dynamic Airspace Configurations

Key tasks such as Initial OSED, VALP and Initial TS were prepared and delivered according to the Project Schedule. They are regularly updated since then. Some delay occurred for the preparation and execution of the validation activity EXE08.01.01, and the preparation of EXE08.01.04, caused by the development of the tool supporting these validation activities; for EXE08.01.04 the execution has been moved to beginning 2018.

#### Solution 08.02 – Dynamic Airspace Configurations supporting Moving Areas

The only task of the Solution is to develop Moving Hazard Zones' scope assessment study that evaluates the MET Gate data content to be used to determine the initial implementation of the moving hazard zones concept. The assessment also focus on the state of the DAC framework providing necessary recommendations for Wave 2

Initial (draft) Study Report is started to be drafted which is due to February 2018. perations.

### 7.1.1.3.2.3 PJ.09 DCB – Advanced DCB

PJ.09 was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2).

PJ09 Advanced DCB evolves the existing DCB process to a powerful distributed network management function which takes full advantage from the SESAR Layered Collaborative Planning, Trajectory Management principles and SWIM Technology to improve the effectiveness of ATM resource planning and the network performance of the ATM system in Europe.

Solution 1 develops shared situation awareness with respect to demand, capacity and performance impacts. Traffic and demand forecast have improved reliability based on complexity assessment and the computation of confidence indexes. Network Operations will be continuously monitored through Network Performance KPA/KPI. Network impact assessment will analyse trade-offs and facilitate collaborative decision making processes.

Solution 2 forms the core functionality of the INAP process (everything which can and should be decided locally. Solution PJ09-02 is the logical follow-up of the SESAR1 Local DCB toolset. It includes: INAP management, ASM integrated into DCB, reconciliation of DCB measures with local complexity management, ATC and Arrival Management. The solution addresses the integration of Local Network

Management with extended ATC planning and arrival management activities in the short-term to execution in a seamless process.

Solution 3 delivers subsidiary Network Management facilitated by a rolling NOP planning environment (including weather, demand pattern and capacity bottlenecks). Network Operations planning and Execution is managed by an agreed set of rules and procedures, guiding subsidiary DCB and UDPP measures under consideration of trade-offs and network performance targets. Collaborative 4D constraints management integrates AUs priorities and reconciles DCB measures with Airports, ACCs, AU and NM.

**Solution 09-01 – Network Prediction and Performance**

In 2017 the Solution 1 progressed according to the delivery plan which is defined in the PMP. The key tasks, such the Initial OSED, first iteration of the VALP and Initial TS have been prepared, reviewed and delivered on-time. There was a minor delay (without impact on the quality) in contribution of the Airspace users, caused by the late start of the support contract.

The validation exercises and their supporting activities (EXE-09.01-01, EXE-09.01-03 & EXE-09.01-04) were progressing well for all three concept elements: demand prediction, complexity assessment and network performance management. In September 2017, the Solution 1 team has also kicked-off the preparation for one of the two main human-in-the-loop (HIL) exercises, EXE-09.01-02. The prototyping and NM system developments are going well.

**Solution 09.02: Integrated Local DCB Process**

Solution 02 has been successfully kicked-of and is progressing according to plan. The Solution has no significant delays, although there have been some small delays in the performance of EXE-09.02-01 & EXE-09.02-02, which have no impact on the performance of EXE-09.02-03. All the exercise validation platforms developments are already ongoing and on time, including key interoperability tests with the NM validation platforms (NMVP and INNOVE).

Initial version of the deliverables (OSED, VALP and TS) has been produced.

**Solution 09.03: Collaborative Network Management**

Solution 03 has been successfully kicked-of and is progressing according to plan with a first successful iteration of validation exercise (09.03-02 Collaborative NOP - iteration 1.a) and a successful workshop for EXE 09.03-01 Collaborative DCB Framework. Initial version of the deliverables (OSED, VALP and TS) has been produced.

**7.1.1.3.3 Industrial Research & Validation for the ‘Advanced Air Traffic Services’ Key Feature**

The IR-VLD Wave 1 call (with reference H2020-SESAR-2015-1) resulted in the following projects related to the ‘Advanced Air Traffic Services’ Key Feature:



Ref.	Project title	Short Topic Description	Type of Action	Max. total co-financing value (in EUR)
PJ.01	Enhanced Arrivals and Departures	Addresses interaction between Traffic Synchronisation and DCB within the extended horizon. Potential information integration needs and balancing	RIA	17.521.324

Ref.	Project title	Short Topic Description	Type of Action	Max. total co-financing value (in EUR)
		mechanisms to be investigated and developed.		
PJ.06	Trajectory Based Free Routing	Realising the objective of airspace users to plan flight trajectories without reference to a fixed route network or published directs within high & very high-complexity environments.	RIA	6.029.408
PJ.10	Separation Management En-route & TMA	Looks at the tactical layer of separation management (for resolution advisory purposes demand and capacity balancing considerations will be taken into account if feasible, but main objective is aiming at the provision of separation between aircraft).	RIA	26.388.516
PJ.11	Enhanced Air & Ground Safety Nets	Current Airborne Collision Avoidance System (ACAS) performance requirements will need to be adapted for the future operations identified by the SESAR Concept. This topic looks at the adaptation of ACAS to new separation modes and to new categories of airspace users.	RIA	5.478.830

**Table 44: IR Projects resulting from Wave 1 call H2020-SESAR-2015-2 related to the 'Advanced Air Traffic services' Key Feature and their max. co-financing value**

#### 7.1.1.3.3.1 PJ.01 EAD – Enhanced Arrival and Departure

PJ.01 was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2).

This Industrial Research has been kicked-off in November 2016. It addresses development of concepts, tools and procedures to increase the capacity of Extended TMAs (E-TMAs) to meet forecast traffic growth in a safe, cost-effective and environmentally sustainable manner. This will be achieved by taking advantage of the latest technological developments from both an airborne and a ground-system perspective and through secure sharing of data.

PJ01 EAD considers all types of European E-TMA environments. In the case of low to medium density/complexity E-TMAs the driver will be to exploit the environmental benefits achieved from Continuous Climb Operations, Continuous Descent Operations and improved arrival sequencing. For the capacity-constrained high-density/complexity E-TMAs, including multiple airports, the focus is to minimise delays and improve resilience alongside providing environmental benefits. This will be accomplished by enhancing arrival and departure management systems which support the dynamic use of Performance Based Navigation routes. Traffic flows will be optimised by greater interaction between the arrival and departure management systems and the systems that balance traffic demand and available capacity across the network and airports.

This work of Project PJ01 EAD provides a major contribution in the operational efficiency and environment areas from advances in Terminal Manoeuvring Areas (TMAs).

PJ01 EAD focuses on operational improvements to increase airspace capacity and cost efficiency, improve safety, predictability and punctuality and provide greater fuel efficiency and environmental sustainability. To progress these operational improvements, PJ01 EAD has planned to undertake

validation of operational improvements to provide evidence of the impact of the improvements on the key performance areas defined for SESAR 2020.

During the ramp-up phase the individual work packages refined and updated their scope and the work schedule. All work packages prepared an initial description of the investigated operational services and their corresponding operational environments. For the first set of exercises, detailed descriptions of validation objectives, anticipated benefit mechanisms and various assessment plans were prepared. Operational requirements were captured, the necessary validations were started and the first exercises were successfully conducted. One Maturity gate on solution 01-03b (Improved parallel operations) was performed at v1 level.

#### **7.1.1.3.3.2 PJ.06 FREE ROUTE**

PJ.06 was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2).

The Free Routing concept enables Airspace Users to fly as close as possible to their preferred trajectory, without being constrained by fixed airspace structures or fixed route networks.

Free Routing (FR) implementation represents a step towards a less fragmented European airspace foreseen by Single European Sky and provides the AUs with the possibility to fly their user preferred routes in accordance with their business needs or mission requirements. FR will result in a seamless airspace enabling more efficient flight, a reduction in AU costs and will promote cheaper travel, increasing personal mobility and trade. In addition, implementing Free Routing Airspace will reduce the greenhouse gas emissions that currently contribute to global warming, thereby creating a

In 2017 Initial Concepts definition for developing and validating concepts enabling Airspace Users to plan flight trajectories without reference to a fixed route network or published directs within high & very high-complexity environments has been done. This work will be updated according to the validation exercises results. The required infrastructure (and supporting tool) enabling the provision of air traffic services in a Free Route environment have been identified.

Solution 06.01 Optimized traffic management to enable Free Routing in high and very high complexity environments

In 2017 the Initial version of the PMP Deliverable D2.1.010 (PJ06-01 SPR-INTEROP/OSED (V3) - Initial version) has been produced. Also the interim version of the PMP Deliverable D2.1.020 - PJ06-01 SPR-INTEROP/OSED (V3) has been almost completed in this period and delivered at the very start of the second reporting period). As part of this task the initial Safety Assessment Report has been produced as well. Consolidated VALP and Platform integration and trials preparation has progressed in line with the planning and Performance assessment and CBA activity has started

Solution 06.02 Management of Performance Based Free Routing in Lower Airspace

In 2017 PMP Deliverable D3.1.010 OSED including the initial safety assessment has been almost completed in line with the updated planning. PMP Deliverable D3.1.020 VALP (V1) has been produced.

Two sets of validation have been conducted

- T03.030.02 Validation V1 #1 Exercise Execution
- T03.030.03 Validation V1 #2 Exercise Execution

#### **7.1.1.3.3.3 PJ.10 PROSA – Separation Management & en-route & TMA**

PJ.10 was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2).

This Industrial Research has been kicked-off in December 2016. It aims at providing the air traffic controller with more automated tools, thus freeing capacity for situations where human intervention

is crucial. This provides even safer service for an increasing amount of traffic and with lower costs, as required by airspace users. This project addresses separation management. It will not only improve current conflict detection tools, but also develop new tools aiding the air traffic controller with resolution advisory and monitoring of flight trajectory. The project also addresses new ways of working together. Air traffic controllers traditionally work in pairs and in specific airspace. Could this be changed to multi-planner setup, sector less airspace and seamless cross-border operations? The project will ensure the research is developed to a stage where it can be used in operational air traffic management systems in Europe. This ensures that anyone can fly safer, cheaper and quicker in Europe in 10 years. Another really important issue is the integration of “Remotely Piloted Aircraft Systems” – drones. Drones are new to European Air Traffic Management, and it is urgent to address concepts and technological developments needed to handle this kind of traffic safely.

During the ramp-up phase the individual work packages refined and updated their scope and the work schedule. All work packages prepared an initial description of the investigated operational services and their corresponding operational environments. For the first set of exercises, detailed descriptions of validation objectives, anticipated benefit mechanisms and various assessment plans were prepared. Based on the operational requirements an initial set of technical specifications were derived and the necessary prototype and validation platform preparations were started and the first exercises were successfully conducted.

#### **7.1.1.3.3.4 PJ.11 CAPITO – Enhanced Air & Ground Safety Nets**

PJ.11 was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2).

This Industrial Research project has been kicked-off in November 2016 is focused on Enhanced Air and Ground Safety Nets, contributing to the Advanced Air Traffic Services key feature. In near-term operations, ground-based safety nets, and notably Short Term Conflict Alert (STCA), need to be adapted to work optimally in future SESAR ATM environments. Airborne Collision Avoidance Systems (ACAS) are operational globally and need to be optimised for all airspaces and to be compatible with existing systems. Their development therefore needs to take into account worldwide initiatives. Experience shows that within ACAS standardization and validation processes it is essential that the European airspace operations are taken into consideration, especially with regard to the evolution and impact of SESAR initiatives on the design of safety nets.

The added value of the CAPITO project is to ensure that the European voice is heard within these global initiatives and that evolving SESAR trajectory management and new separation modes are taken into account ensuring the continuous and effective operation of the last ATM safety layer. CAPITO project members participate in standardisation activities, in particular EUROCAE and RTCA/EUROCAE meetings to disseminate validation results and analysis. It is to be noted the project covers a large spectrum of Airspace Users including the ones related to Remotely Piloted Aircraft Systems (RPAS), General Aviation (GA), rotorcrafts (R) and military operations.

**7.1.1.3.4 Industrial Research & Validation for the ‘Enabling aviation Infrastructure’ Key Feature**

The IR-VLD Wave 1 call (with reference H2020-SESAR-2015-1) resulted in the following projects related to the ‘Enabling aviation infrastructure’ Key Feature:



Ref.	Project title	Short Topic Description	Type of Action	Max. total co-financing value (in EUR)
PJ.14	Communications, Navigation and Surveillance (CNS)	Enforce new CNS technical capabilities to meet operational requirements and needs, taking into account the newly emerging CNS technologies.	RIA	23.213.533
PJ.15	Common Services	This topic will develop solutions that are expected to enhance the benefit of operational solutions, especially their cost effectiveness, by identifying opportunities to provide them through alternative organisational arrangements. This is achieved through the discovery, definition and validation of common services and their enabling elements in the operational solutions.	RIA	5.784.514
PJ.16	CWP – HMI	Looking at automation and new tools to assist Airport ATS, TMA and En-Route Controllers.	RIA	12.861.754
PJ.17	SWIM Infrastructures	Further mature and validate SWIM A/G solutions for advisory services and for safety critical services, federated identity management, a common runtime registry & civil-military interoperability.	RIA	9.754.599
PJ.18	4D Trajectory Management	Sharing trajectories between ATM actors including Airspace Users through an iterative process to take into account more accurate data once available (e.g. intentions, MET forecast, current traffic, airspace management).	RIA	22.193.937

**Table 45: IR Projects resulting from Wave 1 call H2020-SESAR-2015-2 related to the ‘Enabling aviation infrastructure’ Key Feature and their max. co-financing value**

**7.1.1.3.4.1 PJ.14 EECNS – Essential and Efficient Communication Navigation and Surveillance Integrated System**

PJ.14 was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2).

The EECNS project kicked-Off in November 2016. This Enabling Infrastructure projects aims at providing an advanced, integrated and rationalised aviation infrastructure for Communication, Navigation and Surveillance (CNS). It aims at providing the underlying technical capabilities to meet the required operational improvements in support of Optimised ATM Network Services, Advanced Air Traffic Services and High-Performance Airport Operations key features.

The 11 solutions addressed by PJ.14 EECNS cover:

- **Solution PJ.14-01-01: CNS Environment Evolution** will provide an integrated, global view of the future Communications, Navigation and Surveillance services. This would include: The evolution, Strategy and Roadmap for an Integrated CNS; Identify current CNS requirements; Assessing cross-domain CNS vulnerabilities; Identifying short-term and long-term CNS evolution for both ground and airborne system; Defining the future integrated CNS architecture; Defining the integrated CNS spectrum strategy; Identifying areas where the CNS efficiency could be improved; Ensure Civil-Military CNS interoperability.
- **Solution PJ.14-02-01: FCI Future Terrestrial Data Link** has the objective to develop and standardise the candidate future terrestrial data link system LDACS. The goal of this solution is to finalize the development and standardization of the LDACS technology. This includes security and digital voice concepts, and will contribute to the development of a harmonized global standard.
- **Solution PJ.14-02-02: Future Satellite Communications Means (data link)** is focused on the near and long satellite data link technologies for both continental and oceanic regions. It will also include digital voice as an element of the Future Communications Infrastructure (FCI). The main objectives include: Compliance with ATN baseline 2 requirement (especially Real time sharing of 4D trajectories); Development of technical specifications and validation procedures for Long Term SATCOM for ATM/Iris (class A SatCom) integrated in the FCI (IPv6 and ATN/IPS with multilink policy) and taking into account a seamless transition from SESAR baseline and considering the intermediate step of the i4D based on ESA Iris Precursor solution (Class B); Technical validation of satellite Air-Ground Datalink for Long Term SATCOM integrated in the FCI (ATN Baseline 3, ATN/ IPS, multilink); Standardization at global level (ICAO, EUROCAE) of proposed solution for Long Term SATCOM; validation to V2 in wave 1 followed by V3 validation in wave 2. There will be strong coordination with ESA Iris Programme and the reuse and consolidation of the ESA Iris programme prototypes where possible
- **Solution PJ.14-02-04: FCI Network Technologies incl. voice solution and military interfacing** seeks to develop and standardise the FCI elements that integrate all the future terrestrial data link systems. LDACS, SatCom and AeroMACS, delivered respectively by solutions PJ14-02-01, PJ14-02-02, and PJ14- 02-06. In addition, this solution will address transversal topics including security, safety, and civil- military interoperability with ground/ground communications networks. The solution will demonstrate support of symmetric communications via multi-link to a mobile end system (e.g. airplane) by means of LDACS, AeroMACS, and SATCOM data links. This will be validated by demonstration of 4D-trajectory based/sector-less operation in both laboratory and (emulated) mobile environments.
- **Solution PJ.14-02-05: Development of new services similar to FIS-B to support ADS-B solutions for General Aviation.** The solution will investigate suitable means to provide supplementary information for GA and thus, to increase safety particularly in mixed traffic environments. This includes the use of an appropriate infrastructure (3G/4G/5G) as well as the bundling and provision of additional services (FIS [Weather/NOTAM/etc.] and TIS) to GA.
- **Solution PJ14-02-06: Completion of AeroMACS Development.** The primary objectives of this activity are to integrate and verify the AeroMACS Data Link with ATN services, both at ground and on-board. Initially ATN/OSI will be considered, while ATN/IPS will be verified subsequently, in line with the ICAO roadmap. The AeroMACS A/G datalink will also be integrated with the multilink environment, with the definition and potential implementation handover from AeroMACS to VDL2 during take-off, and vice-versa during landing. The Network and Security System requirements will be finalised, also in relation to multilink. A digital voice communications solution over AeroMACS (VoIP) will be finalised and verified. The solution will

also support the standardization process providing input to, and aligning with, the relevant standardization activities in ICAO, EUROCAE/RTCA, AEEC, ETSI, WMF. AeroMACS is expected to reach a V3 maturity level within Wave 1.

- **Solution PJ.14-03-01: GBAS.** The objective is to advance GBAS as a technical enabler and to take advantage of the operational benefits that GBAS can provide. The operational benefits include: Capacity increase in low visibility conditions; Shorter routes and fuel-saving approaches, providing cost-savings, less emissions and noise; Provide precision approach on runways where ILS is not feasible
  - The GAST D-related activities in PJ14-03-01 aim to further mature GBAS to address conditions outside the mid latitudes, to meet the requirements of a globally deployable system. It will also develop and validate the infrastructure needed for operations on complex airports.
  - The plan for the GAST F activities is to provide initial standards to address multi-constellation/multifrequency GBAS, to provide enhanced robustness, especially against challenging aspects of the ionosphere environment.
- **Solution PJ.14-03-02: Multi Constellation / Multi Frequency (MC/MF) GNSS.** The objective of solution is the maturation of the framework and the technical enablers so that GNSS receivers processing any constellation(s) in Multi Frequency can be developed to support the different foreseen expectations from the deployment of GNSS navigation taking profit of multiconstellation and multifrequency. The operational benefits remaining to be identified shall be further assessed, but it is expected that MC/MF GNSS/SBAS would contribute to support: PBN; Approaches with horizontal and vertical guidance; Surveillance (ADS-B); 4D concepts; Autoland capability; Lower minima SVGS operations; Surface movement; Ground infrastructure rationalization.
- **Solution PJ14-03-04: Alternative Position, Navigation and Timing (A-PNT).** The objective is to develop an A-PNT system as a technical enabler to support PBN/RNP operations in case of a GNSS degradation or outage. The solution aims to provide both a feasible short term solution and a long term improvements to support more demanding operational positioning and navigation requirements.
  - The short term work will seek to enhance legacy technologies (e.g. DME, IRS), and hence make use of existing infrastructure and equipment.
  - The medium term will investigate the possibility to improve DME based localization algorithms in the airborne FMS to fully support the OBPM integrity requirements defined for a RNP navigation specification in the PBN manual.
  - For the long term upgrade, new technologies (e.g. LDACS, eLoran) will be studied. A goal will be to improve the performance while increasing spectrum efficiency and creating synergies.
- **Solution PJ.14-04-01: Surveillance Performance Monitoring.** The objective is to enable a harmonised performance monitoring of surveillance systems. Such monitoring will seek to identify degradation trends early, using both off-line and in continuous quasi real-time processes. The specification of surveillance performance monitoring tools supporting both Cooperative and Non-Cooperative surveillances techniques are addressed by this Solution (Ground-based and Space-based, ADS-B, WAM, MLAT, SMR), covering En-Route, TMA and Airport surface and the surveillance monitoring performance will be applied both at sensor level and at the output of the entire surveillance chain (“End-to-end”). The solution targets at the end of wave 1 Maturity V2 for Cooperative Sensor level (WAM, ADS-B and MLAT) and V1 for Non-Cooperative Sensor level and “End-to-end”.

- **Solution PJ.14-04-03: New use and evolution of Cooperative and Non-Cooperative Surveillance.** The objective of this solution is to address the separate evolution of non-cooperative surveillance systems like MSPSR and Video Trackers, and cooperative surveillance systems such as ADS-B, Airport and Wide Area Multilateration (MLAT/WAM) systems. New systems like MSPSR, and additional functionalities for cooperative sensors, such as security screening and reporting methods will be demonstrated in real environments. Evolution of ADS-B datalink and the exchange of data between sensors, and composite surveillance are planned to improve sensor ambiguity resolution performance. A dedicated task will adapt multi sensor tracker systems for the new input data characteristics and implement additional functionalities on multiple platforms. The solution will demonstrate the achievement and proposed improvements using one or more prototypes in real environment.

The project Kick-Off was held in November 2016 in Rome. Key deliverables within the initial reporting period for the transversal Solution 14.01.01 CNS Environment Evolution include, the first release version of the “CNS Evolution, Strategy and Roadmap”.

From the 5 Communication related solutions, the following key points include: for “Solution 14.02.01 FCI Terrestrial Data Link”, the PMP first version deliverables for the LDACS A/G Specification and LDACS deployment report being made available. For “Solution 14.02.02 Future SATCOM datalink”, interaction with ESA was established at preliminary requirements for SPR and INTEROP collected and shared. The “Solution 14.02.04 FCI” provided towards the V1 gate Initial Concept Description, FRD and Identification of potential benefits and risks. Solution 14.02.05 New Services for GA had started the OSED but was slightly behind schedule. The last COM “Solution 14.02.06 Completion of AeroMACS” provided an initial TS/IRS and standardisation report.

From the 3 Navigation related Solutions, the key points of progress include: for “Solution 14.03.01 GBAS”, for the extended scope of GAST D an Availability Note with respect to the upgrade at Frankfurt, GAST F (MC/MF) mock-up in Barcelona Availability Note and a TVALP. All other tasks were progressing to schedule. The “Solution 14.03.02 MC/MF GNSS” provided an initial TS/IRS and showed progress in the prototype developments. The “Solution 14.03.04 A-PNT” identified a need to expand its scope to include a Mid-Term solution for Airborne Multi DME Architecture. As a result, their FRD will be resubmitted to address Short, Medium and Long term A-PNT solutions.

From the 2 Surveillance related Solutions, the key progress include: for “Solution 14.04.01 SPM”, an initial TS/IRS and the identification of an additional Data Pack. For the “Solution 14.04.03 on the evolution of C and NC Surveillance”, has provided the initial TS/IRS.

#### 7.1.1.3.4.2 PJ.15 COSER – Common Services

PJ.15 was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2).

COSER is about defining, architecting and validating services that can be delivered in a harmonised manner. A Common Service is a service that provides a capability (business functionality) to consumers in the same way that they would otherwise need to provide themselves. As a natural consequence, the Common Services approach addresses the unnecessary costs of fragmentation and ensures the delivery of such functionalities with an improved cost effectiveness, which should in turn benefit the whole European ATM Community.

The following Common Services are subject to be developed and validated by PJ.15 solutions:

- PJ.15-01. Sub-Regional Demand Capacity Balancing
- PJ.15-02. Delay Sharing
- PJ.15-08. Trajectory Prediction

- PJ.15-09. Data Centre Service for Virtual Centre
- PJ.15-10. Static Aeronautical Data
- PJ.15-11. Aeronautical Digital Map

Work performed in 2017 can be summarised as follows:

- PJ.15-01 has delivered the Business Model and the High Level Architecture and started the V2/TRL3 phase by developing the validation plan, and detailing the content of the V2/TRL4 validations, subsequently defining the services, a subset of which will be used for the validations.
- PJ.15-02 has delivered the Business Model and the High Level Architecture. The solution already passed the corresponding V1 maturity gate. In addition, PJ.15-02 has started the V2/TRL4 phase by defining the services, which will be used for the validations, developing the validation plan, and starting the development of the V2/TRL4 validations.
- PJ.15-08, PJ.15-10 and PJ.15-11 have delivered the Data Pack V1 containing the Business Model and the High Level Architecture. Finally,
- PJ.15-09 has developed an initial draft of the Business Model and High Level Architecture. Discussions about the scope of the Virtual Centre and adjustments of the Common Service method have taken place during this period.

#### 7.1.1.3.4.3 PJ.16 HMI – CWP – Virtual Centre

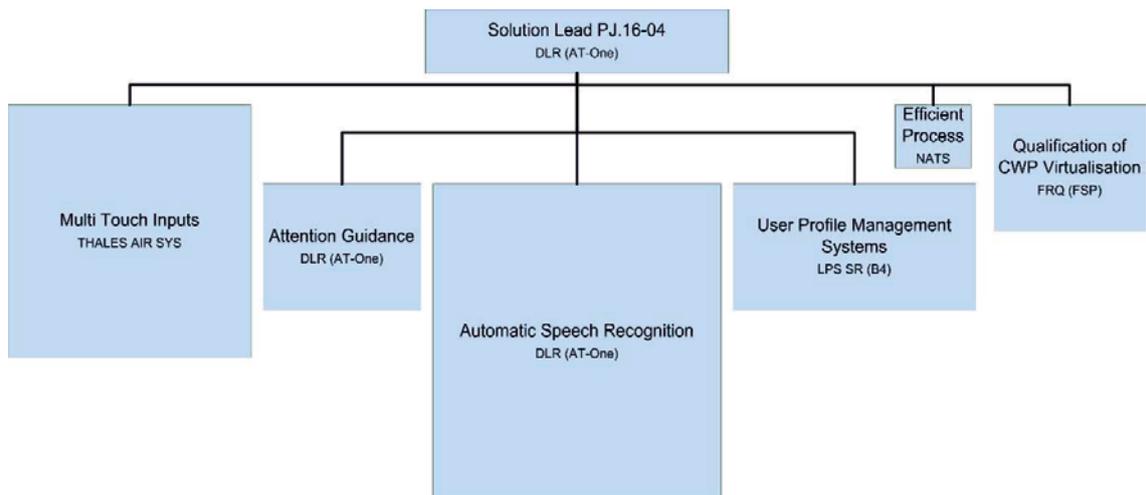
PJ.16 was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2).

HMI-CWP is about two distinct and innovative solutions:

- Solution PJ.16-03 is about Workstation, Service Interface Definition & Virtual Centre Concept develops a concept for separating the Controller Working Position (CWP) from the datacentre where the data is produced. This lean and efficient use of ANSP infrastructure tackles the issues presented by fragmented European ATM systems and country-specific architectures, enabling Europe to move to an interoperable, cost effective and flexible service provision infrastructure. Decoupling of the CWPs should enable a more efficient use of the most valuable and expensive resource, the human. By enabling increased flexibility the ANSPs should better manage staffing for prevailing traffic conditions and assure service continuity.
- Solution PJ.16-04 is about Workstation, Controller Productivity deals with new methods of controller interaction with the Human Machine Interface (HMI), applying mature technologies from other domains to ATM. This will increase controller productivity, reduce workload, stress level and enable the use of SESAR advanced tools, safely facilitating performance based operations.

In 2017

- Solution PJ.16-03 Workstation, Service Interface Definition & Virtual Centre Concept has already delivered some concrete results, as an agreed definition of the concept, a target architecture recognised by the ATM community, a definition of some services, and assessed risks that goes with it. At the end of 2017 the proposal was close TRL2 maturity level i.e. concept validated and has started the work to reach the “ready for industrialisation” maturity.
- Solution PJ.16-04 Workstation, Controller Productivity has ramped up and finalised first the methodology, literature research on the following 6 activities included in this solution:



Good progress is made and the forecast is that TRL2 maturity (Concept validated) will be attained in the course of 2018

#### 7.1.1.3.4.4 PJ.17 SWIM-TI – SWIM Technical Infrastructure

PJ.17 was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2).

The System Wide Information Management (SWIM) relies on a network of SWIM nodes (also called 'ATM intranet') which dramatically reduces the number of interfaces, decouple the information providers from the information consumers, and capitalize on open standards. At the SWIM nodes, SWIM-enabled applications use interoperable services to exchange information conveyed through a SWIM Technical Infrastructure (SWIM-TI) middleware based on an IP-based network.

The three PJ.17 solutions build on the SESAR 1 results to extend the SWIM-TI (which will be a key communication enabler for other SESAR 2020 solutions) include:

- PJ.17-01 "SWIM-TI Purple Profile for Air/Ground Advisory Information Sharing" will support ATM operational improvements that depend on Air/Ground (A/G) information exchanges to enable a better situational awareness and collaborative decision making, with a focus on advisory information. The targeted maturity level in wave 1 is TRL6. The Data Pack will be made available to the SESAR Deployment Manager to complement the initial European SWIM Infrastructure (iSWIM) components. This will enable in particular operational applications to uplink meteorological or aeronautical information using SWIM. Solution PJ17-01 will also anticipate the Air/Ground Safety-Critical Information Sharing ("Feasibility Study for Air/Ground SWIM for Safety Critical Information sharing (PJ17-07)) task". This objective was not applicable in this reporting period (introduced in the 2nd Grant Amendment).
- PJ.17-03 "SWIM-TI Green Profile for G/G Civil Military Information Sharing" will focus on the evolutions to be implemented and the constraints (e.g. in the cyber-security area) to be taken into account for connecting SWIM networks used by the civil ATM community to military networks. The interconnection of these networks will contribute to increase collaboration between the civil ATM community and the military stakeholders, as pointed out in the European ATM Master Plan. PJ.17-03 contributes to the interconnection of the civil and military domains on top of the civil IP network infrastructure, therefore at middleware level (transport and application messaging). The targeted maturity level in wave 1 is TRL4. This TRL4 Data Pack will become the first baseline technical specification for SWIM systems supporting civil-military communications.

- PJ.17-08 “SWIM-TI Common Runtime Registry” will extend the work done in SESAR 1 on the Design-Time Registry to the Runtime Registry which is needed for late binding to SWIM services, provision of routing information to SWIM services, provision of SWIM service status information and lookup of policies. The targeted maturity level in wave 1 is TRL6. This Data Pack will be made available, in particular, to the SESAR Deployment Manager to complement the iSWIM Infrastructure components.

The project Kick-Off was in November 2016. The Solution 17-01 Purple Profile for A/G Advisory Information Sharing provided their technical specification and validation plan in preparation for TRL4. The Solution 17-03 Green Profile for G/G Civil Military Information Sharing made good progress and is on schedule to deliver their FRD and TVALP at the beginning of 2018 prior to their TRL2 Maturity Gate. The Solution 17-08 SWIM TI Common runtime registry delivered on schedule their FRD in preparation for the V1 Maturity Gate at the beginning of 2018.

#### 7.1.1.3.4.5 PJ.18 4DTM – 4D Trajectory Management

PJ.18 was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2).

This Industrial Research has been kicked-off in November 2016. It develops an innovative way of allowing the different Air Traffic Management (ATM) actors to have a unique and coherent view of the planned flight trajectory, guaranteeing that air navigation service providers, airport operators, airlines and the aeronautical community at large share a single vision of the trajectory that is harmonized and updated with the movements of both civil and military aircraft throughout Europe. It also allows air traffic controllers to have more precise information for planning operations and managing traffic more smoothly.

This allows the different ATM actors to have a better knowledge of the flight intention so they can anticipate potential issues, correct deviations and better use their resources to reduce costs, increase safety, reduce CO2 emissions and better react to any unexpected issue the flight may have. This is aligned with Trajectory Based Operations (TBO, which is used on flight efficiency, predictability, environment and capacity) concept, a broader international initiative where the projects contribute to its validation.

The project will also develop new tools to improve the availability consistency, quality and exchange of aeronautical and meteorological information that is both harmonized and top-quality, entailing a significant leap forward in improving the management of aviation operations.

The project is organized in several areas called Solutions, attending different aspects, like type of traffic, set of actors exchanging information or information domain. During the ramp-up phase the individual work packages refined and updated their scope and the work schedule. All work packages prepared an initial description of the investigated operational services and their corresponding operational environments. For the first set of exercises, detailed descriptions of validation objectives, anticipated benefit mechanisms and various assessment plans were prepared. Initial set of operational requirements were derived and the necessary workshop and fast time simulations were started; the first exercises were successfully conducted.

#### 7.1.1.4 Very Large-Scale Demonstrations

Very Large-Scale Demonstration activities are addressed through projects awarded under the calls

- IR-VLD Wave 1 (with reference H2020-SESAR-2015-2),
- VLD Open 1 (within the call with reference H2020-SESAR-2016-2).

Further to the high-level results provided in Part I of this document, the paragraphs below provide update information on the objectives and 2017 achievements of the projects resulting from call IR/VLD Wave 1<sup>43</sup>. Projects are sorted by Key Feature/topic and then by increasing order of their acronym.

##### 7.1.1.4.1 Very Large-Scale Demonstration activity for the ‘High Performing Airport Operations’ Key Feature

The IR-VLD Wave 1 call (with reference H2020-SESAR-2015-1) resulted in the following activity related to the ‘High-Performing Airport Operations’ Key Feature:

Key Feature	Ref.	VLD activity title	Short VLD activity description	Max. total co-financing value (in EUR)
 High-performing airport operations	PJ.28	Integrated Airport Operations (incl. TBS)	Demonstrations focussed on functionalities that enhance airport Integration and throughput	4.001.142

**Table 46: VLD activity resulting from Wave 1 call H2020-SESAR-2015-2 related to the ‘High-Performing Airport Operations’ Key Feature and their max. co-financing value**

##### 7.1.1.4.1.1 PJ.28 IAO – Integrated Airport Operations

PJ.28 was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2).

The IAO project kicked off in December 2016. The aim of the project is to de-risk the deployment of the three following PCP ATM functionalities:

- Departure Management Synchronised with Pre-departure sequencing;
- Airport Safety Nets; and
- Automated Assistance to Controller for Surface Movement Planning and Routing.

To achieve this goal the project will perform three demonstration exercises in Nice, Budapest and Hamburg airports. They will demonstrate the following PCP related SESAR 1 solutions:

- Solution #02 – Airport safety nets for controllers: conformance monitoring alerts and detection of conflicting ATC clearances;
- Solution #22 – Automated assistance to controllers for surface movement planning and routing;
- Solution #53 – Pre-departure sequencing supported by route planning; and
- Solution #23 – D-TAXI service for controller-pilot datalink communications (CPDLC) application.

<sup>43</sup> As VLD Open 1 call award and grant agreement preparation process was not completed in the end of 2017 yet, no information on the activities of the related projects is provided in the annex

In addition, the manual taxi routing functionality will be demonstrated on revenue flights and an ADS-B data collection campaign will be performed in order to demonstrate the adequate performance of ADS-B to support on-board traffic alerting.

The project team refined the project management plan, communication and dissemination plan and work schedule in the first months of 2017. The rest of the year was dedicated to the planning of the different demonstrations, including the development of the demonstration platforms and pre-operational prototypes.

**7.1.1.4.2 Very Large-Scale Demonstration activity for the ‘Optimised ATM Network Services’ Key Feature**

The IR-VLD Wave 1 call (with reference H2020-SESAR-2015-1) resulted in the following activity related to the ‘Optimised ATM Network Services’ Key Feature:

Key Feature	Ref.	VLD activity title	Short VLD activity description	Max. total co-financing value (in EUR)
 Optimised ATM network services	PJ.24	Network Collaborative Management	Demonstrations that improve the European ATM network performance, notably capacity and flight efficiency through exchange, modification and management of trajectory information	4.759.842

**Table 47: VLD activity resulting from Wave 1 call H2020-SESAR-2015-2 related to the ‘Optimised ATM Network Services’ Key Feature and their max. co-financing value**

**7.1.1.4.2.1 PJ.24 NCM – Network Collaborative Management**

PJ.24 was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2).

PJ.24 Network Collaborative Management (NCM) is based on a collaborative approach in Air Traffic Flow and Capacity Management (ATFCM), involving the whole spectrum of ATM actors: Airspace Users (AUs), Airports, Air Navigation Service Providers (ANSPs) and Network Manager (NM).

The project will demonstrate in a network collaborative environment the following objectives:

- optimization of the traffic delivery into sectors and airports and
- minimization of the need for Air Traffic Flow and Capacity Management (ATFCM) measures.

The demonstration scope is to prove that the performance targets and expectations at the network and local level could to be better achieved only through a collaborative synchronized effort of all the involved actors. An important part of improving the performance of network and airport operations is the effective and efficient planning of network (including ground) resources, by linking local optimization processes (including airport processes) with network optimization processes, taking into account stakeholders’ preferences where possible. This facilitates also the innovative usage and application of fine-tuned tailored measures (including target times) to further enhance of performance and predictability.

The focus of this project will be placed on four major areas, each of them corresponding to a local or network level perspective of ATFCM issues:

- Scenario Management (including Hotspot Awareness, network level, with local input) - The identification of a local DCB imbalance (possibly supported by automated local tools) will initiate a local/network coordination process between relevant local stakeholders and NM based on pre-defined scenario selections by local FMPs, and based on network impact assessments (including What-If simulations) performed by NM. Coordinated implemented scenarios and measures will be monitored by both local stakeholders and NM to verify the operational results.
- Tactical Capacity Management (local level) – The focus of this area will be the necessity to adjust the STAM/M-CDM (STAM coordination process) functionality in the ANSP local tool (e.g. iFMP for MUAC/EUROCONTROL) to support the changes resulting from the harmonisation of operational requirements.
- Airspace User Preferences (local level, could use NM in certain cases) - AUs will be supported to optimise their business in the network whilst still optimising congested airport capacity and maintaining predictable operations. Where appropriate they will have more flexibility to select the flights to which specific measures will be applied, including if possible automated processes where AUs provide timely information on the optimisation of departure sequences (for priority flights) in order to swap slots with other flights inside or outside the airline group.
- Airport Network Integration (local/network level) - An overview of Network capabilities are obtained by linking airport ground capacities obtained via the continuous update of the AOPs (through concepts of A-CDM, Airport Surface Traffic Management, Departure Management, Advanced Tower, Extended Arrival Management, and Airport Operations Centre - APOC) with the Network via the NOP. Where local DCB imbalances are detected, to supersede the need for blunt flow rates, the Airport will instead propose an optimal target time of arrival to resolve the situation.

The results of these demonstrations will contribute to the definition of technical systems requirements for SESAR CONOPS implementation, and prepare the pre-deployment phase of enhanced DCB tools within the dynamic DCB (dDCB) toolbox.

PJ.24 NCM submitted the DEMO Plan, which from that moment constitutes the main document in terms of management of the Project and also serves as Exercise Guide. It includes from the spread of the participation of partners in each of the tasks to Use Cases to be demonstrated and schedule of the different executions. Project also focused on the planning of the different demonstrations, including the development of the demonstration platforms and pre-operational prototypes.

#### 7.1.1.4.3 Very Large-Scale Demonstration activity for the 'Advanced Air Traffic Services' Key Feature

The IR-VLD Wave 1 call (with reference H2020-SESAR-2015-1) resulted in the following activity related to the 'Advanced Air Traffic Services' Key Feature:

Key Feature	Ref.	VLD activity title	Short VLD activity description	Max. total co-financing value (in EUR)
 Advanced air traffic services	PJ.25	Arrival Management extended to en-route Airspace	Demonstrations showing extended Arrival Management to en-route Airspace (AMAN horizon extended from 100-120 nautical miles to 180-200)	3.914.104

			nautical miles from the arrival airport)	
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**Table 48: VLD activity resulting from Wave 1 call H2020-SESAR-2015-2 related to the ‘Advanced Air Traffic Services’ Key Feature and their max. co-financing value**

**7.1.1.4.3.1 PJ.25 xStream – Cross-Border SESAR Trials for Enhanced Arrival Management**

PJ.25 was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2).

PJ.25 xStream project aims at extending arrival management horizon up to at least 200 nautical miles from destination airport and at evaluating its impacts and benefits. The project will demonstrate how arrival constraints can be computed and provided to upstream Area Control Centres (ACC). The main objectives are to improve flight efficiency, flight predictability and to reduce workload in terminal area (TMA).

The project will explore concepts related to extended arrival management and their impacts on the following KPA:

- Capacity : Airspace capacity,
- Cost efficiency: ANS Cost efficiency,
- Environment : Fuel efficiency,
- Predictability and punctuality: Variance of actual and reference business trajectories,
- Flexibility: ATM System & Airport ability to respond to changes in planned flights and mission,
- Safety: Accidents/incidents with ATM contribution,
- Interoperability: Capability of ANSP systems to share/manage arrival constraints.
- Demonstrations consist in flight live trials in major European hub airports:
- London Gatwick & Heathrow airports,
- Paris CDG & Orly airports,
- Zurich airport,
- Frankfort airport.

They involve the largest number of upstream ACCs around those platforms (Reims, Maastricht, Bordeaux, Karlsruhe, Brest, Geneva, Zurich, London, Milano, etc.).

Some trials will also be performed in en-route airspace to demonstrate how multiple arrival constraints can be handled. The project also associates Airspace Users in order to implement collaborative processes for the management of arrival sequence (A-Flex). As part of the SESAR 2020 programme, the demonstrations will contribute to SESAR CONOPS definition and engineering standardization work concerning the benefits brought by Extended Arrival Management (E-AMAN).

PJ.25 xSTREAM submitted the DEMO Plan, which from that moment constitutes the main document in terms of management of the Project and also serves as Exercise Guide. It includes from the spread of the participation of partners in each of the tasks to Use Cases to be demonstrated and schedule of the different executions. Project also focused on the planning of the different demonstrations, including the development of the demonstration platforms and pre-operational prototypes.

#### 7.1.1.4.4 Very Large-Scale Demonstration activities for the ‘Enabling Aviation infrastructure’ Key Feature

The IR-VLD Wave 1 call (with reference H2020-SESAR-2015-1) resulted in the following activities related to the ‘Enabling Aviation infrastructure’ Key Feature:

Key Feature	Ref.	VLD activity title	Short VLD activity description	Max. total co-financing value (in EUR)
 Enabling aviation infrastructure	PJ.27	Flight Information Exchange	<p>Project terminated according to the IOP recovery activity (ref to section 1.4.3.3)</p> <p>Demonstrate Flight information exchange during the pre-tactical and tactical phases by ATC systems and Network Manager</p>	6.079.367
	PJ.31	Initial Trajectory Information Sharing	Demonstrate initial Trajectory Information Sharing (i4D) consisting of the improved use of target times and trajectory information, including where available the use of on-board 4D trajectory data by the ground ATC system & Network Manager Systems	18.955.106

**Table 49: VLD activities resulting from Wave 1 call H2020-SESAR-2015-2 related to the ‘Enabling Aviation infrastructure’ Key Feature and their max. co-financing value**

##### 7.1.1.4.4.1 PJ.27 IOPVLD – Flight Information Exchange

PJ.27 was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2). Kicked off in November 2016, the PJ.27 aimed at demonstrating the use of the IOP solutions to ensure the interoperability between heterogeneous ground ATM systems. The project was closely dependent on the further development by PJ.18 of the IOP solution delivered by SESAR 1.

During its ramp up, PJ.27 in close collaboration with PJ.18 did refine its schedule to synchronise the demonstration activities with the development of the IOP solution. However, due to the delay in the IOP roadmap development, one of the resulting mitigation actions approved by the Programme Committee led to the decision to terminate the PJ.27. This was done according the H2020 rules and in a good agreement with all actors concerned.

##### 7.1.1.4.4.2 PJ.31 DIGITS – Demonstration of ATM Improvements Generated by Initial Trajectory Sharing

PJ.31 was awarded under the IR-VLD Wave 1 call (with reference H2020-SESAR-2015-2). The DIGITS project proposes, in a close to operational environment and in fully representative operational

conditions, a set of tightly coordinated development and demonstration actions of key airborne and ground stakeholders in Europe:

- The airborne industry will develop up to certification the worldwide first airborne unit capable of downlinking ADS-C data according to ATN Baseline 2 standard in compliance with PCP AF#6 (Initial Trajectory Information Sharing).
- The ANSPs and ground industry will build up validation and pre-operational system platforms capable of receiving and processing ADS-C data including the Extended Projected Profile (EPP). For MUAC, this will be implemented in the operational system, whilst for DFS, ENAV & NATS ,it will be integrated into their test platforms
- DIGITS plans to have revenue flights becoming available gradually as from late 2018. These commercial flights will downlink ADS-C data to be processed in ATM ground systems of participating ANSPs, covering together a substantial part of European airspace and air traffic under a variety of operational conditions in order to demonstrate the Operational Benefits of Initial Trajectory Information Sharing:

DIGITS will contribute to reinforce the “Enabling Aviation infrastructure” key feature of SESAR 2020 by demonstrating the ATM benefits that can be realized through the use of downlinked 4D trajectory data in ground systems.

The project Kick-Off was in November 2016. The DIGITS project submitted the Demonstration Plan, (DEMOP) which constitutes the main document in terms of project management planning of validation exercises. More specifically it addresses the demonstration objectives, assumptions, nine demonstration exercise plans, simulator sessions and Airspace User participation. Eleven development flights were performed to provide baseline data. Ground simulator coupling sessions are being performed between Airbus and ANSPs, between Aircraft and ANSPs and between Ground partners. The project remains on schedule and will incorporate the 100 planned aircraft into project through the DIGITS-AU project. The DEMOP will be updated accordingly.

## 7.1.2 Annex I.2: Horizon 2020 Scoreboards

The table below follows the instructions on Annual Activity Reports for Joint Undertakings operating under Horizon 2020:

### 5.1 Scoreboard of Horizon 2020 common KPIs

REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU <sup>44</sup>	Value in 2016	Value in 2017
1	SME - Share of participating SMEs introducing innovations new to the company or the market (covering the period of the project plus three years);(Number of SMEs that have introduced innovations)	Number and % of participating SMEs that have introduced innovations to the company or to the market	N	2	43 (8,5%)
2	SME - Growth and job creation in participating SMEs (turnover of company, number of employees)	Turnover of company  Number of employees	N	Turnover: EUR 22.509.957  Number of employees not available	Not available
3	Number of publications in peer-reviewed high impact journals	The percentage of papers published in the top 10% impact ranked journals by subject category.	N	19	66
4	Patent applications and patents awarded in the area of the JTI (number of patents awarded)	Number of patent applications by theme Number of awarded patents by theme	N		Number of patent applications: 4 Number of awarded patents: 3
5	Number of prototypes testing activities and clinical trials	Number of prototypes, testing (feasibility/demo) activities, clinical trials	N	Prototypes: 1 Testing activities: 6 Clinical trials: n/a	Prototypes: 1 feasibility activities: 11 Clinical trials: n/a

<sup>44</sup> Data not provided by SJU is provided by beneficiaries through project reporting

REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU <sup>44</sup>	Value in 2016	Value in 2017
6	Number of joint public-private publications in projects	Number and share of joint public-private publications out of all relevant publications.	N	9	21
7	New products, processes, and methods launched into the market	Number of projects with new innovative products, processes, and methods	N	Innovative products: 2 Innovative processes: 3 Innovative methods: 3	Innovative products: 2 Innovative processes: 3 Innovative methods: 3
8	Time to inform (TTI) <u>all applicants</u> of outcome of evaluation	Number and % of information letters sent to applicants within target (153 days) Average TTI (calendar days) Maximum TTI (calendar days)	Y	27 (100%) Average: 79 days Maximum: 79 days <sup>45</sup>	111 (100%) Average: 109 days Maximum: 124 days <sup>46</sup>
9	Redress after evaluation/evaluation review	Number of redressed requested	Y	0%	1,78 %
10	Time to grant (TTG) from call deadline to grant signature	Number and % of grants signed within target (243 days) Average TTG in calendar days Maximum TTG in calendar days	Y	32 out of 53 (60,4%) Average: 240 days Maximum: 358 days <sup>47</sup>	19 out of 20 (95%) Average: 210 days Maximum: 342 days <sup>48</sup>
11	Time to sign (TTS) from successful applicant letter	Number and % of grants signed within target (92 days)	Y	6 out of 53 (11,3%)	7 out of 20 (35%)

<sup>45</sup> Refers to call H2020-SESAR-2015-2

<sup>46</sup> Refers to calls H2020-SESAR-2016-1 and H2020-SESAR-2016-2

<sup>47</sup> Refers to calls H2020-SESAR-2015-1 and H2020-SESAR-2015-2

<sup>48</sup> Refers to calls H2020-SESAR-2016-1 and H2020-SESAR-2016-2

REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU <sup>44</sup>	Value in 2016	Value in 2017
12	Time to pay (% on time) for pre-financing, interim payment & final payment	Average TTS in calendar days Maximum TTS in calendar days Average number of days for Grants pre-financing (target 30 days), interim payments (target 90 days) and final payments (target 90 days) Average number of days for administrative payments Number of experts appointed	Y	Average: 126 days Maximum: 214 <sup>49</sup> Grants pre-financing < 30 days	Average 99 days Maximum: 248 days <sup>50</sup>
13	Vacancy rate (%)	% vacancy rate during the reporting period	Y	0%	10%
14	Budget implementation/execution: 1. % CA to total budget 2. % PA to total budget	% of CA and PA	Y	100%	92,7% 75,5%
15	Administrative Budget: Number and % of total of late payments	Number of delayed payments	Y	0%	0%

Table 50: Scoreboard of Horizon 2020 common KPIs

<sup>49</sup> Refers to calls H2020-SESAR-2015-1 and H2020-SESAR-2015-2<sup>50</sup> Refers to calls H2020-SESAR-2016-1 and H2020-SESAR-2016-2

**5.2 Indicators for monitoring cross-cutting issues**

REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU <sup>51</sup>	Value in 2016	Value in 2017
16	Number of nationalities in H2020 applicants & beneficiaries	Nationality of Horizon 2020 applicants & beneficiaries (number of )	N	22 <sup>52</sup>	25 <sup>53</sup>
				Austria: EUR 7.675.171 Belgium: EUR 7.840.517 Croatia: EUR 1.050.692 Czech Republic: EUR 2.827.580 Denmark: EUR 1.837.491 Finland: EUR 290.125 France: EUR 100.861.626 Germany: EUR 20.279.307 Greece: EUR 170.000 Hungary: EUR 700.079 Ireland: EUR1.980.327 Italy: EUR 33.961.124 Lithuania: EUR 1.297.799 Luxembourg: EUR 72.000	Austria: EUR 138.502 Belgium: EUR 1.250.094 Bulgaria: EUR 56.300 Czech Republic: EUR 761.232 Denmark: EUR 954.854 Finland: EUR 562.391 France: EUR 3.630.943 Germany: EUR 2.589.678 Ireland: EUR 181.300 Italy: EUR 3.088.784 Malta: EUR 67.109 Netherlands: EUR 2.600.984 Portugal: EUR 128.125
17	Total amount of EU financial contribution by member state	Nationality of Horizon 2020 beneficiaries and corresponding EU financial contribution	N		

<sup>51</sup> Data not provided by SJU is provided by applicants or beneficiaries at the submission or at grant agreement stage

<sup>52</sup> Refers to calls H2020-SESAR-2015-1 (applicants and beneficiaries) and H2020-SESAR-2015-2 (applicants)

<sup>53</sup> Refers to calls H2020-SESAR-2016-1 (applicants and beneficiaries) and H2020-SESAR-2016-2 (applicants and beneficiaries)

REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU <sup>51</sup>	Value in 2016	Value in 2017
18	Number of nationalities in H2020 applicants & beneficiaries (associated countries)	Nationality of Horizon 2020 applicants & beneficiaries (number of )	N	Malta: EUR 118.750 Netherlands: EUR 2.748.284 Poland: EUR 2.467.230 Portugal: EUR 478.675 Slovakia: EUR 1.837.362 Spain: EUR 45.210.363 Sweden: EUR 8.376.403 UK: EUR 14.113.197 <sup>54</sup> 6 (Iceland, Israel, Norway, Serbia, Switzerland, Turkey) <sup>56</sup>	Slovenia: EUR 141.543 Spain: EUR 2.563.262 Sweden: EUR 113.750 United Kingdom: EUR 4.913.877 <sup>55</sup> 6 (Armenia, Israel, Norway, Serbia, Switzerland, Turkey) <sup>57</sup>
19	Total amount of EU financial contribution by associated country	Nationality of Horizon 2020 beneficiaries and corresponding EU financial contribution	N	Iceland: EUR 26.700 Israel: EUR 171.125 Norway: EUR 4.675.415 Serbia: EUR 445.566 Switzerland: EUR 5.195.615 Turkey: EUR 373.125	Israel: EUR 216.661 Norway: EUR 99.988 Serbia: EUR 155.292 Switzerland: EUR 22.750 USA: EUR 51.911 <sup>57</sup>

<sup>54</sup> Refers to calls H2020-SESAR-2015-1 (applicants and beneficiaries) and H2020-SESAR-2015-2 (applicants)

<sup>55</sup> Refers to calls H2020-SESAR-2016-1 and H2020-SESAR-2016-2

<sup>56</sup> Refers to calls H2020-SESAR-2015-1 and H2020-SESAR-2015-2

<sup>57</sup> Refers to calls H2020-SESAR-2016-1 and H2020-SESAR-2016-2

REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU <sup>51</sup>	Value in 2016	Value in 2017
20	Share of EU financial contribution going to SMEs	Number of Horizon 2020 beneficiaries flagged as SME; % of EU contribution going to beneficiaries flagged as SME	N	11,3% <sup>58</sup>	7,97% <sup>59</sup>
21	Percentage of women in H2020 projects	Gender of participants in Horizon 2020 projects	N	10% <sup>60</sup>	15,4% <sup>61</sup>
22	Percentage of women project coordinators in Horizon 2020	Gender of MSC fellows, ERC principle investigators and scientific coordinators in other Horizon 2020 activities	N	13,75% <sup>62</sup>	12% <sup>63</sup>
23	Percentage of women in EC advisory groups, expert groups, evaluation panels, individual experts, etc.	Gender of memberships in advisory groups, panels, etc.	Y	25% <sup>64</sup>	33,3% <sup>65</sup>
24	Share of third-country participants in Horizon 2020	Nationality of Horizon 2020 beneficiaries	N	0	0

<sup>58</sup> Refers to calls H2020-SESAR-2015-1 and H2020-SESAR-2015-2

<sup>59</sup> Refers to calls H2020-SESAR-2016-1 and H2020-SESAR-2016-2

<sup>60</sup> Refers to calls H2020-SESAR-2015-1 and H2020-SESAR-2015-2

<sup>61</sup> Refers to calls H2020-SESAR-2016-1 and H2020-SESAR-2016-2

<sup>62</sup> Refers to call H2020-SESAR-2015-2

<sup>63</sup> Refers to calls H2020-SESAR-2016-1 and H2020-SESAR-2016-2

<sup>64</sup> Refers to call H2020-SESAR-2015-2

<sup>65</sup> Refers to calls H2020-SESAR-2016-1 and H2020-SESAR-2016-2

REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU <sup>51</sup>	Value in 2016	Value in 2017
			N		Australia: EUR 500.372 Canada: EUR 552.122 Iceland: EUR 26.700 Israel: EUR 387.786 Norway: EUR 6.095.573 Russian Federation: 0 EUR Serbia: EUR 1.427.282 Switzerland: EUR 3.311.191 Turkey: EUR 373.125 United States: EUR 1.254.290 <sup>66</sup>
25	Percentage of EU financial contribution attributed to third country participants	Nationality of Horizon 2020 beneficiaries and corresponding EU financial contribution		0	
26	Share of projects and EU financial contribution allocated to Innovation Actions (IAs)	Number of IA proposals and projects properly flagged in the WP; follow up at grant level.	Y	Number of IA projects: 5 % of IA projects out of all projects: 9% % of EU contribution for IA out of overall EU contribution: 11% <sup>67</sup>	Number of IA projects: 9 % of IA projects out of all projects: 12% IA out of overall EU contribution: 13,9% <sup>66</sup>
27	Within the innovation actions, share of EU financial contribution focussed on demonstration and first-of-a-kind activities	Topics properly flagged in the WP; follow-up at grant level	Y	100% (all IA projects are VLD activities)	100% (all IA projects are VLD activities)

<sup>66</sup> Cumulated amount of grant EU contributions signed up to end 2017. Refers to calls H2020-SESAR-2015-1, H2020-SESAR-2015-2, H2020-SESAR-2016-1 and H2020-SESAR-2016-2

<sup>67</sup> Refers to calls H2020-SESAR-2015-1 and H2020-SESAR-2015-2

REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU <sup>51</sup>	Value in 2016	Value in 2017
28	Scale of impact of projects (high-technology readiness level)	Number of projects addressing TRL between ...(4-6, 5-7)?	Y	28 projects up to TRL 2 or equivalent operational concept maturity level ('ER') 17 projects from TRL 2 to 6 or equivalent operational concept maturity level	44 projects up to TRL 2 or equivalent operational concept maturity level ('ER') 17 projects from TRL 2 to 6 or equivalent operational concept maturity level 9 projects from TRL 6 to 7 or equivalent operational concept maturity level Projects address transversal activities, i.e. non-directly TRL or operational concept-related activities
29	Percentage of H2020 beneficiaries from the private for profit sector	Number of and % of the total Horizon 2020 beneficiaries classified by type of activity and legal status	Y	357 out of 707 (50,5%) <sup>68</sup> ER: 38 out of 128 (29%) <sup>69</sup> IR-VLD: 319 out of 579 (55%) <sup>70</sup>	250 out of 383 (65%) for PRC ER: 76 out of 162 (47%) IR: 95 out of 119 (80%)

<sup>68</sup> Refers to calls H2020-SESAR-2015-1 and H2020-SESAR-2015-2

<sup>69</sup> Refers to call H2020-SESAR-2015-1

<sup>70</sup> Refers to call H2020-SESAR-2015-2

REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU <sup>51</sup>	Value in 2016	Value in 2017
30	Share of EU financial contribution going to private for profit entities (Enabling & industrial tech and Part III of Horizon 2020)	Horizon 2020 beneficiaries classified by type of activity; corresponding EU contribution	Y		EUR 139,2 million out of total 192,4 for PRC (72,4%)
31	EU financial contribution for PPP (Art 187)	EU contribution to PPP (Art 187)	Y		
32	PPPs leverage: total amount of funds leveraged through Art. 187 initiatives, including additional activities, divided by the EU contribution	<p>Total funding made by private actors involved in PPPs</p> <ul style="list-style-type: none"> <li>- in-kind contribution already committed by private members in project selected for funding</li> <li>- additional activities (i.e. research expenditures/investment of industry in the sector, compared to previous year)</li> </ul>	Y		

VLD: 79 out of 102 (77%)<sup>71</sup>

<sup>71</sup> Cumulated amount of grant EU contributions signed up to end 2017. Refers to calls H2020-SESAR-2015-1, H2020-SESAR-2015-2, H2020-SESAR-2016-1 and H2020-SESAR-2016-2



REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU <sup>51</sup>	Value in 2016	Value in 2017
33	Dissemination and outreach activities other than peer-reviewed publications.	A drop down list allows the choice of the type of dissemination activity. Number of events, funding amount and number of persons reached thanks to the dissemination activities	N		
34	Proposal evaluators by country	Nationality of proposal evaluators	Y	Serbian: 1 French: 5 UK: 2 + SESAR JU staff involved in the evaluation Belgian: 2 UK:4 French: 4 Dutch: 3 Spanish: 3 Italian: 1 Turkish:1	Turkish: 1 Austrian: 2 Cypriot: 2 Finnish: 1 French: 4 German: 4 Greek: 4 Hungarian: 1 Italian: 4 Dutch: 3 Portuguese: 2 Romanian: 3 Slovenian: 2 Spanish: 3 Swedish: 1 UK: 5 +SESAR JU staff involved in the evaluation:

REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU <sup>51</sup>	Value in 2016	Value in 2017
35	Proposal evaluators by organisations' type of activity	Type of activity of evaluators' organisations	Y	Industry: 1 University: 7 (+ 20 SESAR JU)	Higher Education: 4 Research organisation: 2 Non-research public body: 4 Non-research private body: 4 Other: 6

REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU <sup>51</sup>	Value in 2016	Value in 2017
36	Participation of RTOs and Universities in PPPs	<p>Number of participations of RTOs to funded projects and % of the total</p> <p>Number of participations of Universities to funded projects and % of the total</p> <p>% of budget allocated to RTOs and to Universities</p>	Y	<p>159 out of 707 (22,5%)<sup>72</sup></p> <p>ER: 75 out of 128 (58,6%)<sup>73</sup></p> <p>IR-VLD: 84 out of 579 (14,5%)<sup>74</sup></p>	<p>117 out of 383 (17%) for RTOs and Universities (HES and REC)</p> <p>ER: 83 out of 162 (51%)</p> <p>IR: 18 out of 119 (15%)</p> <p>VLD: 16 out of 102 (16%)<sup>75</sup></p>
37	The objective is ensuring that research projects funded are compliant with provisions on ethics efficiently	% of proposals not granted because non-compliance with ethical rules/proposals invited to grant (target 0%); time to ethics clearance (target 45 days)	Y	0%	0%
38	Error rate	% of common representative error	Y	7,29%	See section 4.3: 2,82%
39	Implementation of ex-post audit results for H2020 projects	% residual error	Y	6,21%	2,24%
		Number of cases implemented in total €million	Y	n/a	n/a

<sup>72</sup> Refers to calls H2020-SESAR-2015-1 and H2020-SESAR-2015-2

<sup>73</sup> Refers to call H2020-SESAR-2015-1

<sup>74</sup> Refers to call H2020-SESAR-2015-2

<sup>75</sup> Cumulated amount of grant EU contributions signed up to end 2017. Refers to calls H2020-SESAR-2015-1, H2020-SESAR-2016-1, H2020-SESAR-2016-2 and H2020-SESAR-2016-3

REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU <sup>51</sup>	Value in 2016	Value in 2017
		of cases implemented/total cases			

**Table 51: Indicators for monitoring cross-cutting issues**

### 7.1.3 Annex I.3: Scoreboard of KPIs specific to SESAR JU

The tables below provide an overview of KPIs specific to the SESAR JU:

REF	Name of H2020 Key Performance Indicator	Definition	Value in 2016	Value in 2017	Target by 2024
40	PPP – Leverage: In –kind contributions committed by private members in SESAR 2020 projects selected for funding	Private funding balancing public funding in all project types	<p>Total whole Programme: 2,03</p> <p>IR-VLD</p> <p>Whole programme: 2,14</p> <p>Without EUROCONTROL (MA part): 1,43</p> <p>ER whole programme 1,10</p>	<p>Total whole Programme: 3,49</p> <p>ER whole programme: 1,13</p> <p>IR:</p> <p>Whole programme: 4,34</p> <p>Without EUROCONTROL (MA part): 3,01</p> <p>VLD:</p> <p>Whole programme: 2,95</p> <p>Without EUROCONTROL (MA part): 2,70</p>	<p>Total whole programme: 2,68</p> <p>(1/3 EU funding, 2/3 non EU funding)</p>
41	Completion of SESAR 2020 programme	Actual v Planned % complete per project as of the end of the reporting period	n/a	<p>3 calls for proposals completed + 2 ongoing out of the 8 planned at the end of 2017</p> <p>1 grant completed + 1 terminated</p> <p>77 grants in execution</p> <p>4 grants in preparation</p>	100%

REF	Name of H2020 Key Performance Indicator	Definition	Value in 2016	Value in 2017	Target by 2024
42	Delivery of SESAR 2020 Solutions	Number of solutions ready for pre-industrialisation v plan	n/a	n/a (planned for Release 8)	70% <sup>76</sup>

**Table 52: KPIs specific to the SESAR JU – 2017 and comparison with 2016**

The table below provides an overview of the KPIs set in the ATM Master Plan, defining the Performance Ambitions that SESAR may enable through the full implementation of its vision within the 2035 timeframe, provided that deployment would be achieved in an optimal and timely manner. In 2017, the SESAR JU, in collaboration with its members in the context of project PJ.19, further defined the SESAR 2020 Performance Framework, in which the performance ambitions are outlined according to several Key Performance Areas (KPA), including those captured in the SES High-Level Goals and by the SES Performance Scheme. The SESAR Solutions assess the performance benefits and costs of the operational improvements through validation exercises and dedicated analysis. The results of the validation are then extrapolated at ECAC level by the SESAR Solutions to provide an overall performance assessment of the solution. All the results at a Solution level are then collected and consolidated. The table below provides the KPAs and performance ambitions set in the SESAR 2020 Performance Framework:

REF	ATM Master Plan SESAR Performance Ambition KPA	KPI	ATM Master Plan overall SESAR 2020 Performance Ambition (vs. baseline 2012)
43	Cost efficiency	PA1	30-40% reduction in ANS costs per flight
44	Operational efficiency	PA2	3-6% reduction in flight time
		PA3	5-10% reduction in fuel burn
		PA4	Arrival predictability: 2 minute time window for 70% of flights actually arriving at gate
45	Capacity	PA5	10-30% reduction in departure delays
		PA6	5-10% additional flights at congested airports
		PA7	System able to handle 80-100% more traffic

<sup>76</sup> Approximate target. The estimated number of solutions will be refined by the end of 2016 as it will be determined by proposals to the call IR-VLD Wave 1 currently open.

REF	ATM Master Plan SESAR Performance Ambition KPA	KPI	ATM Master Plan overall SESAR 2020 Performance Ambition (vs. baseline 2012)
46	Environment	PA8	5-10% reduction in CO2 emissions
47	Safety	PA9	Safety improvement by a factor 3-4
48	Security	PA10	No increase in ATM related security incidents resulting in traffic disruptions

**Table 53: SESAR 2020 Performance Framework**

A first consolidation exercise was conducted in late 2017. The table below provides the results of that initial assessment:

KPA	Overall SESAR 2020 Ambition	SESAR2020 VT starting point	Units	SESAR 2020 Initial Performance results (VT starting point are the objectives)
<b>SAFETY</b>	factor 3-4	not yet defined	not yet defined	Not yet available due to project's lack of maturity
<b>Airport Capacity (CAP3)</b>	10%	7%	% increase peak hour throughput	up to 17%
<b>TMA Capacity (CAP1)</b>	47%	26%	% increase in peak hour throughput	20%-59%
<b>En-Route Capacity (CAP2)</b>	49%	16%	% increase in peak hour throughput	21%-49%
<b>Punctuality (PUN1)</b>	7%	7%	Increase in proportion of flights departing within +/- 3 minutes of SOBT	4.8%-8.9%
<b>Predictability (PRD1)</b>	96%	62%	Reduction in variance of block-to-block flight time	36%-64%

KPA	Overall SESAR 2020 Ambition	SESAR2020 VT starting point	Units	SESAR 2020 Initial Performance results (VT starting point are the objectives)
Environment/Fuel Efficiency (FEFF1)	500	340	saving kg/flight	7kg-27kg
ATCO Productivity (CEF2)	52%	40%	% increase in ATCO productivity	Not available due to insufficient inputs
Technology Cost (CEF3)	22%	16%	% reduction in technology cost per flight	Not available due to insufficient inputs

**Table 54: Performance ambitions, Validation target starting point and SESAR 2020 Initial Performance assessment results**

### 7.1.4 Annex I.4: Procurement activity in 2017

In order to manage the timely implementation of its procurement activities supporting the implementation of the SESAR JU objectives for 2017, SESAR JU used a contract action planning where all the procurement/contract activities are recorded over 2017. This file is updated on a weekly basis in concertation with OIA. This planning is a repository of all the procurement activities planned in the SPD as well as unforeseen activities at the time of the SPD adoption upon validation of the Corporate Management team and details the timeline for implementation of these activities on the basis of SESAR JU needs and applicable rules. In particular, the SESAR JU launched and finalised the following procurement activities in 2017.

SAoO	Type of Procedure	Title	Total Budget (Est.)	Type of Contract	Signed
2 - Industrial Research & Validation	Amendment	SDSS	0 €	Direct service contract	22/12/2018
2 - Industrial Research & Validation	Specific Contract	Programme Management Support	363.440 €	Framework Contract	18/12/2017
4 - Transversal Steering & SESAR Outreach	Amendment	Digital Communications	0 €	Framework Contract	
4 - Transversal Steering & SESAR Outreach	Amendment	Web support	220.000 €	Direct service	25/04/2017
4 - Transversal Steering & SESAR Outreach	Call for Expression of interest	Scientific Committee	50.000 €	Expert Contract	04/02/2017
4 - Transversal Steering & SESAR Outreach	Joint procurement	Fourniture et placements de visuels signalétique et de matériel d'exposition	22.000 €	EC Framework Contract	12/12/2017
4 - Transversal Steering & SESAR Outreach	Joint procurement	Joint event in Strasbourg EP	59.190 €	Service contract	27/07/2017
4 - Transversal Steering & SESAR Outreach	Joint procurement	Joint event in Strasbourg EP	444 €	Service contract	16/10/2017

SAOO	Type of Procedure	Title	Total Budget (Est.)	Type of Contract	Signed
4 - Transversal Steering & SESAR Outreach	Negotiated Procedure	Professional Staff Association	1.000.000 €	Framework Contract	On-going procedure
4 - Transversal Steering & SESAR Outreach	Open call for tenders	3PRM - Airspace Users, Lot 1	0 €	Framework Contract	23/08/2017
4 - Transversal Steering & SESAR Outreach	Open call for tenders	3PRM - Airspace Users, Lot 2	0 €	Framework Contract	08/03/2017
4 - Transversal Steering & SESAR Outreach	Open call for tenders	3PRM - Airspace Users, Lot 3	0 €	Framework Contract	17/03/2017
4 - Transversal Steering & SESAR Outreach	Open call for tenders	3PRM - Airspace Users, Lot 4	0 €	Framework Contract	30/05/2017
4 - Transversal Steering & SESAR Outreach	Open Procedure	Web services	520.000 €	Framework Contract	On-going procedure
4 - Transversal Steering & SESAR Outreach	SC	Events	20.000 €	Framework Contract	26/09/2017
4 - Transversal Steering & SESAR Outreach	Specific contract	3PRM - Airspace Users, Lot 1	666.922 €	Framework Contract	03/10/2017
4 - Transversal Steering & SESAR Outreach	Specific Contract	Airport Expertise (ACI) 2016-1019	200.000 €	Framework Contract	19/04/2017
4 - Transversal Steering & SESAR Outreach	Specific Contract	Airport Expertise (ACI) 2016-1019	199.503 €	Framework Contract	21/12/2017
4 - Transversal Steering & SESAR Outreach	Specific Contract	Communications support for Digital Communication	63.352 €	Framework Contract	12/06/2017

SAoO	Type of Procedure	Title	Total Budget (Est.)	Type of Contract	Signed
4 - Transversal Steering & SESAR Outreach	Specific Contract	Communications support for Digital Communication	78.000 €	Framework Contract	19/01/2017
4 - Transversal Steering & SESAR Outreach	Specific Contract	Communications support for Digital Communication	28.178 €	Framework Contract	07/04/2017
4 - Transversal Steering & SESAR Outreach	Specific Contract	Communications support for Digital Communication	81.813 €	Framework Contract	13/06/2017
4 - Transversal Steering & SESAR Outreach	Specific Contract	Communications support for Digital Communication	76.852 €	Framework Contract	30/11/2017
4 - Transversal Steering & SESAR Outreach	Specific Contract	Communications support for Strategic communication	63.635 €	Framework Contract	08/06/2017
4 - Transversal Steering & SESAR Outreach	Specific Contract	Communications support for Strategic communication	21.552 €	Framework Contract	18/12/2017
4 - Transversal Steering & SESAR Outreach	Specific Contract	Digital Communications	99.793 €	Framework Contract	17/11/2017
4 - Transversal Steering & SESAR Outreach	Specific Contract	Strategic advice (BCG)	729.850 €	Framework Contract	18/07/2017
4 - Transversal Steering & SESAR Outreach	Specific Contracts	3PRM - Airspace Users, Lot 2	302.480 €	Framework Contract	20/07/2017
4 - Transversal Steering & SESAR Outreach	Specific Contracts	3PRM - Airspace Users, Lot 4	227.000 €	Framework Contract	31/07/2017
5 - Financial, Administrative and Corporate management	Amendment	Audit – PKF	0 €	Amendment	21/12/2017

SAoO	Type of Procedure	Title	Total Budget (Est.)	Type of Contract	Signed
5 - Financial, Administrative and Corporate management	Amendment	Cleaning services	4.000 €	Amendment	26/12/2017
5 - Financial, Administrative and Corporate management	Amendment	Extension Testa NG SC 60	4.813 €	EC Framework Contract	27/06/2017
5 - Financial, Administrative and Corporate management	Amendment	External audit	0 €	Framework Contract	23/03/2017
5 - Financial, Administrative and Corporate management	Amendment	Mobile telephony (MTS III)	0 €	EC Framework Contract	31/10/2017
5 - Financial, Administrative and Corporate management	Amendment	Reception Services	0 €	Service contract	31/07/2017
5 - Financial, Administrative and Corporate management	Amendment	Security Services and Maintenance of Security Systems (amendment 3)	20.000 €	Direct service	18/05/2017
5 - Financial, Administrative and Corporate management	Amendment	Travel Agency	0 €	Direct service contract	25/01/2017
5 - Financial, Administrative and Corporate management	Open call	Security Services and Maintenance of Security Systems - Lot 1	120.000 €	Direct service	13/09/2017
5 - Financial, Administrative and Corporate management	Open call	Security Services and Maintenance of Security Systems - Lot 2	153.000 €	Direct service	06/09/2017
5 - Financial, Administrative and Corporate management	Order Form	Renewal of Microsoft licenses maintenance	8.245 €	EC Framework	15/05/2017
5 - Financial, Administrative and Corporate management	Specific Contract	Adobe licences	5.591 €	EC Framework Contract	06/11/2017



SAoO	Type of Procedure	Title	Total Budget (Est.)	Type of Contract	Signed
5 - Financial, Administrative and Corporate management	Specific Contract	Assurance Responsibility civil	0 €	EC Framework Contract	20/12/2017
5 - Financial, Administrative and Corporate management	Specific Contract	Audit	28.128 €	EC Framework Contract	23/01/2018
5 - Financial, Administrative and Corporate management	Specific contract	ICT Support	41.917 €	EC Framework Contract	29/06/2017
5 - Financial, Administrative and Corporate management	Specific contract	Maintenance of the Pilot DMS, Intranet and QMS	21.230 €	EC Framework Contract	12/06/2017
5 - Financial, Administrative and Corporate management	Specific contract	Maintenance of the Pilot DMS, Intranet and QMS	131.866 €	EC Framework Contract	30/08/2017
5 - Financial, Administrative and Corporate management	Specific contract	Mobile telephony (MTS III)	35.000 €	EC Framework Contract	06/07/2017
5 - Financial, Administrative and Corporate management	Specific Contract	MTS II	4.200 €	EC Framework Contract	06/02/2017
5 - Financial, Administrative and Corporate management	Specific Contract	Programme Management Support	403.270 €	Framework Contract	27/06/2017
5 - Financial, Administrative and Corporate management	Specific Contract	Project Audit	207.216 €	Framework Contract	09/06/2017
5 - Financial, Administrative and Corporate management	Specific Contract	Project Audit	104.504 €	Framework Contract	27/06/2017
5 - Financial, Administrative and Corporate management	Specific Contract	Project Audit	277.614 €	Framework Contract	30/06/2017

SAoO	Type of Procedure	Title	Total Budget (Est.)	Type of Contract	Signed
5 - Financial, Administrative and Corporate management	Specific Contract	TESTA-NG	5.831 €	EC Framework Contract	07/02/2017
5 - Financial, Administrative and Corporate management	Specific Contract	Testa-NG II	171.190 €	EC Framework Contract	15/12/2017
5 - Financial, Administrative and Corporate management	Specific contract	Voice II	42.000 €	EC Framework Contract	07/08/2017
5 - Financial, Administrative and Corporate management	Very low value negotiated procedure	Management team seminar	2.439 €	Purchase Order	18/01/2017

Table 55: Main procurement activities launched and completed in 2017

## 7.2 Annex II. Statistics on financial management

Statistics on financial management are provided in part II section 2.3.

### 7.3 Annex III. Organisation chart

At 31<sup>st</sup> December 2017, the organisation chart was as follows:

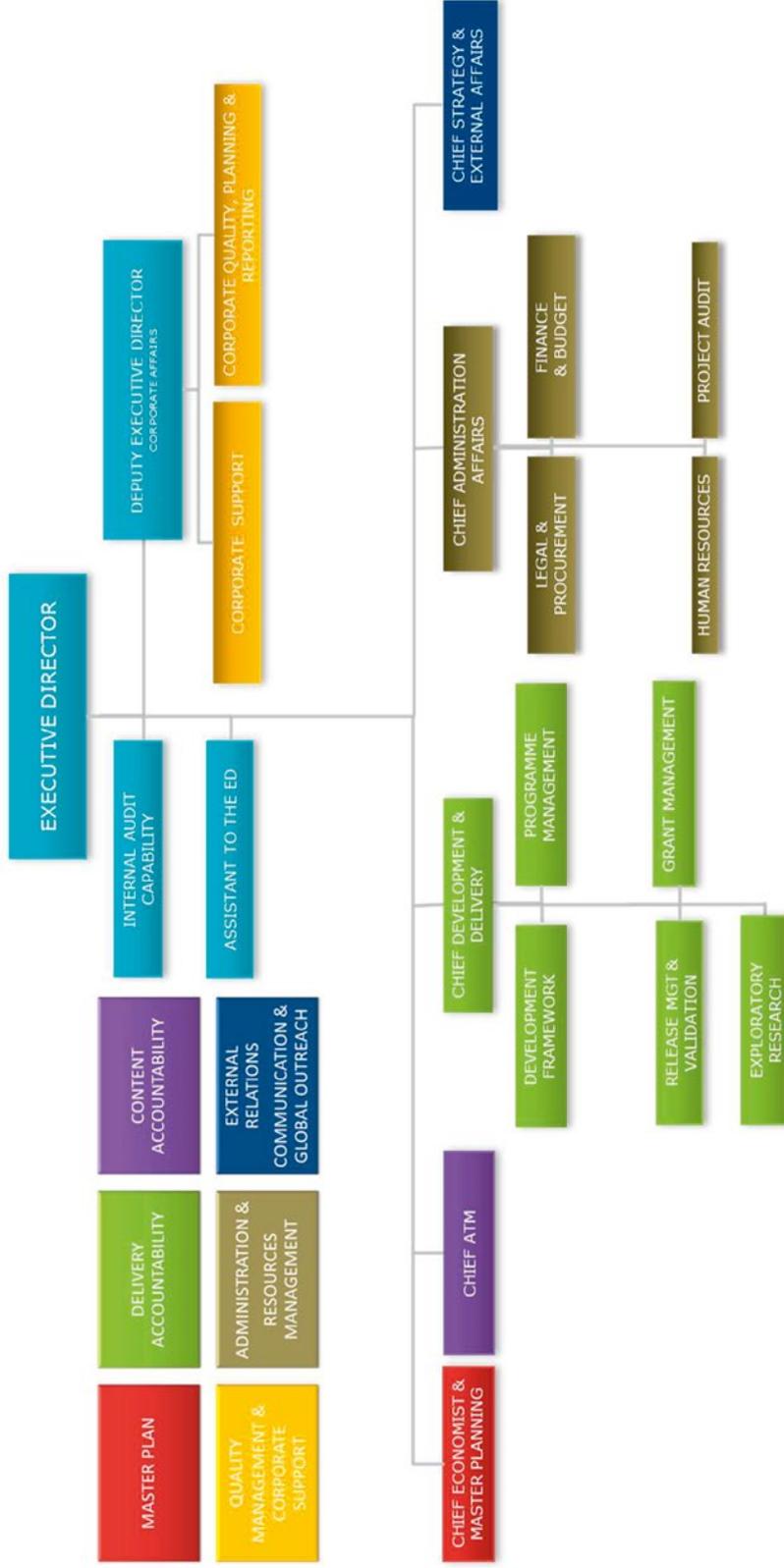


Figure 16: Organisation chart of the SESAR JU as at 31/12/2017

## 7.4 Annex IV. Establishment plan

Table of 39 positions per area and activity on 31/12/2017:

Activity	Function / Job title
Executive Director	Executive Director
TBD	TBD
Audit	Internal Audit Capability
Executive secretariat	Assistant to the Executive Director
Corporate Affairs including corporate support and corporate quality, planning and reporting	Deputy Executive Director Corporate Affairs
	Head of Corporate Support
	Administrative Assistant – Facility Coordinator
	Head of Corporate Quality, Planning & Reporting
Strategies and relations with ICAO, follow up of MoC with third countries and communication	Chief Strategies & External Relations
	Head of International Affairs
Relations with different stakeholders and coordination of ED activities	Head of Stakeholders and Institutional Relations
Communication internal/external, media	Senior Communications & Media Relations Officer
Implementation of the day-to-day communication strategy	Communications & Events Officer
Development & delivery, Release and validation	Head of Release Management & Validation
Development & delivery, grant management and development framework	Call Coordinator
	Grant Manager
	Grant Manager
	Grant Manager
	Administrative Assistant – Expert Coordinator
ATM	ATM Architecture Framework Expert
	Chief ATM
	ATM Expert – Architecture & Systems Engineering

	ATM Expert - Airport & Airspace User Operations
	ATM Expert - TMA, En-route & Network Operations
	ATM Expert - CNS & Avionics
AU relations, business case, Master Planning	Chief Economist & Master Planning
Digital transformation and innovation	Manager Digital Transformation & Innovation
General administration, Finance, legal and HR	Chief Administration Affairs
Project Audit	Project Auditor
Finance and Budget Coordination and responsibility for the follow up of the SESAR JU Budget	Head of Finance & Budget
Accounting	Deputy Accounting Officer
Financial administration and budget	Financial Officer
	Financial and Budget Officer
Legal Affairs and Contract	Head of Legal Affairs and Procurement
Procurement procedures, personal data protection, day-to-day legal issues	Legal & Procurement Officer, Data Protection Officer
	Legal & Procurement Officer
	Legal & Procurement Officer
HR Legal matters	HR Legal Officer
Recruitment, HR Administration, staff development	HR Officer

**Table 56: list of the 39 SESAR JU positions (31/12/2017)**

(\*) Staff member eligible to Transitional Provisions Article 2 of Council Regulation (EC) 1361/2008 (8 staff)

(\*\*) Positions currently covered by a CA indefinite duration contract. These staff members are not additional to the 39 posts included in the Staff Establishment Plan approved by the Administrative Board of the SESAR JU, but they are contractual forms used by the SESAR JU to fill in specific positions taking into consideration the needs and expertise requested. The same is applicable for the staff seconded by the members to the SESAR JU, in accordance with Article 8 of the SESAR JU Statutes.

The 2 additional temporary positions approved for 2016 and 2017 are the following:

Activity/Sector	Function / Job title
Financial administration	Financial Officer
Legal Affairs and Contract	Legal Officer

**Table 57: The 2 additional positions requested for 2016 and 2017**

## 7.5 Annex V. Human and financial resources by activity

Human and financial resources allocation by activity is provided in part II section 2.3.4 and 2.4.

## 7.6 Annex VI. Specific annexes related to part II

### 7.6.1 Exception Register

Under Article 32(3) of the EU's Financial Regulation and Article 29 of the SESAR JU's Financial Regulation, the Joint Undertaking is required to implement its budget in compliance with effective and efficient internal control. In practice this means that there must be procedures for monitoring of performance and for follow-up of internal control weaknesses and exceptions.

In particular, Internal Control Standard no 8 "Processes and Procedures" - as defined under ED decision SESAR JU/ED/612 - requires the SESAR JU to establish arrangements to track and give prior approval to control overrides or deviations from policies and procedures.

For this purpose, the SESAR JU registered and managed exceptions since 2009. Early 2018, the SESAR JU will document an updated procedure describing the internal SESAR JU process for the management of the SESAR JU Exception Register and establishing templates for its implementation.

No exception was registered by the SESAR JU in 2017 in the Exception Register.

## 7.7 Annex VII. Specific annexes related to part III

### 7.7.1 Internal Control Assessment report at 31/12/2017 – Assessment against Internal Control Standards

Building blocks	#	Title	Description	Y-1 SJU's compliance with the ICS	Comments / Actions plan
Mission and Values	ICS 1	Mission	The Agency's raison d'être is clearly defined in up-to-date and concise mission statements developed from the perspective of the Agency's customers.	3	The SJU has up-to-date mission statements and management established an internal organisation note to increase the understanding of the organisational values, missions and responsibilities
	ICS 2	Ethical and Organisational Values	Management and staff are aware of and share appropriate ethical and organisational values and uphold these through their own behaviour and decision-making.	3	
	ICS 3	Staff Allocation and Mobility	The allocation and recruitment of staff is based on the Agency's objectives and priorities. Management promote and plan staff mobility so as to strike the right balance between continuity and renewal.	3	
	ICS 4	Staff Evaluation and Development	Staff performance is evaluated against individual annual objectives, which fit with the Agency's overall objectives. Adequate measures are taken to develop the skills necessary to achieve the objectives.	3	
Human Resources	ICS 5	Objectives and Performance Indicators	The Agency's objectives are clearly defined and updated when necessary. These are formulated in a way that makes it possible to monitor their achievement. Key performance indicators are established to help management evaluate and report on progress made in relation to their objectives.	3	The staff average seniority in the SJU is difficult to compare with other institutions average seniority due to roles of very specific nature linked to a specialized domain of ATM.
	ICS 6	Risk Management Process	A risk management process that is in line with applicable provisions and guidelines is integrated into the annual activity planning.	3	
	ICS 7	Operational Structure:	The Agency's operational structure supports effective decision-making by suitable delegation of powers. Risks associated with the Agency's sensitive functions are managed through mitigating controls and ultimately staff mobility. Adequate IT governance structures are in place.	3	
Operations and Control Activities	ICS 8	Processes and Procedures	The Agency's processes and procedures used for the implementation and control of its activities are effective and efficient, adequately documented and compliant with applicable provisions. They include arrangements to ensure segregation of duties and to track and give prior approval to control overrides or deviations from policies and procedures.	3	The SJU does not have an IT masterplan; the IS Development is outsourced and the SJU makes use of EC/H2020 IT tools as far as available. An information and document management system has been put in place in 2017.
	ICS 9	Management Supervision	Management supervision is performed to ensure that the implementation of activities is running efficiently and effectively while complying with applicable provisions.	3	The supervision of operational performance is based on the SPD objectives, including the reference to useful performance indicators.
	ICS 10	Business Continuity	Adequate measures are in place to ensure continuity of service in case of "business-as-usual" interruption. Business Continuity Plans are in place to ensure that the Commission is able to continue operating to the extent possible whatever the nature of a major disruption.	2	Due to the size of the organisation, its objectives, its priorities, the SJU staff currently does not attend training related to BCP and the BCP is not reviewed yearly.
	ICS 11	Document Management	Appropriate processes and procedures are in place to ensure that the Agency's document management is secure, efficient (in particular as regards retrieving appropriate information) and complies with applicable legislation.	3	An Information & Document Management System (IDMS) has been delivered in October 2017. Although a filing system, as described in the ICS Requirement R23 is not in place in the SJU, documents containing confidential and personal information are only available to relevant staff and data protection policy is in place.

Information and Financial Reporting	ICS 12	Information and Communication	Internal communication enables management and staff to fulfil their responsibilities effectively and efficiently, including in the domain of internal control. Where appropriate, the Agency has an external communication strategy to ensure that its external communication is effective, coherent and in line with the Commission's key political messages. IT systems used and/or managed by the Agency (where the Agency is the system owner) are adequately protected against threats to their confidentiality and integrity.	3	The SJU has a data management system, which has been further improved with the IDMS project.
	ICS 13	Accounting and Financial Reporting	Adequate procedures and controls are in place to ensure that accounting data and related information used for preparing the organisation's annual accounts and financial reports are accurate, complete and timely.	3	
Evaluation and Audit	ICS 14	Evaluation of Activities	Evaluations of expenditure programmes, legislation and other nonspending activities are performed to assess the results, impacts and needs that these activities aim to achieve and satisfy.	3	
	ICS 15	Assessment of Internal Control Systems	Management assesses the effectiveness of the Agency's key internal control systems, including the processes carried out by implementing bodies, at least once a year.	3	The SJU does not have an ICC but the position lies with the QPR team.
	ICS 16	Internal Audit Capability	The Agency has an Internal Audit Capability (IAC), which provides independent, objective assurance and consulting services designed to add value and improve the operations of the Agency.	3	

## 7.7.2 Internal Control Assessment report at 31/12/2017 – Assessment against Internal Control Framework

Components	#	Principle	Description	Characteristics	Y - 4 SU's compliance	Principle avg	Component avg	Comments / Actions plan	
I. Control environment	1	Demonstrates commitment to integrity and ethical values	The Commission demonstrates a commitment to integrity and ethical values	<p><b>Tone at the top.</b> The Administrative Board and all management levels respect integrity and ethical values in their instructions, actions and behaviour.</p> <p><b>Standards of conduct.</b> The SU's expectations on integrity and ethical values are set out in standards of conduct and understood at all levels of the organisation, as well as by entrusted bodies, outsourced service providers and beneficiaries.</p> <p><b>Alignment with standards.</b> Processes are in place to assess whether individuals and departments are aligned with the SU's expected standards of conduct and to address deviations in a timely manner.</p> <p><b>The Administrative Board oversees the SU's governance, risk management and internal control systems and ensures their effectiveness.</b> This happens through the use of appropriate working arrangements and communication channels between SIU Areas.</p> <p><b>Executive Director oversees the internal control systems within their Directorate-General.</b> Executive Director oversees the development and performance of internal control. They are supported in this task by the Chief(s) in charge of risk management and internal control.</p> <p>The College of Commissioners demonstrates independence from management and exercises oversight of the development and performance of internal control</p>	3	3			
	2	Exercises oversight responsibility	The College of Commissioners demonstrates independence from management and exercises oversight of the development and performance of internal control	<p><b>General.</b> Executive Director oversees the development and performance of internal control. They are supported in this task by the Chief(s) in charge of risk management and internal control.</p> <p>In their capacity as <b>Authorising Officer</b>, Executive Director provides a Declaration of Assurance on the appropriate allocation of resources and their use for their intended purpose and in accordance with the principles of sound financial management, as well as on the adequacy of the control procedures in place (see Appendix 2).</p> <p><b>The Chief(s) in charge of risk management and internal control play a key role by coordinating the preparation of the SU's Annual Activity Report.</b> In this context, they sign a declaration taking responsibility for the completeness and reliability of management reporting (see Appendix 3). This declaration covers both the state of internal control in the SU and the robustness of reporting on operational performance. However, responsibility for achieving operational objectives remains with the relevant Directorate and unit.</p>	3	3		This Declaration is part of the CAAR (Part V.)	
	3	Establishes structure, authority and responsibility	Management establishes, with oversight, appropriate reporting lines, and authorities and responsibilities in the pursuit of objectives	<p><b>Management structures are comprehensive.</b> The design and implementation of management and supervision structures cover all policies, programmes and activities. In particular for spending programmes, they cover all management modes, expenditure types, delivery mechanisms and entities in charge of budget implementation (i.e. both direct and indirect beneficiaries) to support the achievement of policy, operational and control objectives.</p> <p><b>Authorities and responsibilities.</b> The SU and the Executive Director, as appropriate, delegate authority and use appropriate processes and technology to assign responsibility and segregate duties as necessary at the various levels of the SU.</p> <p><b>Reporting lines.</b> The Executive Director designs and evaluates reporting lines within departments and with entrusted entities to enable the execution of an authority, fulfilment of responsibilities, and flow of information.</p>	3	3			
	4	Demonstrates commitment to competence	The Commission demonstrates a commitment to attract, develop, and retain competent individuals in alignment with objectives	<p><b>Competence framework.</b> The Chief(s) defines the competences necessary to support the fulfilment of responsibilities, and flow of information.</p> <p><b>Professional development.</b> SIU Areas provide the training and coaching needed to attract, develop, and retain a sufficient number of competent staff.</p> <p><b>Mobility.</b> SIU Areas promote and plan staff mobility so as to strike the right balance between continuity and renewal.</p> <p><b>Succession planning and deputing arrangements</b> for operational activities and financial transactions are in place to ensure continuity of operations.</p>	3	3			
	5	Enforces accountability	The Commission holds individuals accountable for their responsibilities in the pursuit of objectives	<p><b>Enforcing accountability.</b> The SU defines clear roles and responsibilities and holds individuals and entrusted entities accountable for the performance of internal control activities across the organisation and for the implementation of corrective action as necessary.</p> <p><b>Staff appraisal.</b> Staff efficiency, abilities and conduct in the service are assessed annually against expected standards of conduct and set objectives. Cases of underperformance are appropriately addressed.</p> <p><b>Staff promotion.</b> Promotion is decided after consideration of the comparative merits of eligible staff taking into account, in particular, their appraisal reports.</p>	3	3			
						3	3		
						3	3		
						3	3		
						3	3		
						3	3		



III. Control activities	10	Selects and develops control activities	The Commission selects and develops control activities that contribute to the mitigation of risks to the achievement of objectives to acceptable levels	Control activities are performed to mitigate the identified risks and are cost-effective. They are tailored to the specific activities and risks of the SIU and their intensity is proportional to the underlying risks.	2	Control activities must be defined in the context of the new Internal Control Framework
				Control activities are integrated in a control strategy. The control strategy includes a variety of checks, including supervision arrangements, and where appropriate, should include a balance of approaches to mitigate risks, considering manual and automated controls, and preventive and detective controls.	2	
				Segregation of duties. When putting in place control measures, management considers whether duties are correctly divided between staff members to reduce risks of error and inappropriate or fraudulent actions.	3	
	11	Selects and develops general control over technology	The Commission selects and develops general control activities over technology to support the achievement of objectives	Business continuity plans based on a business impact analysis following corporate guidance are in place, up-to-date and used by trained staff to ensure that the Commission is able to continue working to the extent possible in case of a major disruption. Where necessary, business continuity plans must include coordinated and agreed disaster recovery plans for time-sensitive supporting infrastructure (e.g. IT systems).	3	2.8
				Control over technology. In order to ensure that technology used in business processes, including automated controls, is reliable, and taking into account the overall corporate processes, the SIU selects and develops control activities over the acquisition, development and maintenance of technology and related infrastructure.	3	
				Security of IT systems. The SIU applies appropriate controls to ensure the security of the IT systems of which they are the system owners. They do so in accordance with the IT security governance principles, in particular as regards data protection, professional secrecy, availability, confidentiality and integrity.	3	
	12	Deploys through policies and procedures	The Commission deploys control activities through corporate policies that establish what is expected and in procedures that put policies into action	Appropriate control procedures ensure that objectives are achieved. The control procedures assign responsibility for control activities to the department or individual responsible for the risk in question. The staff member(s) put in charge perform the control activities in a timely manner and with due diligence, taking corrective action where needed. Management periodically reassesses the control procedures to ensure that they remain relevant.	3	3
				Exception reporting is one of the management tools used to draw conclusions about the effectiveness of internal control and/or the changes needed in the internal control system. A system is in place to ensure that all instances of overriding controls or deviations from established processes and procedures are documented in exception reports. All instances must be justified and approved before action is taken, and logged centrally.	3	
				The impact assessment and evaluation of expenditure programmes, legislation and other non-spending activities are performed in accordance with the guiding principles of the Commission's better regulation guidelines, to assess the performance of EU interventions and analyse options and related impacts on new initiatives.	3	

IV. Information and communication	13	Uses relevant information	The Commission obtains or generates and uses relevant quality information to support the functioning of internal control	Information and document management. SIU identifies the information required to support the functioning of the internal control system and the achievement of its objectives. Information systems process relevant data, captured from both internal and external sources, to obtain the required and expected quality information. In compliance with applicable security, document management and data protection rules, this information is produced in a timely manner, and is reliable, current, accurate, complete, accessible, protected, verifiable, filed and preserved. It is shared within the organisation in line with prevailing guidelines.	3	3	
	14	Communicates internally	The Commission internally communicates information, including objectives and responsibilities for internal control, necessary to support the functioning of internal control	Internal communication. The SIU communicates internally about their objectives, challenges, actions taken and results achieved, including but not limited to the objectives and responsibilities of internal control.	3	3	
	15	Communicates externally	The Commission communicates with external parties about matters affecting the functioning of internal control	Separate communication lines, such as whistleblowing hotlines, are in place at the SIU level to ensure information flow when normal channels are ineffective.  External communication. SIU ensure that their external communication is consistent, relevant to the audience being targeted, and cost-effective. The SIU establishes clear responsibilities to align SIU Areas communication activities with the SIU's political priorities and narrative of the institution.  Communication on internal control. The SIU communicates with external parties on the functioning of the components of internal control. Relevant and timely information is communicated externally, taking into account the timing, audience, and nature of the communication, as well as legal, regulatory, and fiduciary requirements.	3	3	

<p><b>V. Monitoring activities</b></p>	<p>16</p>	<p>Conducts ongoing and/or separate assessments</p>	<p>The Commission selects, develops, and performs ongoing and/or separate assessments to ascertain whether the components of internal control are present and functioning</p>	<p><b>Continuous and specific assessments.</b> The SIU continuously monitors the performance of the internal control system with tools that make it possible to identify internal control deficiencies, register and assess the results of controls, and control deviations and exceptions. In addition, when necessary, the Directorate General carries out specific assessments, taking into account changes in the control environment. Ongoing assessments are built into business processes and adjusted to changing conditions. Both kinds of assessment must be based on the general principles set out in Appendix 1.</p> <p><b>Sufficient knowledge and information.</b> Staff performing ongoing or separate assessments has sufficient knowledge and information to do this, specifically on the scope and completeness of the results of controls, control deviations and exceptions.</p> <p><b>Risk-based and periodical assessments.</b> The SIU varies the scope and frequency of specific assessments depending on the identified risks. Specific assessments are performed periodically to provide objective feedback.</p>	<p>2</p>	<p>2</p>	<p>Control activities must be assessed in the context of the new Internal Control Framework</p>
<p>17</p>	<p>Assesses and communicates deficiencies</p>	<p>The Commission assesses and communicates internal control deficiencies in a timely manner to those parties responsible for taking corrective action, including senior management and the College of Commissioners, as appropriate</p>	<p><b>Deficiencies.</b> With the support of the Chief(s) in charge of risk management and internal control, the SIU considers the results of the assessments of how the internal control system is functioning within the SIU. Deficiencies are communicated to management and to the departments responsible for taking corrective action. They are reported in the Annual Activity Reports and to the responsible Administrative Board, as appropriate. The term 'internal control deficiency' means a shortcoming in a component or components and relevant principle(s) that reduces the likelihood of a SIU achieving its objectives. There is a major deficiency in the internal control system if management determines that a component and one or more relevant principles are not present or functioning or that components are not working together. When a major deficiency exists, the SIU cannot conclude that it has met the requirements of an effective system of internal control. To classify the severity of internal control deficiencies, management has to use judgment based on relevant criteria contained in regulations, rules or external standards.</p> <p><b>Remedial action.</b> Corrective action is taken in a timely manner by the staff member(s) in charge of the processes concerned, under the supervision of their management. With the support of the Chief(s) in charge of risk management and internal control, the Executive Director monitors and takes responsibility for the timely implementation of corrective action.</p>	<p>3</p>	<p>2.25</p>	<p>Control activities must be assessed in the context of the new Internal Control Framework</p>	

## 7.8 Annex VIII. Final Financial Accounts

The Final Financial Accounts for 2017 are provided in a separate document, subject to the review by the European Court of Auditors (ECA) and subject to adoption in a separate procedure.

Pending on this adoption, the main information in relation with the Final Financial Annual Accounts for 2017 is the following:

### Balance sheet:

	Note	31.12.2017	EUR '000 31.12.2016 (restated)
<b>NON-CURRENT ASSETS</b>			
<i>Intangible assets</i>	2.1	4	36
<i>Property, plant and equipment</i>	2.2	187	63
<i>Pre-financing</i>	2.3	71 330	40 840
		<b>71 522</b>	<b>40 939</b>
<b>CURRENT ASSETS</b>			
<i>Pre-financing</i>	2.3	10 937	35 971
<i>Exchange receivables and non-exchange recoverables</i>	2.4	61 336	54 250
<i>Cash and cash equivalents</i>	2.5	7	17
		<b>72 280</b>	<b>90 237</b>
<b>TOTAL ASSETS</b>		<b>143 802</b>	<b>131 176</b>
<b>CURRENT LIABILITIES</b>			
<i>Payables and other liabilities</i>	2.6	(101 458)	(224 339)
<i>Accrued charges</i>	2.7	(75 947)	(18 375)
		<b>(177 404)</b>	<b>(242 714)</b>
<b>TOTAL LIABILITIES</b>		<b>(177 404)</b>	<b>(242 714)</b>
<b>NET ASSETS</b>		<b>(33 603)</b>	<b>(111 538)</b>
<b>NET ASSETS</b>			
<i>Contribution from Members</i>	2.8	1 873 397	1 631 792
<i>Accumulated deficit</i>		(1 743 330)	(1 518 085)
<i>Economic result of the year</i>		(163 670)	(225 245)
<b>NET ASSETS</b>		<b>(33 603)</b>	<b>(111 538)</b>

### Statement of financial performance:

	Note	2017	EUR '000 2016 (restated)
<b>REVENUE</b>			
<b>Revenue from non-exchange transactions</b>			
<i>Recovery of expenses</i>	3.1	–	299
		<b>–</b>	<b>299</b>

**Revenue from exchange transactions**

<i>Financial revenue</i>		0	1
<i>Other exchange revenue</i>	3.2	43	56
		<b>43</b>	<b>57</b>
<b>Total revenue</b>		<b>43</b>	<b>356</b>
<b>EXPENSES</b>			
<i>Operating costs</i>	3.3	(156 065)	(216 411)
<i>Staff costs</i>	3.4	(4 022)	(4 576)
<i>Finance costs</i>		(5)	(5)
<i>Other expenses</i>	3.5	(3 620)	(4 609)
<b>Total expenses</b>		<b>(163 713)</b>	<b>(225 601)</b>
<b>ECONOMIC RESULT OF THE YEAR</b>		<b>(163 670)</b>	<b>(225 245)</b>

## Cash flow statement:

	Note	2017	EUR '000 2016 (restated)
<i>Economic result of the year</i>		(163 670)	(225 245)
<b>Operating activities</b>			
<i>Depreciation and amortization</i>		85	250
<i>(Increase)/decrease in pre-financing</i>		(5 457)	(14 927)
<i>(Increase)/decrease in exchange receivables and non-exchange recoverables</i>		(7 087)	(53 827)
<i>Increase/(decrease) in payables</i>		(122 881)	(90 163)
<i>Increase/(decrease) in accrued charges</i>		57 572	6 792
<i>Increase/(decrease) in cash contributions</i>		132 099	145 172
<i>Increase/(decrease) in in-kind contributions</i>		109 505	221 846
<i>Other non-cash movements</i>		(40)	-
<b>Investing activities</b>			
<i>(Increase)/decrease in intangible assets and property, plant and equipment</i>		(138)	(10)
<b>NET CASHFLOW</b>			
		<b>(10)</b>	<b>(10 112)</b>
<i>Net increase/(decrease) in cash and cash equivalents</i>		(10)	(10 112)
<i>Cash and cash equivalents at the beginning of the year</i>	2.5	17	10 129
<i>Cash and cash equivalents at year-end</i>	2.5	7	17

## Result of the implementation of the budget:

	Title	2017	EUR '000 2016
<b>Revenue</b>		<b>162 523</b>	<b>132 813</b>
<i>of which:</i>			
<i>Contribution from the European Union</i>	1	113 147	131 519
<i>Contribution from EUROCONTROL</i>	2	32 605	-

<i>Contribution from other Members</i>	3	0	-
<i>Other Revenue</i>	4	16 770	1 294
<b>Expenditure</b>		<b>(144 785)</b>	<b>(102 973)</b>
<i>of which:</i>			
<i>Staff expenditure</i>	A-1	(5 048)	(5 019)
<i>Admin expenditure</i>	A-2	(3 321)	(2 712)
<i>Operational expenditure</i>	B0-3	(136 416)	(95 243)
<b>Exchange rate differences</b>		<b>0</b>	<b>(1)</b>
<b>Budget result of the year</b>		<b>17 738</b>	<b>29 839</b>

## 7.9 Annex IX. Other annexes

### 7.9.1 IX.1 List of acronyms and definitions

Acronym	Long Name / Definition
4 D	4 Dimensions
ABAC	Accrual Based Accounting
ACAS	Airborne Collision Avoidance System
A-CCD	Advanced Continuous Climb Departure
A-CDA	Advanced Continuous Descent Approach
ADS-B	Automatic Dependence Surveillance-Broadcast
ADS-C	Automatic Dependence Surveillance-Contract
ADEXP	ATS Data Exchange Presentation
AeroMacs	Aeronautical Mobile Airport Communications System
AFUA/ASM	Advanced Flexible Use Airspace/Airspace Management
AIM	Aeronautical Information Management
AMAN	Arrival Manager
AOC	Airlines Operational Communication
AOP	Airport Operation Plan
ASAS	Airborne Separation Assistance System
ASPA	Airborne Spacing
ATC	Air Traffic Control
ATM	Air Traffic Management
ATSA ITP	Air Traffic Situation Awareness- In-Trail Procedure
AU	Airspace Users (Civil)
CA	Contract Agent
CCD	Continuous Climb Departure
CDA	Continuous Descent Approach
CDM	Collaborative Decision Making
CNS	Communication, Navigation, Surveillance

Acronym	Long Name / Definition
CTA	Controlled Time Arrival
CWP	Controller Working Position
DART	Data-driven Aircraft Trajectory
DCB	Demand and Capacity Balancing
DCMAC	Directorate Civil Military ATM Coordination (part of EUROCONTROL)
DMAN	Departure Manager
EGNOS	European Geostationary Navigation Overlay Service
EOCVM	European Operational Concept Validation Methodology
EPP	Extended Projected Profile
ER	Exploratory Research
EU	European Union
FCI	Future Communication Infrastructure
Flightpath 2050	Report of the High Level Group (HLG) on Aviation and Aeronautics Research established by the European Commission in December 2010, setting out a new vision for the aviation sector by 2050
GA	General Aviation
GA/R	General Aviation & Rotorcraft
GANP	Global Air Navigation Plan (from ICAO)
GBAS	Ground Based Augmentation System
GNSS	Global Navigation Satellite System
H2020	Horizon 2020 Framework Programme
HMI	Human Machine Interface
I 4D	Initial 4 Dimensions
IBA	Identified beneficiary action
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
IOP	Inter-operability
IR	Industrial Research & Validation

Acronym	Long Name / Definition
LVC	Low Visibility Conditions
LVP	Low Visibility Procedure
Members	2 founding members (the European Union and EUROCONTROL) and 19 stakeholder members of which all apart from the EU are signatory to a Membership Agreement or Accession Agreement
MSP	Multi Sector Planning
NRA	Non-radar airspace
NOP	Network Operation Plan
OAT	Operational Air Traffic
P-RNAV	Precision Area Navigation
R&I	Research & Innovation
RNP	Required Navigation Performance
RPAS	Remotely Piloted Aircraft System
RSP	Required Surveillance Performance
RTS	Real Time Simulation
S&M	Sequencing & Merging
SBT/RBT	Shared Business Trajectory/Reference Business Trajectory
SES	Single European Sky
SESAR	Single European Sky ATM Research is the SESAR R&I programme (called SESAR 1 for the period covering 2008 to 2016, and SESAR 2020 starting in 2015 with a maximum period for award of grants ending in December 2020)
SESAR 1	The SESAR 1 research and innovation programme, also referred to as the SESAR 1 programme or SESAR 1 R&I programme, is the coordinated set of activities undertaken by the members and managed by the SESAR JU over the period from 2008 through to 2016
SESAR 2020	The SESAR 2020 research and innovation programme, also referred to as the SESAR 2020 programme or SESAR 2020 R&I programme, is the coordinated set of activities described in this document and being undertaken by the members and managed by the SESAR JU, starting in 2015 with a maximum period for award of grants ending in December 2020
SESAR JU	SESAR Joint Undertaking
SNE	Seconded National Expert
STAM	Short Term ATFCM Measures
STCA	Short Term Conflict Alert

Acronym	Long Name / Definition
SWIM	System Wide Information Management
SWIM-TI	System Wide Information Management Technical Infrastructure
TA	Temporary Agent
TMA	Terminal Manoeuvring Area
TRL	Technology Readiness Level
TTA	Target Time Arrival
UAS	Unmanned Aerial System
UDPP	User Driven Prioritisation Process
UTM	UAS Traffic Management
VLD	Very Large-Scale Demonstration
VLL	Very Low-Level

**Table 58: List of acronyms and definitions**

## 7.9.2 IX.2 Composition of the Administrative Board as at 31 December 2017

SESAR JU Founding Members	Member	Alternate
European Union	Mr. Henrik Hololei (Chair), European Commission	Mr Filip Cornelis
EUROCONTROL	Mr. Frank Brenner (Deputy Chair), EUROCONTROL Agency	Mr. Philippe Merlo
SESAR JU members	Member	Alternate
Airbus	Mr. Bruno Darboux	Mr. Bruno Ley
AT-One consortium	Prof. Dr.-Ing. Dirk Kügler	Dr Helmut Többen
B4-consortium	Mr. Maciej Rodak	Mr. Lubos Hlinovsky
COOPANS	Ms Susanne Isaksen	Mr. Steen Erichsen
Dassault Aviation	Mr. Frédéric Falchetti	Ms Catherine Champagne
DFS	Mr. Robert Schickling	Mr. Ralf Bertsch
DSNA	Mr. Maurice Georges	Mr. Philippe Barnola
ENAIRE	Mr. Angel Luis Arias	Ms Mariluz de Mateo
ENAV	Mr. Iacopo Prissinotti	Mr. Cristiano Cantoni
LEONARDO (formerly "FINMECANICCA")	Mr. Stefano Porfiri	Mr. Fabio Ruta
Frequentis	Mr. Christian Pegritz	Mr. Michael Holzbauer
Honeywell	Mr. George Papageorgiou	Mr. Sander Roosendaal
INDRA	Mr. Rafael Gallego Carbonell	<i>Vacant</i>
NATMIG	Mr. Aage Thunem	Mr. Magnus Lindegren
NATS	Mr. Jonathan Astill	Mr. Dave Curtis
SEAC	Mr. Mark Burgess	Mr. Gérard Batistella
Skyguide	Mr. Thomas Buchanan	Mr. Pascal Latron
Thales Air Systems SAS	Mr. Luc Lallouette	Mr. Todd Donovan
ThalesAvionics SAS	Mr. Philippe Priouzeau	Mr. Pascal Combe
Stakeholder Representatives	Member	Alternate
Military	Air Commodore (retd) Chris Lorraine, MAB Mr. Jorge Domecq, European Defence Agency	Mr. Per Coulet Mr. Roland Van Reybroeck
Civil users of airspace	<i>Vacant</i>	Mr. Giancarlo Buono

Air Navigation Service Providers	Mr. Guenter Martis, CANSO	Mr. Eduardo Garcia
Equipment manufacturers	Mr. Vincent de Vroey, ASD	Mr. Yoann Viaouet
Airports	Mr. Olivier Jankovec, Airports Council International	Mr. Panos Spiliotis
Staff in the ATM sector	Mr. Michele Altieri, ENAV	Mr. Theodore Kiritsis
Scientific community	Mr. Peter Hecker, Technische Universität Carolo-Wilhelmina zu Braunschweig	Mr. J.A. Mulder
<b>Permanent Representatives</b>	<b>Member</b>	<b>Alternate</b>
SESAR JU Executive Director	Mr. Florian Guillermet	n/a
SESAR JU Deputy Executive Director	Mr. Peter Hotham	n/a
SESAR JU Chief Administration Affairs	Mr. José Calvo Fresno	n/a
SESAR JU Internal Audit	Ms. Véronique Haarsma	n/a
Secretary of the Board	Ms. Ilaria Vazzoler	n/a

**Table 59: Composition of the SESAR JU Administrative Board 31/12/2017**

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founding members



## Members

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**NATS**



**THALES**



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