Interim evaluation of the SESAR Joint Undertaking (2014-2016) operating under Horizon 2020

Final Report

Written by: Paul Ravenhill, Tatjana Bolic
Expert group: Tatjana Bolic, Paul Ravenhill, Helge Pfeiffer, Michael Dooms, Heather Allen
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Directorate E - Aviation
Unit E3 - Single European Sky

Contact: Octavian Vasile

E-mail: MOVE-E3-SINGLE-SKY-UNIT@ec.europa.eu

European Commission
B-1049 Brussels

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Abstract

This report is the interim evaluation of the SESAR Joint Undertaking (SJU) in executing the SESAR2020 programme from 2014 to 2016 as required by Article 32(2) of the Council Regulation (EU) No 1291/201 and Article 7 of the Council Regulation (EC) No 219/2007, amended by Regulation (EU) No 721/2014.

The evaluation was conducted between January 2017 and June 2017 by a team of independent experts and is based on expert opinion, relevant documentation, survey results, stakeholder interviews and data analysis.

The analysis complies with the requirements of the revised evaluation guidelines of the Better Regulation Package and covers the five main evaluation criteria: relevance, efficiency, effectiveness, coherence, and EU added value. In addition, the criteria: openness and transparency are considered.

1. EXECUTIVE SUMMARY

Scope

This document presents the results of an evaluation of the SESAR Joint Undertaking (SJU) operating under the Horizon 2020 budget during 2014 to 2016. The evaluation was conducted by a team of independent experts during January 2017 to June 2017. The evaluation is requested by both the regulation establishing the SJU and the Horizon2020 regulation. The following criteria were considered: relevance, efficiency, effectiveness, coherence and EU added value with additional consideration of: openness and transparency.

The evaluation is intended to inform the European Commission's views on the effectiveness of the SJU, of transport Joint Undertakings created under Horizon 2020 and the need for future initiatives using Public-Private Partnership as means of promoting R&D.

What is the SESAR Joint Undertaking?

The SJU is responsible for the execution and management of the development phase of the SESAR programme - the technological pillar of the Commission's Single European Sky (SES) policy.

The SES was the Commission's response to the significant air transport delays that plagued the 1990s. The SES legislation promotes the development, modernisation, and harmonisation of Air Traffic Management (ATM) across Europe. Over the years, SES has developed into a performance-oriented system in which the service providers (or ANSPs) are incentivised to adopt new concepts and technologies (as well as new ways of managing the business) to achieve the SES High Level Goals:

- Increasing safety by a factor of 10;
- A tripling of capacity;
- A halving of unit costs; and
- A reduction of the environmental impact per flight by 10%.

Achieving these goals is a critical enabler for achieving sustainable Air Transport growth and hence growth within the wider EU economy in line with the Lisbon Agenda. The role of SESAR is to achieve modernisation of ATM using a classic three-phase approach:

- **Definition:** In 2007 and 2008 a large industry consortia developed the first edition of the European ATM Master Plan – a blue print for the modernisation of ATM. It defined a new concept and the enabling systems to achieve the high-level goals.
- **Development:** The SJU is responsible for the maintenance and execution of the European ATM Master Plan. To do so they manage a large and complex R&D programme that identifies and matures "solutions" required by the European ATM Masterplan. An important element of this work is to maintain the Master Plan so that it reflects changing needs – for example since the economic crash of 2008 the focus has been more on achieving the cost-efficient and environmental goals rather than the capacity goal which was considered critical in 2007.
- **Deployment:** Ensuring that the delivered solutions enjoy widespread implementation, leading (alongside other developments in the industry) to the High Level Goals being reached. A separate, but interrelated arrangement – the SESAR Deployment Manager - is responsible for the Deployment Phase.

The current view is of a continuous ATM lifecycle managed through updates to the European ATM Masterplan. The current evaluation only considers the role of the SJU as the Manager of the Development Phase, as that is its domain in the three-phase approach.

What are the main achievements to date?

There are two phases of SJU activity: SESAR1 and SESAR2020. SESAR1 was launched in 2009 and was active until the end of 2016. SESAR1 is subject to a separate evaluation by the same team.

For SESAR1, the SJU was established as an "EU-body" subject to EU Financial Regulations with an overall budget of €2.1Bn (in equal parts from the Commission, EUROCONTROL and the industry partners). The major achievements of SESAR1 were:

- Completion of over 300 projects, 350 validation exercises and 30,000 flight trials leading to…
- …63 SESAR Solutions (new or improved operational procedures or technologies) of which…
- …27 are mandated for deployment by the SESAR Deployment Manager under the Pilot Common Project Regulation; illustrating…
- …A strong and leading brand for ATM modernisation both within Europe and globally.

The success of SESAR1 is best illustrated by the European ATM Master Plan and SESAR Solutions Catalogue. These two documents define the intent and output the SESAR1 programme; together with the detailed results of the SESAR1 Programme they have enabled Europe to play a leading role in setting global standards in ICAO and in particular in the definition of the Global Air Navigation Plan (GANP).

In 2014 the European Council agreed to the extension of the SJU until 2024 with a further of €585m from the Horizon 2020 budget and a total budget of €1.58Bn (again resulting from an equal contribution from EUROCONTROL and the industry partners).

This evaluation of the SJU covers the period from January 2015 to December 2016 operating under the Horizon 2020 budget. During this time:

- A new membership process has been successfully concluded, leading to the renewal of the majority of existing members and an expanded membership, totalling 19 Members covering 37 companies including Aeronautical Research establishments as full members for the first time. The European Commission and EUROCONTROL continue as founding members.
- A new work programme has been defined which has garnered strong support from the stakeholders for integrating operational and technical aspects into projects with a greater focus on delivering mature solutions with identified performance uplifts.
- Two calls for proposals have been completed leading to grants for:
  - 28 Exploratory Research (ER) projects
  - 20 Industrial and Validation Projects
  - 5 Very Large Scale Demonstrations
- Two further calls have been launched:
  - ER2 focussing on Remotely Piloted Aircraft Systems (RPAS)

  - ER3-VLD an open call for Exploratory Research (application-based) and Very Large Scale Demonstrations
- By the end of 2017, the full work programme will be in the execution phase.

What are the main findings of the evaluation?

The evaluation of SESAR2020 has been dominated with the issues surrounding the application of H2020 rules to a policy-driven Joint Undertaking as opposed to an R&D-led Joint Technology Initiative (JTI). This situation appears exasperated by requiring the SJU to act as an EU-body and follow rules designed for a JTI. This has led to unnecessary complexity and confusion as well as duplicated and overlapping reporting requirements for both the SJU and its Members.

At the core of the issue is the difficulty of using the H2020 procedures and tools to manage a collaborative research programme. This is best highlighted by the fact that the SJU Membership is often organised by consortia but grants are awarded to the constituent companies. Momentum created in the previous programme was lost to the transition to the new H2020 framework. In fact, one year was lost to these transition difficulties and a significantly increased workload was placed on the limited SJU resources, which could only be overcome by changes in the type of staff employed bringing further organisation pressure. It is testament to the efficiency and capability of the SJU and the wider partnership that this period was managed successfully.

Beyond the application of the H2020 rules, our evaluation demonstrates that the SJU took the opportunity of the extension to apply lessons learned from the SESAR 1 programme and thereby strengthen SESAR2020:

- The SESAR2020 programme for industrial research and validation, to be performed by the Members, has been streamlined and is now focussed around 25 projects each with a defined set of "solutions" that will be matured towards deployment.
- The projects now integrate operational and technical aspects, which will encourage even closer relationships between service providers and suppliers leading to stronger solutions, which are closer to deployment.

These developments will strengthen the innovation pipeline within the SJU remit (development phase of SESAR). Further:

- A greater emphasis on Very Large Demonstrators (VLDs) will increase the evidence available to support industrialisation of SESAR solutions. VLDs will be conducted by both Members and external stakeholders thus increasing likelihood of stakeholder buy-in and deployment. This will improve the transparency and feedback for the ATM modernisation lifecycle at the core of the wider SESAR programme.
- The extension of Exploratory Research will encourage greater participation of academia and SMEs within the work programme. In addition, the new programme structure should enable ideas to move from Exploratory Research to the core SESAR programme, through Demonstration at pilot sites for ideas with high potential having either strong political or stakeholder support.

The SJU has also used the opportunity to strengthen the governance arrangements:

- The New Master Planning Committee will provide a basis for ensuring even stronger stakeholder support for updates to the European ATM Master Plan.

- The Revised Scientific committee will further support pull through of advanced research in to the main programme.

These developments will help strengthen the links to both the academic research community and the deployment phase.

These findings are supported by the positive feedback received during interviews and in the various surveys conducted as part of the evaluation.

Throughout our evaluation, SJU Members and ATM Stakeholders have highlighted the importance of **SESAR and the SJU as key enablers for the implementation of the wider SES policy**:

- Network investors (the airlines, airports and ANSPs) are confident that SESAR is delivering the necessary solutions to achieve ATM modernisation.
- ANSPs and Airports are benefiting from "working together" leading to partnerships beyond SJU scope (e.g. Borealis, COOPANS, ITec).
- Manufacturers support the SJU because it provides access to operational stakeholders and hence improves their R&D leading to products with marketability and hence return on investment.
- Whilst the wider supply chain of the manufacturers (and large ANSPs) is not directly represented in the SJU Membership, they are active in SESAR work programme through subcontracting and other arrangements (for example Linked Third Parties under H2020). The SJU has therefore led to a wide and inclusive participation in ATM R&D.

In terms of the main evaluation criteria:

Effectiveness	The SJU has been extremely effective in organising the activities of the SESAR Development phase. This includes maintenance of the Master Plan, delivering the R&D programme and building international links to ensure global interoperability and European leadership in ATM solutions. The new work programme is likely to strengthen execution of the programme and increase the quality of the research performed and results generated. The new programme is solution-oriented and integrates operational and technical aspects. The governance arrangements have also been strengthened compared to SESAR1 with greater emphasis placed on achieving wider involvement of the full range of stakeholders in maintenance of the ATM Master Plan
Efficiency	There is currently limited evidence available to gauge the efficiency of the SJU under Horizon 2020 rules as only a limited part of the programme has been just launched in the period the evaluation is looking at. The SJU has engaged extra staff with the requisite knowledge to deal with the additional burden. Whilst current metrics may indicate transition issues from SESAR1, this was due to an initial lack of knowledge in the SJU and the Members of the H2020 rules, procedures, and tools, as well as the lack of maturity in those rules, procedures and tools which caused some delays. The SJU has already taken corrective action e.g. the additional administrative staff and performance levels have returned to the excellent levels of SESAR1. However, action is still required by the Commission to reduce the burden of the overlaps and inconsistencies between reporting requirements on EU-bodies and those stemming from Horizon 2020 on both the SJU and its Members (see Recommendation 4).

EU Added Value	The application of a fixed co-funding rate of 70% based on Horizon 2020 rules as opposed to the 50% of actual costs used under SESAR1 leads to the change of expected leverage from 2 in SESAR1 to 1.4 for SESAR2020. SESAR1 achieved a leverage value of 1.8. The true EU-added value of the SJU is as enabler of the much more significant benefits of implementing the Single European Sky.
Coherence	The activities of the SJU have been evaluated as being coherent at four levels: • Internal – through maintenance of the Master Plan. • Horizon 2020 – though ACARE and Clean Sky. • EU – through the strong policy link with the SES, Transport White Paper and Aviation Strategy as well as links with other agencies and organisations such as EASA, EDA, ESA and EUROCAE. • Globally – through strong links with ICAO, the FAA (NextGen) and other national and regional programmes.
Relevance	The work of the SJU has continued relevance. The SJU has created a strong public-private partnership, committed to achieving the SES High Level Goals, as reinforced by successive European ATM Master Plan updates. The value of SESAR as a modernisation programme is now beginning to take hold, with the successful launch of the Deployment Phase (through SESAR Deployment Manager), leading to actual deployment of SESAR solutions. Continued relevance requires industry-wide stakeholder consensus to be maintained through Master Plan Update campaigns.
Openness and Transparency	The work of the SJU is considered to be open and transparent. SJU publications are well received – particularly the European ATM Roadmap and SESAR Solutions Catalogue which together define the objective and results of the SESAR Development Phase. Each solution is supported by a detailed set of documentation (Solution Pack) designed to support implementation including safety cases and references to standards and regulatory material. Under SESAR2020 the SJU is strengthening link to standardisation and reducing the implementation ”gap”. The SJU promotes SESAR at trade shows and other public events and is active on social media with a positive presence on LinkedIn and Twitter. The SJU is often now representing the wider EU community from research to deployment, from safety to standards and connecting to space. The SJU is increasingly trusted by the EC to be the lead on new and innovative research planning for the sector, including drones and cyber security. This ensures the transparency and relevance of the whole programme for all stakeholders, including many new entrants.

What Recommendations were made?

The evaluation of SESAR1 highlighted three areas of improvement relating to how the activities of the SJU could further support the longer-term role of SESAR as a modernisation programme with a strong link the Single European Sky policy area:

- Rec 1: Strengthen the “partnership approach” including the process for maintaining the European ATM Master Plan.

- Rec 2: Strengthen the "architecture" to enable streamlining of deployment planning and monitoring.
- Rec 3: Strengthen the links to academia to ensure the innovation pipeline is fed with new ideas.

The evaluation of SESAR2020 highlighted significant steps taken by the SJU to address these issues. In particular, the new Master Planning Committee and wider scope for Exploratory Research address Recommendations 1 and 3.

Following the evaluation of SESAR2020 two further recommendations were made:

Recommendation 4: Resolve issues with application of H2020

The application of H2020 rules has clearly been problematic during the transition from SESAR1 to SESAR2020. No evidence has been provided that H2020 rules have simplified the management of the SJU, nor made the administration burden of beneficiaries lower. Serious concerns have been raised during the interviews and survey responses that they are not appropriate for the management of programme. These issues need to be addressed. In particular, the Commission should:

- In the short term, provide a derogation allowing the SJU to make multi-annual commitments such that grant agreements can cover funds not yet allocated to the SJU. This will remove the need for annual amendments to grant agreements.
- In the short term, modify the H2020 tools to allow grant coordinators to group beneficiaries in support of the "consortia" concept used for SJU Membership.
- In the longer term, rethink the application of H2020 rules and how they could be adapted to better reflect the management of a programme, the priorities of which need to change over the years in order to remain relevant, and need to direct research efforts to emerging problems.

Rec 5: Take steps to further close the industrialisation gap

During the interview process stakeholders strongly supported the continuation of SESAR, both the development phase under the SJU management and the deployment phase led by the SESAR Deployment Manager (SDM). The common belief is that the ATM modernisation lifecycle, and hence achievement of the SES goals, could be successful if these two elements work in tandem.

Whilst success for the SJU can be measured by the number of successfully matured solutions; success for the overall SESAR programme must mean solutions are successfully deployed. The current scope of the SJU and SDM activities have created what is referred to as the "industrialisation gap". This is created by the SJU programme ending at TRL6 (or E-OCVM V3) and the SESAR Deployment Manager requiring solutions at TRL8 (or E-OCVM V5). The industrialisation gap includes activities such as standardisation and the developing evidence for certification.

The SESAR2020 programme closes the gap compared to SESAR1 in two crucial areas:

- There is greater support for standardisation activities. Part of the exploitation of the new projects is for team members to actively work within the standards groups (and in particular EUROCAE working groups).
- The VLDs will provide evidence for certification so long as they are defined in an appropriate manner.

However, more can still be done to manage this "gap" and we believe that future options for the SJU should be as open as possible. For example, providing public funds to initial or pilot deployments on the basis that the work done to achieve certification supports

development of Means of Compliance and other standards and certification material hence reducing the risk and cost of future deployments. Such an activity cannot currently be funded by the SJU or the SDM with sufficient co-funding. However, we believe such activities would be beneficial to improving the success of SESAR and future options such as providing CEF funds to the SJU to support such activities or even combining the roles of the SJU and SDM under one organisation with a range of financial instruments to support exploratory research, industrial research, industrialisation and deployment should be investigated.

2. INTRODUCTION

The 2011 Transport White Paper ("Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system", (European Commission, 2011)) sets out a number of key goals and initiatives to build a competitive transport system that responds to European citizens' and businesses' needs for increased mobility and contributes to more growth and jobs, while at the same time reducing Europe's dependence on imported oil and cutting carbon emissions in transport by 60% by 2050.

The Roadmap sets out to remove major barriers and bottlenecks in many key areas across the fields of transport infrastructure and investment, innovation and the internal market. The aim is to create a Single European Transport Area – including a Single European Railway Area and a Single European Sky – with more competition and a fully integrated transport network that links the different modes and allows for a profound shift in transport patterns for passengers and freight. Among the landmark goals for 2050, the Roadmap includes:

- Phasing out the use of conventionally-fuelled cars in cities;
- A 40% use of sustainable low carbon fuels in aviation;
- A 50% shift of medium distance intercity passenger and freight journeys from road to rail and waterborne transport;
- At least 40% cut in shipping emissions;
- Deployment of a modernised air traffic management infrastructure (SESAR).

The development of new technologies and innovative approaches in business models, services and products, is recognized as playing an instrumental role in achieving a faster and cheaper transition to a more efficient and sustainable European transport system, in particular by acting on three main factors: vehicles' efficiency through new engines, materials and design; cleaner energy use through new fuels and propulsion systems; better use of network and safer and more secure operations through information and communication systems.

In light of this ambitious agenda, the EU earmarked €6.3 billion of its €77 billion new Framework Programme for Research and Innovation covering the period 2014-2020 – Horizon 2020 (H2020)[1] – towards transport research and innovation, under the heading "Smart, green and integrated transport" (Regulation (EU) No 1291/2013). This is an increase of **50%** compared with the previous funding period.

In this context, the EU also decided to step up or renew partnerships with the transport industry within H2020, in order to overcome fragmentation, to better target research and innovation (R&I) efforts and to accelerate the market uptake of innovative solutions by ensuring industry buy-in.

Public-Private Partnerships (PPPs) were already a major new feature of the previous research framework programme (FP7), which ran from 2007 to 2013, where they were introduced to support key areas of research and technological development that can contribute to Europe's competitiveness and quality of life, by bringing together industry, the research community, in some cases Member States, regulators and the EU to define and implement common research agendas and pool together resources to invest in large-scale multinational research activities.

[1] Regulation of the European Parliament and of the Council establishing Horizon 2020-The Framework Programme for Research and Innovation (2014-2020), SEC(2011) 1427-Volume 1 and SEC(2011) 1428-Volume 1

Under FP7, PPPs were implemented either in the form of Joint Undertakings (JUs) under Article 187 of the Treaty on the Functioning of the EU (TFEU) – as was the case in the strategic areas of aeronautics (Clean Sky) and air traffic management (SESAR), Innovative Medicines (IMI), fuel cells and hydrogen technologies (FCH), embedded computing systems (ARTEMIS) and nano-electronics (ENIAC) – or in the looser form of contractual PPPs (cPPPs), such as the Factory of the Future, Energy-efficient Buildings or Green Cars.

Based on the experience gathered during FP7, the European Commission sought to build on this partnering approach under Horizon 2020 and published a series of proposals for Council regulations on public-private and public-public partnership initiatives under Horizon 2020. In May 2014, the Innovation Investment Package was officially adopted by the EU Member States, setting up a new generation of public and private partnerships that pool research and innovation investments of more than €22 billion.

The package includes seven Joint Undertakings, where the six out of seven are actually the **Joint Technology Initiatives (JTIs)** (European Commission MEMO 14/289, 2014), established under Article 187 of the Treaty on the Functioning of the European Union (TFEU) and managed by dedicated entities called Joint Undertakings[2], as defined under the Article 187 of the Treaty on the Functioning of the EU (TFEU).

The seventh, SESAR JU, has been established in 2007 as a 'Union body' rather than a JTI and its duration has been extended as such, under the Horizon 2020. This implies that a large number of consolidated SJU principles, processes, governance and membership arrangements established under SESAR1 have not been changed.

The JUs (JTIs and the SJU[3]) organise their own research and innovation agenda and award funding for projects on the basis of competitive calls. Among these, four JUs are active in the transport sector, receiving funding under the "Smart, green and integrated transport" challenge of H2020, namely:

- **SESAR** (Single European Sky Air Traffic Management Research) **Joint Undertaking**, the continuation of the Joint Undertaking developing a new generation of air traffic management systems in the framework of the Single European Sky, aiming to deliver safer, cleaner and more cost-efficient air travel, with an EU contribution of €585 million for the period 2014-2020;
- **Clean Sky 2**, the follow up to Clean Sky 1, a Joint Technology Initiative aimed at developing and demonstrating new break-through technologies for the civil aircraft market to cut aircraft emissions and noise, and secure the future international competitiveness of the European aviation industry, with a EU contribution of €1,755 million for the period 2014-2020;
- **FCH2**, the follow-up to FCH 1 (Fuel Cells and Hydrogen), a Joint Technology Initiative aimed at developing a portfolio of clean, efficient and affordable fuel cells and hydrogen technologies to the point of market introduction and help secure the future international competitiveness of this sector in Europe, with a EU contribution of €665 million for the period 2014-2020;
- and finally, **S2R** (the Shift2Rail Joint Undertaking) a new JU established under Horizon 2020 to develop rail system technologies and solutions to help complete the Single European Railway Area, and increase the attractiveness and long-term

[2] "The JTIs are established under Article 187 of the Treaty on the Functioning of the European Union (TFEU) and managed by dedicated entities called **Joint Undertakings**." (European Commission MEMO 14/289, 2014)

[3] SESAR JU is a Union body, subject to Articles 208 and 209 of the EU Financial Regulation, while the JTIs are subject only to Article 209 of the same Regulation.

sustainability of the rail sector, with a EU contribution of €450 million for the period 2014-2020.

2.1. Purpose of the evaluation

The current evaluation covers the operation of the SJU from 2014 to 2016 under Horizon 2020. The results will be used to inform the European Parliament and Council, national authorities, the research community and other stakeholders on the outcome realized so far by the SJU operating under Horizon 2020.

The results of this evaluation will be used to improve the implementation of the Joint Undertakings (JUs) in general and of the SJU in particular under Horizon 2020 and contribute to the formulation of the 2018-2019 SJU Annual work programmes and serve as a basis for the ex-ante impact assessment of a possible next generation JUs.

2.2. Scope of the evaluation

The interim evaluation of the SESAR JU is a key requirement both in the SESAR basic act and in the regulatory framework of Horizon 2020.

First of all, Article 7 of the (Council Regulation (EC) No 219/2007), amended by (Council Regulation (EU) No 721/2014) requires the Commission to carry out, with the assistance of independent experts, an interim evaluation on the SJU.

Second, the co-legislator explicitly requires, as part of the Horizon 2020 Interim Evaluation, an in-depth assessment on whether the PPP is implemented in an open, transparent and efficient way, as stipulated in Article 32(2) of the (Regulation (EU) No 1291/2013).

The evaluation covers five main criteria: *relevance, efficiency, effectiveness, coherence and EU added value,* with additional consideration of *openness and transparency*. The evaluation questions are set out in Section 4.

In addition, the evaluation includes an analysis of the contribution of the SJU to the Union's general transport policy objectives and to the implementation of Regulation (EU) No 1291/2013 and in particular part of the Smart, Green and Integrated Transport Challenge under the Societal Challenges pillar of (Council Decision 2013/743/EU) establishing the specific programme implementing Horizon 2020 — the Framework Programme for Research and Innovation (2014-2020).

2.3. Structure of the report

The remainder of this report is structured as follows:

- Section 3: Sets out the context for the evaluation by providing background information on the SESAR Programme and the related SES Policy Area.
- Section 4: Sets out the evaluation questions.
- Section 5: Describes the evaluation methodology. Section 5 is supported by a separate Annex, which contains full details of the surveys, reference material and interviews used to inform this evaluation.
- Section 6: Describes the implementation of the SJU in terms of the budget, membership and work conducted. Statistics are provided in terms of the distribution of funds between members, Member States and research areas.
- Section 7: Provides the detailed analysis in terms of effectiveness, efficiency, coherence, EU added value and relevance.
- Section 8: sets out the conclusions to the evaluation.

- Section 9: provides recommendations to the SJU going forward.
- Section 10: provides a list of references used in this document.

The report is completed by the following annexes:

- Annex A: Acronyms
- Annex B: SESAR2020 Work Programme
- Annex C: SESAR2020 Solutions
- Annex D: Bibliography
- Annex E: Interviews Conducted
- Annex F: Public Survey
- Annex G: Beneficiary Survey
- Annex H: Cross TJU Findings

3. BACKGROUND TO THE INITIATIVE

The Single European Sky ATM Research (SESAR) programme is an initiative of the EU to modernise and harmonise Air Traffic Management in Europe. SESAR is the technological pillar of the Single European Sky (SES). This section sets out the background to SESAR and establishes the policy context with the SES.

3.1. Description of the initiative, objectives and relevance

3.1.1. Initiation of SESAR

Following severe flight delays in the late 1990's, The Single European Sky (SES) initiative was launched by the European Commission to reform European Air Traffic Management. The first SES legislative package (SES1) was drafted by the commission in 2001 and adopted by the European Parliament and Council in March 2004, entering into the force a month later.

SES1 was fundamentally a prescriptive package. It established key principles such as the separation of service provision from regulation (hence the creation of National Supervisory Authorities), the certification and designation of service providers and the transposition of ICAO and EUROCONTROL[4] rules in to EU law. It also established the concept of Functional Airspace Blocks (FABs) requiring Member States to harmonise airspace in accordance with operational requirements rather than national boundaries.

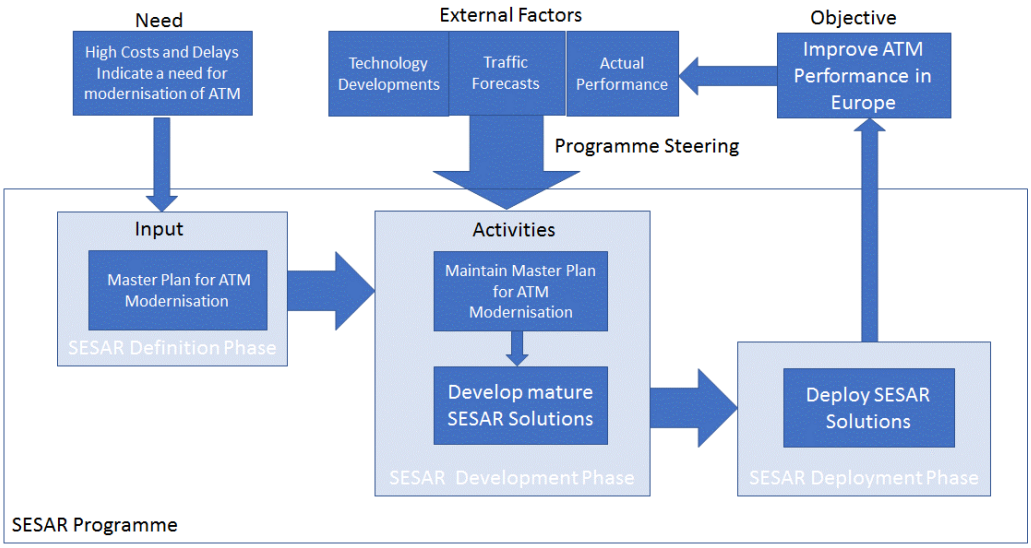
In terms of technical modernisation, the interoperability Regulation enabled Implementing Rules (IRs) to be developed to support harmonised deployment. Early IRs were used to ensure common implementation dates for key infrastructure such as COTR rule[5] but there was no overarching plan or architecture that could be enabled.

The SESAR project was conceived by the industry in its widest sense, including the Commission and EUROCONTROL with the objective of developing such an overarching plan – referred to as the European ATM Master Plan that would enable modernisation of ATM through a partnership approach of all stakeholders.

This initiative was strongly supported by the Commission and EUROCONTROL. The intervention logic is summarised in Figure 1 including the three phases of SESAR, which are explained in further detail in the section 3.1.2. The right-hand side of the figure illustrates the ATM Modernisation Lifecycle that is at the heart of the SESAR programme and is described in Section 3.1.5.

[4] The EUROCONTROL Safety Regulatory Requirements – ESARRs

[5] Commission Regulation (EC) No 1032/2006 of 6 July 2006 laying down requirements for automatic systems for the exchange of flight data for the purpose of notification, coordination and transfer of flights between air traffic control units



SESAR forms part of the SES policy to transform the ATM Sector

Figure 1. SESAR Programme intervention logic.

The SESAR Project was aimed at reducing fragmentation in both R&D and deployment planning. **The objective was one Master Plan, agreed to and followed by all**. The potential benefits of SESAR were considered to be (Steer Davies Gleave, 2005):

- Earlier implementation, and consequential benefits of new concepts and technologies;
- Potentially, a better phasing of projects, taking advantage of reduced implementation times and greater focus on high-priority projects;
- Lower expenditure on conventional system upgrades of legacy systems;
- Lower development costs – or "better value-added" development – due to a reduced number of parallel developments;
- Lower equipage costs for aircraft operators; and
- Competitive advantage for the European air transport industry.

Further, in his speech at the launch event of the Definition Phase in November 2005, Commission Vice President Jacques Barrot expressed the objectives of the SESAR programme as:

"to achieve a future European Air Traffic Management (ATM) System for 2020 and beyond which can, relative to today's performance:

- Enable a three-fold increase in capacity which will also reduce delays, both on the ground and in the air;
- Improve the safety performance by a factor of 10;
- Enable a 10% reduction in the effects flights have on the environment and;
- Provide ATM services at a cost to the airspace users which is at least 50% less[6]."

These objectives became known as the SES High Level Goals. They form an integral part of the first edition of the European ATM Master Plan and as such were adopted by the

[6] As reported in SESAR Definition Phase D5

Council in March 2009 (Council Decision 2009/320/EC; SESAR Consortium). Their evolution and the SESAR contribution to achieving them are central to understanding the effectiveness, coherence and added value of the SJU.

3.1.2. The SESAR Definition Phase

The SESAR programme consists of three distinct phases:

- Definition: Defined the need for the modernisation of ATM and generated the first edition of the ATM Master Plan,
- Development: R&D Programme to develop "solutions" to achieve modernisation,
- Deployment: Timely synchronised deployment of those solutions.

As illustrated in the Figure 1 the three phases form a continuous ATM modernisation lifecycle.

The original definition phase was initiated in 2005 as a €60million 2-year programme co-financed by the European Commission and EUROCONTROL and managed by EUROCONTROL. It was performed by the Global Consortium consisting of 30 members and 20 subcontractors covering all ATM stakeholders: ANSPs, airports, airspace users and manufacturers. Six main deliverables were produced that described current performance and performance needs, an operational concept and architecture to meet those needs, a deployment sequence and master plan along with a work programme for the R&D required to refine the proposed concept, architecture and systems (see Table 1).

Table 1. SESAR definition phase deliverables.

Milestone 1 (D1)	Milestone 2 (D2)	Milestone 3 (D3)	Milestone 4 (D4)	Milestone 5 (D5)	Milestone 6 (D6)
Current Situation	Performance Needs	Concept of Operations	Deployment Sequence	ATM Master Plan	Work Programme
• Capture of Current Situation with clear identification of Rationale • Strengths, Weaknesses, Deficiencies, Overview of Current Initiatives, etc. • Expectations for Future	• Outline Vision of Future Air Transport Industry & Role of ATM • Performance Requirements for Future Network • Identification of "Best Practice" & Principles upon which to Build	• Concept of Operations • Architecture for Future ATM System Network • Set of Enabling Technologies Identified • Outline of Total Cost & Preliminary Assurance that Target is Viable	• Confirmation of Viability (Technical, Financial, Institutional, etc.) • Options for Deployment Sequence & Recommended "Best" Approach • Definition of Deployment Packages (Transition from Legacy Systems/Framework)	• Detailed Plan of Actions which All Relevant Organisations need to undertake to Implement Changes • Inputs to Future Business Plans, R&T/D Plans, Risk Assessment Regimes, Development of Future Management Processes, etc.	• Proposed Management Structure for SESAR Implementation Phase • Proposed Structured Lifecycle & Methods to Support Implementation • Detailed Programme of Work for First 5 Years of Implementation Phase

The deliverables of the definition phase provided the initial context for the work of the SESAR Joint Undertaking; but they also defined a concept of industrial partnership to drive harmonisation of European ATM through the adoption of a common concept and architecture. In particular, D5 was adopted as the first edition of the European ATM Master Plan (SESAR Consortium, 2008) and D6 (SESAR Consortium DLM-0710-001-02-00, 2008) which contained the first draft of the SESAR definition phase work programme.

3.1.3. The SESAR Development Phase

The SESAR Joint Undertaking (SJU) was established to "manage the activities of the development phase" of SESAR. The role is defined in Article 1.5 of SJU Basic Regulation ((Council Regulation (EC) No 219/2007), see Text Box 1). In effect, SJU has (at least) four distinct roles:

- Management of the SESAR Development Phase work programme as a Public-Private Partnership,
- Maintenance of the European ATM Master Plan,
- Supporting the global interoperability of ATM,
- Providing support to the Commission on technical issues relating to the SES (in recent years this has included cybersecurity, drones and datalink as well as advice on the contents of the Pilot Common Project).

5. The aim of the Joint Undertaking shall be to ensure the modernisation of the European air traffic management system by coordinating and concentrating all relevant research and development efforts in the Community. It shall be responsible for the execution of the ATM Master Plan and in particular for carrying out the following tasks:

- organising and coordinating the activities of the development phase of the SESAR project, in accordance with the ATM Master Plan, resulting from the definition phase of the project managed by Eurocontrol, by combining and managing under a single structure public and private sector funding,
- ensuring the necessary funding for the activities of the development phase of the SESAR project in accordance with the ATM Master Plan,
- ensuring the involvement of the stakeholders of the air traffic management sector in Europe, in particular: air navigation service providers, airspace users, professional staff associations, airports, and manufacturing industry; as well as the relevant scientific institutions or the relevant scientific community,
- organising the technical work of research and development, validation and study, to be carried out under its authority while avoiding fragmentation of such activities,
- ensuring the supervision of activities related to the development of common products duly identified in the ATM Master Plan and if necessary, to organise specific invitations to tender.

Text Box 1. Extract from SJU Basic Regulation (Council Regulation (EC) No 219/2007).

Together, these roles emphasise the importance of the link between the work of the SJU and wider SES policy. SESAR Development phase is not just an R&D programme; it is a transformative programme for a critical sector in the European economy.

The SJU is a Public-Private Partnership in the truest sense – it combines the public (EU funds and EUROCONTROL in-kind contribution) with private funds to achieve a common goal – the modernisation of European ATM.

It is important to note that prior to the creation of the SJU, it had been envisaged that a single body would have responsibility for both the development and deployment phases. The SESAR Definition Phase referred to this as the "SESAR Performance Partnership". However, as Article 171 of the Treaty establishing the European Union[7] was used as legal basis for the creation of the SJU, the role was limited to the development phase – *"research, technological development and demonstration programmes".* As will be discussed in the next section another body – the SESAR Deployment Manager – has since been created to manage the Deployment Phase.

[7] Official Journal C 325 , 24/12/2002 P. 0033 - 0184

This legal basis and role of SESAR JU is important to the evaluation. The SJU is not a Joint Technology Infinitive (JTI). JTIs were created under the FP7 and subsequently H2020 legislation to support the Lisbon Growth and Jobs Agenda (Council Decision 2006/971/EC) and have a research focus in that they aim to increase research in their respective fields.

The **SJU is policy oriented** with the specific objective of supporting the modernisation of ATM in Europe. It was not set up as a JTI due to its specific policy-oriented activities (EC COM(2013) 494)[8].

3.1.4. SESAR and SES2

The second package of the Single European Sky legislation (SES2), adopted in 2009, was a significant revision of SES which:

- Introduced Network Manager and the concept of Network Functions.
- Introduced a **performance scheme** to provide economic regulation of ANSPs (including setting of targets for safety, capacity, and environmental impact).
- Transformed Functional Airspace Blocks from an airspace issue to an operational one requiring Member States to optimise service provision within FABs.
- Provided a definition of Common Projects as the legal basis for "synchronised deployment" of mature SESAR Solutions, within the SESAR deployment phase. The SESAR deployment phase has subsequently been launched under the management of the SESAR Deployment Manager (Commission Implementing Regulation (EU) No 409/2013, 2013).

SES2 also strengthened the links between SESAR JU and the overall SES policy. Firstly, by inclusion of a recital requiring close coordination between SES and SESAR JU (see Text Box 2) and secondly through the introduction of links between the performance scheme and the European ATM Master Plan.

> (6) 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) calls for the development and implementation of an ATM Master Plan. The implementation of the ATM Master Plan requires regulatory measures to support the development, introduction and financing of new concepts and technologies. It should result in a system composed of fully harmonised and interoperable components, which guarantee high performance air transport activities in Europe. The schedule for implementation of the single European sky should take into consideration the timescale foreseen for the development and deployment phases of the SESAR programme as a part of the single European sky. Both processes should be closely coordinated.

Text Box 2. Extract from SES2 regulation.

Achievement of the high-level goals requires implementation of all aspects of the SES legislation – including deployment of SESAR solutions, but also institutional and organisational reform incentivised through the Performance Scheme. SES2 also strengthened the social dialogue to ensure that the human dimension is taken into account in achieving the necessary transformation. At the same time, the EASA system was strengthened to support the safety dimension.

[8]Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Public-Private Partnerships in Horizon 2020: A powerful tool to deliver on innovation and growth in Europe.

3.1.5. SESAR Deployment Phase and the ATM Modernisation Lifecycle

In December 2014, the SESAR Deployment Phase was launched by establishing the SESAR Deployment Manager[9] in accordance with Commission Implementing Regulation (EU) No 409/2013 with the mandate to secure deployment of the Pilot Common Project (Commission Implementing Regulation (EU) No 716/2014 of 27 June 2014). All three phases of SESAR now form a continuous ATM modernisation lifecycle (see Figure 2).

Figure 2: The SESAR ATM Modernisation Lifecycle[10]

The SJU manages the R&D needed for the modernisation of ATM, culminating in mature SESAR solutions (at TRL 6). The mature SESAR solutions are published and can be taken up for deployment.

Core functionalities requiring synchronised deployment can be mandated using the provisions of Commission Implementing Regulation (EU) No 409/2013 and entrusted to SESAR Deployment Manager, that is funded by the Connecting Europe Facility (CEF). The CEF includes funds identified for deployment of core functionalities and additional funds for deployment of SESAR solutions with local benefits.

The objective of the deployment (both EU-wide and voluntary local) is to improve the ATM performance, and to contribute to the achievement of the SES High Level Goals. As both the development and deployment phase are progressing over time, the impact of the external factors is assessed periodically and taken into account in the updates to the European ATM Master Plan, thus steering the SESAR programme in order to remain relevant in the changing environment.

The external factors influencing the programme include: the technology developments outside of the strict ATM environment, traffic demand and the actual performance of the European ATM system. The recent years have seen rapid developments in drones, cybersecurity issues, big data – all have been reflected in the Master Plan updates.

The urgency of deployment of some solutions depend on the need, which is created by the traffic demand. As traffic demand depends on many factors, and as the past decades have seen more than one slump in the demand, the traffic forecasts in Europe are regularly updated. EUROCONTROL's STATFOR forecasts are used by different ATM stakeholders in their daily operations.

Of course, the actual performance of the system also influences the need for R&D and consequently for its deployment. SES2 introduced the network manager function and performance scheme (including setting of targets for safety, capacity, and environmental impact), within its performance pillar. Thus the actual operations are managed by the

[9] http://www.sesardeploymentmanager.eu/

[10] https://ec.europa.eu/transport/modes/air/sesar_en

ANSPs and the Network Manager (NM) working together, and the performance of the system is assessed by the Performance Review Body (PRB). These assessments also help steer the SESAR programme.

3.1.6. SESAR today

The role of the SESAR programme, and therefore the requirements placed on the SJU have clearly evolved over time. At a policy level the main changes are:

- The economic crisis of 2008 profoundly affected the traffic levels in Europe. It is now projected that the doubling of traffic compared to 2005 forecast for 2020 will not occur until at least 2040.
- There is an increased awareness of the environmental impact of aviation. Sustainable growth of air transport requires both improved aircraft and fuels (the role of Clean Sky) but also efficient procedures (the role of SESAR).
- The Deployment Phase has been successfully launched. Deployment of the Pilot Common Project (PCP) is underway under the management of the SESAR Deployment Manager (SDM). This strengthens the interface between the Development and Deployment Phases of SESAR and increases the importance of the Master Plan as a single reference for ATM modernisation in Europe and the likelihood of SESAR solutions being deployed.
- There is an increased focus on performance led development within the ATM sector. SESAR solutions therefore need to respond to both EU-wide and local performance needs.
- A number of significant technological issues have emerged (for example cyber-security, drones) that effect the required work of the SJU.

The policy link for SESAR remains as crucial today as it ever was. The need for SESAR was reinforced in the Commission Transport White Paper published in 2011 (European Commission, 2011) and the subsequent implementation report published in 2016 (European Commission, SWD(2016) 226). The Commissions Aviation Strategy[11] published in December 2015 also recognises the importance of SESAR to achievement of wider air transport goals.

3.1.7. The extension of the SJU

In 2014, the duration of the SESAR Joint Undertaking was extended from 2016 to 2024 (Council Regulation (EU) No 721/2014, 2014), leading to two distinct phases of the SESAR development phase, see Table 2.

Table 2. Phases of the SESAR Development Phase

Programme	Dates	EC Contribution	Total Available Budget	Financial Rules
SESAR1	2008 - 2016	TEN-T: €350 M FP7: €350 M	€2.1 Bn	SJU Rules (based on FP7)
SESAR2020	2015 - 2024	H2020: €585 M	€1.8 Bn	H2020

[11] https://ec.europa.eu/transport/modes/air/aviation-strategy_en

The extension of the SJU was achieved by (Council Regulation (EU) No 721/2014). It is important to realise that the extension of the SESAR was just that: an extension of current SJU until 31st December 2024 with only minor amendments to the regulation. The SJU remains an EU body within the context of Article 208 of the EU Financial Regulation and all the reporting requirements that this entails. With the imposition of rules deriving from Horizon 2002 this has led to duplication of reporting requirements. This issue is discussed in Section 6.1, and is central to understanding the progress of SESAR2020.

3.1.8. SESAR2020 and Horizon 2020 Policy

As discussed previously in this section, SESAR is primarily the technological arm of the SES. The SJU role, from a SES policy objective is to maintain the European ATM Master Plan and develop mature SESAR Solutions for the SESAR Deployment Phase.

As part of the Horizon 2020 programme the SJU is also expected to contribute to the achievement of H2020 objectives. The remainder of this section therefore provides a summary of those objectives as they relate to the transport Joint Undertakings.

Priorities and Specific Objectives in Horizon 2020

Horizon 2020 supports the implementation of the Europe 2020 strategy and other Union policies, and is expected to contribute to the Commission's top priorities for strengthening Europe's competitiveness and stimulating investment for the purpose of job creation.

In the light of this ambitious agenda, and to assist global leadership for the European transport industry, the EU earmarked €6.3 billion of its €77 billion new Framework Programme for Research and Innovation covering the period 2014-2020 – Horizon 2020 (H2020) – towards transport research and innovation, under the heading "Smart, green and integrated transport". This is an increase of 50% compared with the previous funding period. In this context, the EU also decided to step up a number of partnerships with the transport industry, in order to overcome fragmentation, to better target research and innovation and to help to accelerate the market uptake of innovative solutions by ensuring industry buy-in.

The first priority of Horizon 2020 is *Excellent Science*, which aims to reinforce and extend the excellence of the Union's science base and to consolidate the European Research Area in order to make the Union's research and innovation system more competitive on a global scale. The second priority is *Industrial Leadership*, which aims to speed up the development of the technologies and innovations that will underpin tomorrow's new technology and help innovative European SMEs to grow into world-leading companies. The third priority *Societal Challenges* responds directly to the policy priorities and societal challenges that are identified in the Europe 2020 strategy and which aim to stimulate a critical mass of research and innovation efforts needed to achieve the Union's policy goals.

Societal Challenge 4: Smart, Green and Integrated Transport

Within Horizon 2020, the specific objective of the Transport Challenge 'Smart, Green and Integrated Transport' is to boost the competitiveness of the European transport industries and "to achieve a European transport system that is resource efficient, climate and environmentally friendly, safe and seamless for the benefit of all citizens, the economy and society".

The Specific Programme is structured in four broad lines of activities aiming at:

- Resource efficient transport that respects the environment. The aim is to minimise transport systems' impact on climate and the environment (including noise and air pollution) by improving their efficiency in the use of natural resources and by reducing their dependence on fossil fuels.
- Better mobility, less congestion, more safety and security. The aim is to reconcile the growing mobility needs with improved transport fluidity, through innovative solutions for seamless, inclusive, affordable, safe, secure and robust transport systems.
- Global leadership for the European transport industry. The aim is to reinforce the competitiveness and performance of European transport manufacturing industries and related services including logistic processes and retain areas of European leadership (such as aeronautics).
- Socio-economic and behavioural research and forward-looking activities for policy making. The aim is to support improved policy making which is necessary to promote innovation and meet the challenges raised by transport and the related societal needs.

To meet these goals, appropriate infrastructures, technologies and services will need to be developed and targets have been set for this. For example, this would include the full deployment of SESAR Programme to achieve a modernised and cost-effective ATM system for Europe.

3.2. Baseline

SESAR2020 is the successor programme to SESAR1. This section describes the situation before SESAR1 in terms of:

- The ATM value chain in terms of the development of new products; and
- The modes of ATM research prior to SESAR1.

The purpose in doing so is to further explain the need for the SESAR programme and establish issues that SESAR was intended to address. The section therefore concludes with a synopsis of the findings of the SESAR1 Evaluation that has been conducted in parallel to this evaluation in order to define the remaining challenges for SESAR2020.

3.2.1. ATM Value Chain

Air Traffic Management (ATM) is central to the provision of safe and efficient Air Transport. ATM is typically provided under monopoly conditions by national Air Navigation Service Providers (ANSPs). ANSPs were traditionally part of the Government, often with the same organisation providing regulatory functions (this is still the case in America, where the Federal Aviation Authority (FAA) is both regulator and service provider).

Over the last 20 years there has been a steady process of "corporatisation" of ANSPs. In most cases the ANSP is created as a standalone organisation fully funded by the collection of Air Navigation Charges from Airspace Users. These organisations typically remain under public ownership but there are examples where they are under private ownership (for example NATS and NavCanada).

Whilst en-route ATM is provided as a monopoly service there have been a number of States who have decided to open airport Air Traffic Control (ATC) services to competition. The most mature market is in the UK, but Spain, Germany and Norway (amongst others) allow for some competition for ATM services.

This has led to two quite distinct markets for ATM products within Europe:

- A rather static market for en-route systems such as Flight Data Processors (FDP), Radar Data Processes (RDP) and Controller Work Positions. These systems tended to have a lifecycle of between 10 and 20 years.
- A more dynamic market for airport systems (Tower FDPs, airfield lighting systems, surface movement guidance and control systems).

For en-route systems manufacturers tended to develop new generations under contract to an ANSP. Each new system would be specified by the ANSP and developed as a bespoke system, often with proprietary interfaces. This led to limited development of products.

As the market for airport ATC systems is several hundred airports across Europe rather than one en-route ANSP per State, there tended to be more innovation in airport systems.

3.2.2. ATM Research prior to SESAR

In 2005 air transport was experiencing significant year on year growth and a fear that delays would increase again if significant action was not taken to modernise and de-fragment European ATM. Significant R&D was being undertaken in Air Traffic Management. EUROCONTROL spent about €150-200 million a year on research and development (although some of this cost covers the planning and coordination of implementation) in the ATM sector; the Commission funding for ATM under the Fifth Framework Programme amounted to €20.8 million between 1998 and 2002, and was planned to support ATM by around €100 million over the 2002-2006 period; and the European Investment Bank also contributed €390 million to support ATM in Europe between 1999 and 2003 (Steer Davies Gleave, 2005).

The review of existing R&D by the SESAR definition phase identified 58 initiatives; including (SESAR Consortium DLT-0507-221-00-02, 2006):

- FP6 funded programmes including research on topics such as SWIM, A-SMGCS and CDM, which were to become central to the SESAR Development Phase work programme.
- EUROCONTROL research including the PHARE[12] which included research on 4D trajectory management, which formed the basis of the concept, developed with the Definition Phase.
- National Programmes which fed into the procurement plans of ANSPs. In particular, LFV in Sweden had a strong national programme.

The R&D tended to be conducted by research organisations and ANSPs, with limited involvement from airspace users and airport operators. A core issue at the time was application of Airborne Separation Assistance System (ASAS) within a Free Flight environment – including delegation of separation tasks to the cockpit and how this fitted in with the trajectory based concepts. Without the creation of SESAR it is not clear how the completing issues would have been resolved.

[12] https://www.eurocontrol.int/phare/public/subsite_homepage/homepage.html

3.2.3. Issues for SESAR2020

The work of SESAR1 has already addressed the core issues:

- Fragmentation: The SJU is a focal point for the SESAR Development Phase and, with the support the Membership, are able to support prioritisation of R&D within ATM.
- Limited deployment: A number of "solutions" developed by SESAR1 are already being deployed (see Section 7.4.3). With the launch of the SESAR Deployment Phase this is set to increase.
- Limited involvement: The working methods within SESAR1 have led to more integrated R&D teams consisting of airports, ANSPs and manufacturers. Through specific contractual arrangements the SJU was able to ensure input from airlines, staff, military, and regulators and in the process helped to build consensus on the developed solutions.

The challenges for the SJU in managing the SESAR2020 work programme are:

- Strengthening links to the wider R&D community (academia, SMEs, etc.) to ensure the innovation pipeline is fed with ideas from the wider community in line with H2020 objectives.
- Strengthening links with the Deployment Phase to ensure that the solutions required for early deployment are prioritised.
- Strengthening the process for developing the European ATM Master Plan and ensuring it remains consistent with SES goals but also expands its scope to include additional objectives from Horizon 2020 – for example considering role of ATM in achieving resource efficient transport that respects the environment.

4. EVALUATION QUESTIONS

The underlying objective of this interim evaluation is to assess progress and mid-term achievements of the SJU operation during the period 2014-2016. It is a challenging objective considering that no projects have been completed by the end of 2016.

As stipulated in Article 32(3) of the Council Regulation (EU) 1291/2013, the interim evaluation of SJU should focus on the following main aspects:

- **Openness**: The extent to which the SJU enables world-class research that helps Europe drive in to a leadership position globally, and how it engages with a wider constituency to open the research to the broader society.
- **Transparency**: The extent to which the SJU keeps an open non-discriminatory attitude towards a wide community of stakeholders and provides them with easy and effective access to information.
- **Effectiveness**: The progress towards achieving the objectives set, including how all parties in the PPP live up to their financial and managerial responsibilities.
- **Efficiency:** (a requirement set in Article 25(3) of the Council Regulation (EU) 1291/2013) will consider the relationship between the resources used by an intervention and the changes generated by the intervention.

The above mentioned main evaluation aspects are integrated in the overall evaluation framework (addressed under different evaluation questions listed below).

Evaluation question 1: Background, objectives and relevance of the initiative (see Section 3)

PPPs are one of the Horizon 2020 implementation modalities, where all involved partners commit to support the development and implementation of industrial research and innovation activities of strategic importance to the Union's competitiveness and industrial leadership or to addressing specific societal challenges[13].

The SJU is part of the Smart, Green and Integrated Transport Challenge under the Societal Challenges pillar of Horizon 2020, alongside the S2R JU, the Clean Sky JU and the FCH JU. The Smart, Green and Integrated Transport Challenge aims to boost the competitiveness of the European transport industries and achieve a European transport system that is resource-efficient, climate-and-environmentally-friendly, safe and seamless for the benefit of all citizens, the economy and society, in accordance with the Europe 2020 Strategy and with a view to meeting the 2030 and 2050 targets set out in the Transport White Paper as well as those of other policy initiatives.

The policy and regulatory framework were analysed, and context and background information concerning the extension of the SJU provided, specifically, while also highlighting any commonalities or major differences with the other TJU. A brief description of the initiative, its objectives and the problems it intends to solve under SESAR 2020 is presented. This information is summarised in an Intervention Logic diagram.

The analysis assesses how well adapted the establishment and extension of the SJU specifically, and of the TJUs in general, is with regard to the EU's general transport objectives and the challenges identified. It considers whether the objectives and tasks set out in the SJU's basic act have been appropriate in this respect.

[13]Art 25.1 of the Council Regulation (EU) No 1291/2013 establishing Horizon 2020.

Evaluation question 2: Implementation of the SJU under S2020 (see Section 6)

The focus of this question is on understanding how the programme is being implemented and assess whether the PPP made public funds accessible through transparent processes and through competitive calls, and in accordance with the provisions of SJU Statutes in Annex I of the SJU Regulation (Council Regulation (EC) No 219/2007). The analysis includes an overview of the budget allocation among the different work areas, the allocation methods and patterns between calls for the SJU Members and open calls for non-members and the types and sizes of projects. Information about different participation patterns and the distribution of funds among beneficiaries provides the necessary evidence in assessing whether the SJU has reached the main actors in European research.

Evaluation question 3: Effectiveness of implementation and main achievements (see Sections 7.1 and 7.2.2)

The overall approach in answering this evaluation question focuses on assessing the link between the SJU's mandate/responsibilities and objectives set in the Article 1(5) of its legal basis, its governance and the actual activities and performance.

- *SJU's mission and governance*. The amended legal basis is reviewed to address the key issues in the context of this evaluation: whether the establishment of the SJU and its governance are in line with the basic act and whether they represent a workable framework for achieving the objectives set for in Article 1(5) of its basic act, including how all parties in the PPP live up to their financial and managerial responsibilities and keep an open non-discriminatory attitude towards a wide community of stakeholders.
- *Operational Effectiveness.* The progress of the SJU towards meeting the objectives set out for it in Article 1(5) of the SJU Regulation is assessed, in particular evaluating whether its operational framework and activities have been effective in this respect.
- *Direct achievements*. Direct achievements focus on concrete outcomes and deliverables of SJU interventions ('what is produced through this intervention'). Information on different forms of the direct achievements is crucial to assess whether SJU funded research projects reached their scientific goals. It also represents the core of an evidence-based analysis of the funded projects. However, considering that not even one project was completed by the end of 2016, it is acknowledged that this is a particularly challenging task. Thus, for the current exercise, expected outputs and results to be produced by the SJU's funded research based on the ATM Master Plan, SESAR 2020 and the Key Performance Indicators (KPIs) are examined and assessed.

Evaluation question 4: Operational efficiency (see Section 7.2.3)

Efficiency considers the relationship between the resources used and changes generated. The analysis covers the efficiency of the governance structure and the efficiency of the operations, understood as the whole programme administration lifecycle (from setting up the research agenda, definition of the work programme and publication of Calls, to evaluation and selection of proposals, negotiation, contract/budget engagement).

Evaluation question 5: European added value (See Section 7.3)

The EU-added value relates to changes that can be reasonably attributed to an EU intervention, rather than other factors. A full analysis and evidence in response to this evaluation question will be addressed centrally by the Horizon 2020 Interim Evaluation (at the central level).

To answer this question at the SJU level, the additional value resulting from the extension of the SJU specifically, and the TJUs more generally is considered, compared to what would have been achieved without setting up such structures at EU level.

Among others this assessment covers the SJU's ability to leverage additional investments in research and innovation. Leverage effect reflects the SJU's ability to attract additional financing and multiply Horizon 2020 budget resources, including additional activities (if applicable) which are activities of the industry outside the work plan of the SJU. The leverage effect is defined as the total amount of funds leveraged through an Article 187 initiative, including additional activities, divided by the respective EU contribution to this initiative.

Evaluation Question 6: Coherence (See Section 7.4)

The question of 'coherence' is mainly relevant at programme/general objectives level, i.e. Horizon 2020 and will be fully addressed in the Horizon 2020 Interim Evaluation.

However, information at specific action level could valuably feed into the overall analysis. The evaluation considers how well the intervention worked: i) internally within the SJU (ability to coordinate different viewpoints and strategies within the ATM sector), ii) within H2020 and iii) with other EU policies and interventions.

The Council Regulation establishing Horizon 2020 states that the research priorities covered by PPPs may, where appropriate, be included in regular calls of Horizon 2020 work programmes, in order to develop new synergies with research and innovation activities of strategic importance[14]. On the other hand Article 1(5) of the SJU Regulation states that the role of the SJU is to "coordinate and concentrate all relevant research and development efforts in the Union". The implications of this clause and whether it has contributed to ensuring better coordination among projects and providing all stakeholders with relevant and available information on projects funded across Europe is assessed.

Evaluation question 7: Synthesis, conclusions and recommendations (see Sections 8 and 9)

The work done under the previous tasks is synthesised, conclusions are drawn and recommendations provided, based on the analyses of the available evidence.

[14]Article 25.4 of the COUNCIL REGULATION (EU) No 1291/2013 establishing Horizon 2020

5. METHOD/PROCESS FOLLOWED

5.1. Process/Methodology

5.1.1. Evaluation of the Transport Joint Undertakings

The European Commission assembled a team on nine experts under the Chairmanship of Prof. Michael Dooms to perform evaluations of the Transport Joint Undertakings (TJUs) namely: SESAR, Clean Sky and Shift2Rail. The expert team met on four occasions to ensure a consistent approach to the evaluations was taken. However, for the most part the evaluation teams worked independently from one another.

5.1.2. Evaluation of SESAR Joint Undertaking

The SESAR evaluation was performed by Dr. Tatjana Bolic and Mr. Paul Ravenhill, supported by Mr. Helge Pfeiffer (who supported both SESAR and Clean Sky evaluations) with additional material from Mrs. Heather Allen on Transport Issues.

The evaluation was conducted between 17th January and 30th June 2017 and was based solely on expert judgement and the information sources described below and in further detail in the Annexes to this report.

5.2. Sources of information

5.2.1. Documentation

Detailed desk study of relevant documentation was performed. Material consulted include:

- Legislation relating to SES and SESAR.
- SJU Documentation
- Annual Reports
- Annual Work Programmes
- Single Planning Documents
- Audit Reports
- External Reports

A full list of the material consulted in presented at Annex D.

5.2.2. Interviews

A number of face to face and telephone interviews were conducted with:

- Staff of the European Commission
- SESAR Joint Undertaking Staff
- SESAR Members
- Industry Stakeholders.

In total, 30 interviews were conducted between February and June 2017. A full list of interviews is presented in Annex E.

5.2.3. Public Survey

An on-line public survey was conducted between the 8th December 2016 and 10th March 2017. The questions were developed by the European Commission before the Evaluation Team initiated their work. The survey covered all nine Joint Undertakings operating under Horizon 2020. There were 68 responses for SESAR JU. The results are summarised and presented in Annex F.

5.2.4. Beneficiary Survey

A survey prepared by European Commission was sent to the 179 organisations that either participated in or applied for funds for SESAR1 and SESAR2020. There were 49 responses. The main results are presented in Annex G.

5.3. Limitations – robustness of findings

In general terms, the experts considered that the data collected to be sufficient for the tasks and had no reasons to doubt the robustness of their findings based on this study and data.

However, it should be noted that the work of the SJU under H2020 was only in the very early stages by the end of 2016. Significant progress has been made in launching projects in 2017; but this does not form part of the evaluation.

6. IMPLEMENTATION OF SESAR JOINT UNDERTAKING

6.1. Legal basis and institutional set-up

The SJU was established by Council Regulation 219/2007 in February 2007 (Council Regulation (EC) No 219/2007). This regulation was amended by Council Regulation (EC No 1361/2008) to give the SJU status as an EU-body. A full history of establishment phase is presented in the first Mid-Term Evaluation of the SJU (COWI, 2010). Under SESAR1, the SJU was required to meet all the obligations of an EU-body under Article 208 of Regulation (EU, EURATOM No 966/2012). As such, they were subject to extensive audit by the Court of Auditors and established an Internal Audit Capability. All previous audits and evaluations have indicated that the SJU was properly established and operated in accordance with the legal baseline for SESAR1.

For SESAR2020 the SJU was extended by (Council Regulation (EU) No 721/2014). The extension took account of the success of SJU under SESAR1. Recital 15 states:

The experience acquired from the operation of the Joint Undertaking as a Union body under Article 185 of Council Regulation (EC, Euratom) No 1605/2002[15] shows that the current framework of operation is sufficiently flexible and adapted to the needs of the Joint Undertaking. The Joint Undertaking should operate in accordance with Article 208 of Regulation (EU, Euratom) No 966/2012 of the European Parliament and the Council. The Joint Undertaking should also adopt financial rules which do not depart from the framework Financial Regulation except where its specific needs so require and with the Commission's prior consent.

The clear intent is continuity with the SESAR1 arrangements. However, Recital 16 also states:

The participation in indirect actions funded by the Joint Undertaking should comply with Regulation (EU) No 1290/2013 of the European Parliament and of the Council. It is not foreseen that a derogation in accordance with Article 1(3) of that Regulation will be necessary. The Joint Undertaking should, moreover, ensure consistent application of these rules based on relevant measures adopted by the Commission.

The legal basis therefore requires the SJU to act both as EU-body and fundamentally as a Horizon 2020 JTI. As will be seen in Section 7 this has led to duplicated efforts and confusion amongst the SJU Members.

On the other hand, the fact that the SJU was extended meant that the organisational set-up already existed and was efficient and dedicated enough to be able to adapt to the challenge of simultaneously closing the activities of SESAR1 whilst defining the SESAR2020 work programme, launching and concluding a Membership Process and organising a series of calls to launch the work programme. These achievements are discussed in the remainder of this section.

[15] Council Regulation (EC, Euratom) No 1605/2002 of 25 June 2002 on the Financial Regulation applicable to the general budget of the European Communities

6.2. SESAR2020 Budget

The overall budget for SESAR2020 is defined to be €1.58Bn. The breakdown of the budget by funding source is provided in Table 3.

Table 3. SESAR2020 Budget.

Source of Funding	Estimate
PPP Budget – EU H2020	€500 M
Budget – Exploratory research EU H2020	€85 M
PPP Budget – EUROCONTROL	€500 M
PPP Budget – Industry commitment	€500 M
Total	**€1585 M**

The final outturn is likely to be lower than the regulatory estimate for the following reasons:

- The Industry Commitment could fall below the full €500 million. It is understood from interviews with SJU staff that the current figure is closer to €400 million, but this may change with future calls.
- The change from SESAR1 rules to H2020 rules includes a change in the co-funding rates from 50% of actual costs to the 70% of eligible costs. If a co-funding is 70%, then the EU contribution will only co-fund €214 million leading to an overall budget of €1.299 Bn.
- However, eligible costs are calculated based on employment costs and fixed overhead rate. This leads to different co-funding rates based on actual costs. Based on the SESAR1 financial returns, the SJU has tentatively calculated that co-funding rate based on actual will be close to 56%. This would provide an overall budget close to the full €1.585 Bn.

The SESAR2020 budget is lower than that for SESAR1. The SESAR1 budget of €2.1 Bn equated to €300 M per annum for seven years; the SESAR2020 budget roughly €225 M per annum.

6.3. SESAR2020 Membership

6.3.1. Membership Process

In accordance with the requirements of the amended SJU Basic Regulation an open call for members was launched as a "Call for expressions of interest to become candidate member of the SESAR Joint Undertaking" on 9th of July 2014 (SJU, 2014a).

The intention was to achieve both renewal of the existing members and the attraction of new members. By the submission deadline of the 30th September 2014 there were 24 applications.

The negotiations with selected candidate members should have finished at the end of 2014, early 2015. Selected candidates were to be invited to submit their final proposal by the end of April 2015. However, as the transition to the Horizon 2020 rules was wrought with difficulties and consequent delays, SESAR 2020 Membership Accession call was

launched on 25th November 2015, with a deadline of 28th January 2016 (ADB(M)035-MoM, 2015). The Administration Board decided that 19 entities can accede to Membership of SJU on March 9th 2016. These 19 entities would account for "140 entities, with a very wide geographical scope" (ADB(M)032-MoM, 2014). The Membership Agreements were signed by Members on July 6th 2016 (ADB(D)14-2016, 2016).

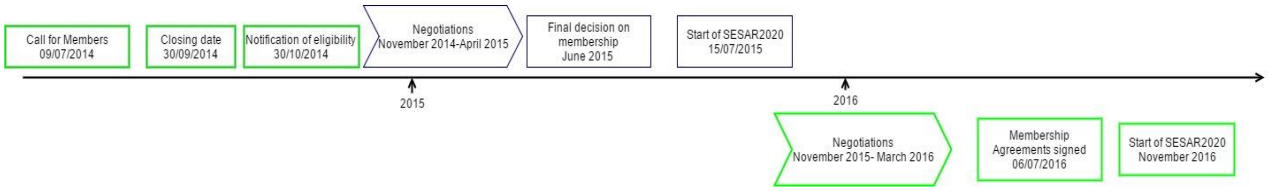


Figure 3. Timeline from the launch of the call for members until the start of SESAR2020.

The initially planned start date of SESAR 2020 should have been the 15th of July 2015, but the Membership agreements were signed by the SJU in March 2016[16] and by the Members in July of 2016. Consequently, the Grant Agreements for the projects restricted to SJU Members, signifying the start of the core SESAR2020, were signed between November 2016 and January 2017. Figure 3 depicts the planned timeline from the launch of the call for Members of SJU (above the timeline), and the actual closure of the call and initiation of Industrial Research in SESAR2020. The events in the green boxes represent the actual closure of the phases of the call. The black boxes depict the planned times for these events.

6.3.2. Members of SESAR2020

Table 4 lists the members of SESAR 2020. A Member that signed the Membership agreement can be a standalone company or a consortium. The consortia are not a legal entity, thus under a Horizon 2020 rules, each consortium member is a separate beneficiary.

Table 4. SJU members in S2020, and their companies (beneficiary), by sector, country and indication if they were part of SESAR1 or not.

Member	Beneficiary	Sector	Country	SESAR1
AT-ONE	DLR	Research Org	Germany	*
	NLR	Research Org	Netherlands	*
B4	PANSA	Service Provider	Poland	
	ANS CR	Service Provider	Czech Republic	
	ORO Navigacija	Service Provider	Lithuania	
	LPS SR	Service Provider	Slovak Republic	
COOPANS	Naviair	Service Provider	Denmark	√
	Croatia Control Ltd	Service Provider	Croatia	
	LFV	Service Provider	Sweden	√
	AustroControl	Service Provider	Austria	√
	IAA	Service Provider	Ireland	√
FSP	Frequentis AG	Ground Industry	Austria	√
	Atos Belgium SA/NV	Ground Industry	Belgium	
	HungaroControl	Service Provider	Hungary	

[16]http://www.sesarju.eu/sites/default/files/documents/adb/2016/ADB-D-02-2016-Accession_of_New_Members_signed.pdf

Member	Beneficiary	Sector	Country	SESAR1
NATMIG	Sintef	Ground Industry	Norway	√
	AirTel ATN Ltd	Ground Industry	Ireland	
	SaaB AB	Ground Industry	Sweden	
SEAC2020	Heathrow Airport Ltd	Service Provider	UK	√
	Munich Airport	Service Provider	Germany	√
	Aeroports de Paris	Service Provider	France	√
	Zurich Airport	Service Provider	Switzerland	√
	Schiphol Airport	Service Provider	Netherlands	√
	Avinor AS	Service Provider	Norway	√
	Swedavia AB	Service Provider	Sweden	√
Airbus SAS	Airbus SAS	Airborne Industry	France	√
Dassault Aviation	Dassault Aviation	Airborne Industry	France	
Honeywell Aerospace SAS	Honeywell Aerospace SAS	Airborne Industry	France	√
Thales Avionics SAS	Thales Avionics SAS	Airborne Industry	France	√
Finmeccanica – Leonardo	Finmeccanica – Leonardo***	Ground Industry	Italy	√
Indra Sistemas SA	Indra Sistemas SA	Ground Industry	Spain	√
Thales Air Systems SAS	Thales Air Systems SAS	Ground Industry	France	√
DFS	DFS	Service Provider	Germany	√
DSNA	DSNA	Service Provider	France	√
ENAIRE	ENAIRE	Service Provider	Spain	√
ENAV SpA	ENAV SpA	Service Provider	Italy	√
NATS EnRoute Plc	NATS EnRoute Plc	Service Provider	UK	√
Skyguide	SkyGuide	Service Provider	Switzerland	**

*Associate to SJU in SESAR1

**Associate to DSNA and DFS in SESAR1

***Two members in SESAR1 – Alenia Allemanchi and Selex S.I, now Finmecanicca – Leonardo.

As can be seen in the table above, there are 19 SJU members in S2020, which are composed of 37 individual companies, which are beneficiaries of H2020 grants. In addition, EUROCONTROL is a founding Member. The majority of EUROCONTROLs contributions are not subject to co-funding by the Commission as EUROCONTROL is an intergovernmental organisation and therefore not eligible. Some contribution by EUROCONTROL Maastricht Upper Area Control Centre is eligible for co-funding.

It is important to note that the SJU membership does not include Universities and SMEs, due to the costs of becoming a Member which are prohibitive for this type of organisations.

Table 5 lists the companies that are no longer Members of SJU in SESAR2020. There is only one consortium Member that pulled out of SESAR2020 – NORACON. NORACON was

composed of 9 entities, six of which continued into the SESAR2020, albeit within different consortia (e.g. Austro Control, LFV, Naviair and IAA are a part of COOPANS).

Table 5. Companies no longer Members of SJU in SESAR2020.

Company	SJU Member	Sector	Country
EANS	NORACON	Service Provider	Estonia
Finavia	NORACON	Service Provider	Finland
Isavia	NORACON	Service Provider	Iceland
Fraport	SEAC	Airport	Germany

Figure 4 below shows the distribution of the SJU members by country, while Figure 5 shows the distribution of beneficiaries (entities belonging to SJU Members) by country.

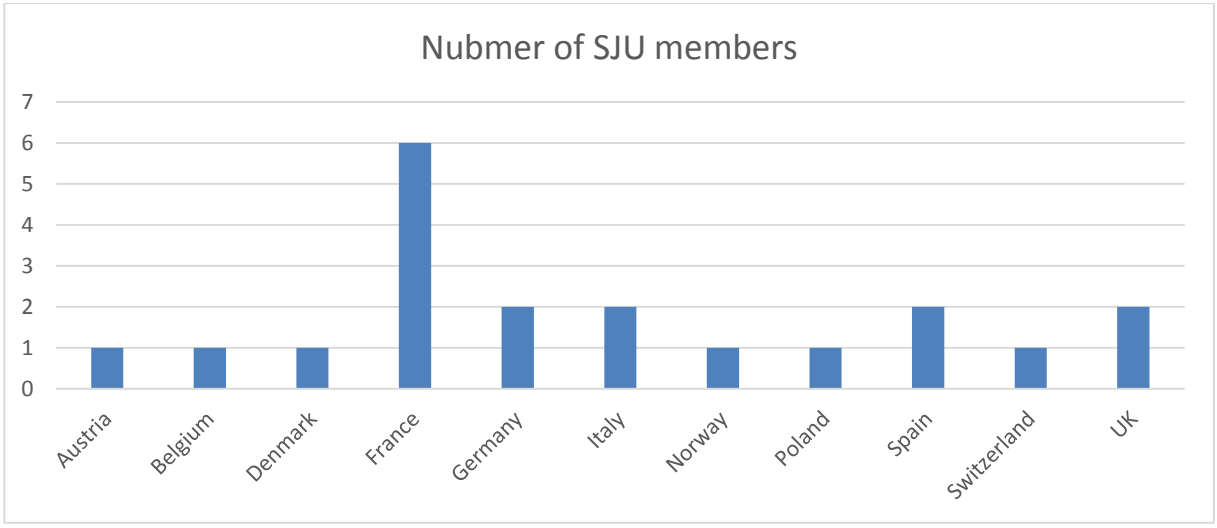


Figure 4. SJU membership, by country.

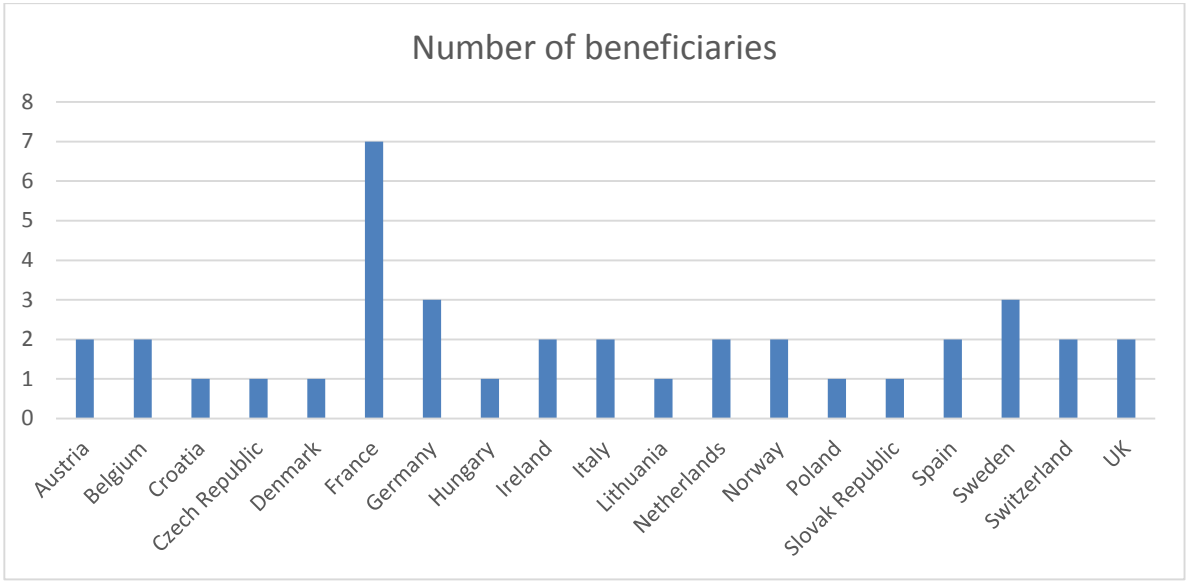


Figure 5. Number of SJU member companies (beneficiaries) by country.

As can be seen in Figure 5, the highest number of beneficiaries is situated in France. Those entities account for an ANSP, airports, and manufacturers of air (airframe and avionics) and ground systems (air traffic control systems).

6.3.3. Comparison with SESAR1

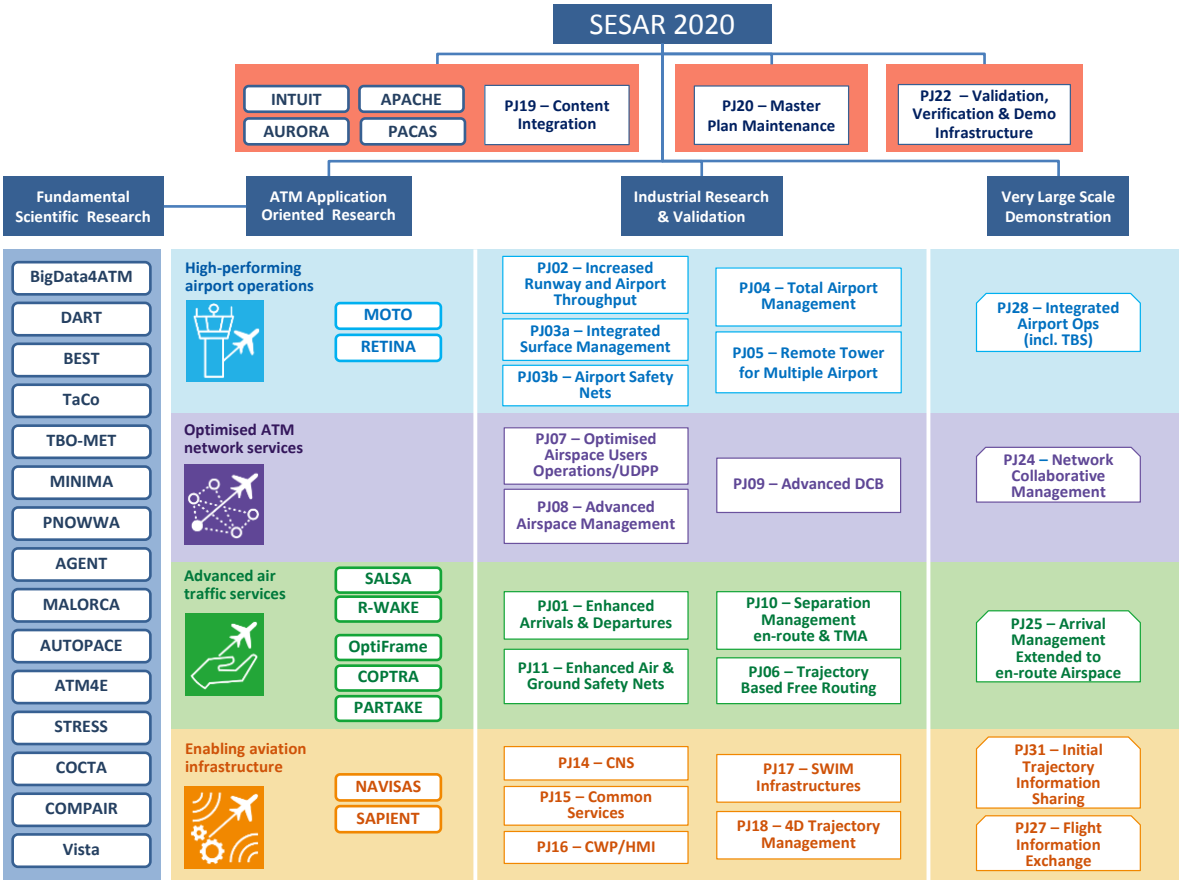
Table 4 and Table 5 demonstrate strong continuity in membership from SESAR1 to SESAR 2020. Nevertheless, all candidate members underwent a thorough evaluation. Finally, on the 9th March 2016 (July 2016 signed by Members), the SESAR JU Membership was officially renewed[17] with 19 (20) entities (EUROCONTROL is a founding member).

In SESAR1, in addition to Full Members, two forms of associates were used: "Associate to the SJU" and "Associate to a Member of the SJU". Under H2020 rules, these forms of membership are no longer possible, being replaced by Linked Third Parties (LTPs). Skyguide was previously an Associate to two Members (DSNA and DFS) and AT-One were an Associate to the SJU. After the first wave of calls restricted to SJU members, 78 (out of 140 identified at the accession process) LTPs are participating in the awarded Grant Agreements.

Whereas the "associates" in the Clean Sky Joint Undertaking are a matter of the Council Regulation and its annexes, such provisions for the SESAR JU do not exist in the respective SJU regulations its amendments (Council Regulation (EC) No 219/2007; Council Regulation (EU) No 721/2014).

6.4. SESAR2020 Work Programme

The SESAR Work Programme is illustrated in Figure 6 which also indicates the projects selected by calls in 2016. The Work programme is described in greater detail in Annex B.



[17] Allowed accession by the SJU, that is to say, accession was signed by the SJU, Members signed the agreements on 6th July 2016.

Figure 6: SESAR2020 Work Programme, from (SJU, 2016).

The structure of the SESAR2020 Work Programme is significantly different from SESAR1. In particular, within the Industrial Research and Validation part, rather than having several hundred interrelated projects, there are now 25 projects or "PJs" that integrate all the research activities required to mature SESAR solutions. SESAR solutions are the real outputs of SESAR Development Phase. They represent new or improved technologies and concepts that can be deployed to support achievement of the SES high level goals.

The core programme is organised into four areas:

- High Performing Airport Operations,
- Optimised ATM network services,
- Advanced air traffic services,
- Enabling aviation infrastructure.

The core programme of Industrial Research and Validation is supported by Very Large Scale Demonstrations which are designed to add additional evidence of the maturity of SESAR solutions and generate additional evidence for standardisation activities and nedeed regulatory approval.

Exploratory Research is divided in two parts: Fundamental Scientific Research, and ATM Application Oriental Research which is closer to the core programme.

The call structure used to launch this programme is described in the next section.

6.5. Call Structure

The budget for the three forms of activities is provided in Table 6.

Table 6. SESAR2020 work programme elements and associated budget, for duration of SESAR2020, excluding SJU running costs, studies, third parties and support (source (SJU, 2015a)).

	Type of Call	Budget
Industrial Research	Restricted Calls	€335m
Very Large Demonstrations	Restricted Calls	€63m
	Open Calls	€37m
Exploratory Research	Open Calls	€81m

6.5.1. Industrial Research

Industrial Research (Applied Research & Pre-industrial Development) and Validation (IR&V) calls are focused on maturing and validating technologies and operations, and are dedicated to SJU Members.

The topics are "aligned to ATM 'key features'", and the calls are launched in two "waves":

- Wave 1 covering 2016-2019 has already been launched,
- Wave 2 from 2019-2021 will be launched in 2018.

The division of the IR into two waves has the aim of enabling a re-focusing of efforts, in case the research results and the externally induced shift of priorities warrant it at the end of wave 1.

On 18th December 2015 a first call for proposals for Wave 1 of (IR&V) in the EU's Horizon 2020 programme was published, calling for Industrial Research and restricted Very Large Demonstrations (VLDs are addressed in the section 6.5.2), under the call identification number H2020-SESAR-2015-2.

The call description states: "This call for proposals brings the results from the SESAR Programme 1, requiring further research, as well as new research content aligned with the European ATM Master Plan together in a coordinated programme of activities performed across 28 closely connected actions. This work will award as a maximum of 28 complementary grants to be awarded to the Members of the SJU and performed in the context of the SESAR2020 partnership arrangements and managed within a formal governance structure."

The activities of this call, were organised into three separate Work Areas and broken down into 28 topics:

- Work Area A – SESAR 2020 Transversal Activities: 3 topics,
- Work Area B – Industrial Research & Validation Activities: 18 topics,
- Work Area C – Very Large Scale Demonstrations Activities: 7 topics[18].

The total budget allocated for this call was 260 M€ (218 M€ for IR&V comprising Work Areas A and B, and 42 M€ for VLD comprising Work Area C).

At the close of the call, one proposal was received for each area of the call.

Evaluation (by topics) took place in Q2 of 2016, and was performed by SJU expert and programme management staff, and at least one independent expert. Applicants were informed of the evaluation on 8th July 2016. Out of 21 proposals for Work Areas A and B, 20 proposals were retained (IR&V projects). All the grants were signed in the period from 30th September to 1st December 2016. "Pre-financings for all 25[19] grant agreements have also been paid in Q4 2016. Consequently, all IR and VLD projects were launched in execution in Q3 and Q4 2016." (SJU, 2016).

Figure 7 shows the number of beneficiaries (SJU Members or partners in the SJU Member consortia) by country. As the geographical participation is the same as for the SJU membership (Figure 5), it shows that all the SJU Members and partners in SJU Member consortia participate in the awarded projects.

[18] Note that further details on this part of the call (restricted VLD) can be found in Section 6.5.2

[19] Number 25 includes 5 VLD projects (restricted to SJU Members) awarded.

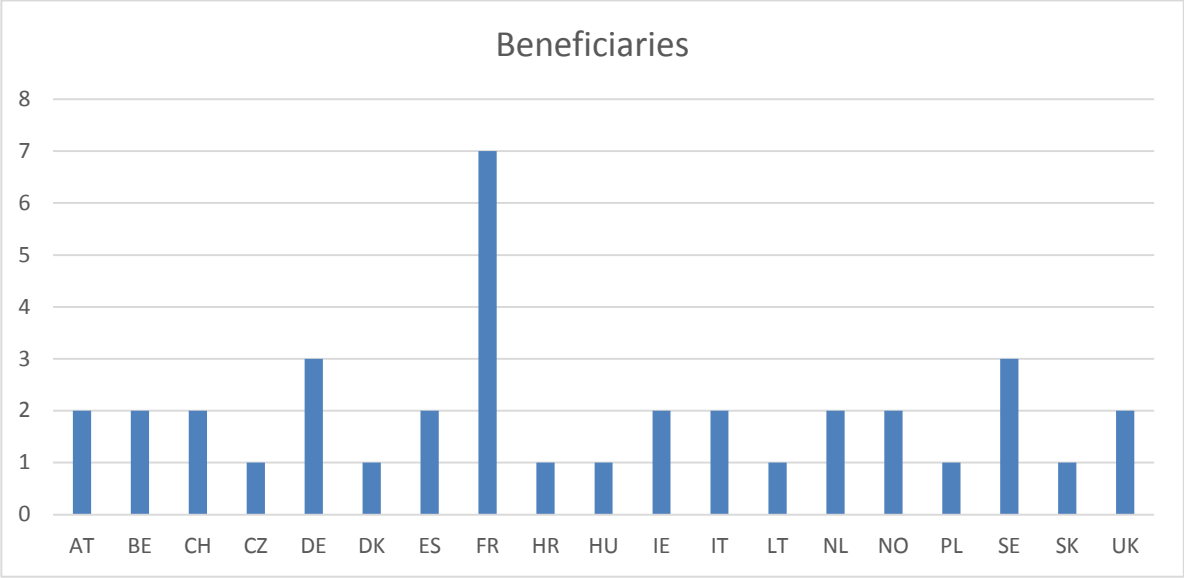


Figure 7. Number of beneficiaries (SJU members or partners in the SJU member consortia), by country.

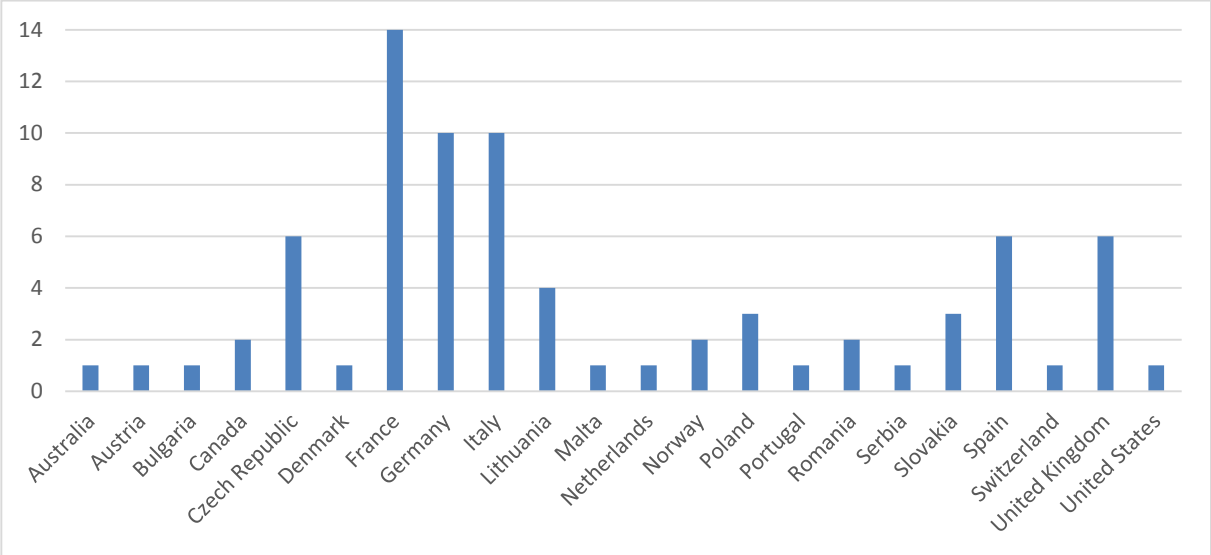


Figure 8. Distribution of LTPs by country, for the 20 awarded IR&V projects.

Figure 8 shows the distribution of LTPs by country for the 20 IR&V projects. In total, 78 LTPs are participating.

Average grant size for the 20 projects is €23.411.293,73. The average EU contribution requested in these projects is €10.440.423,49. Out of €218 M earmarked for these Work Areas, €208,8 M were awarded.

6.5.2. Very Large Demonstrations

Very Large Scale Demonstration (VLD) calls aim to apply the operational concepts and technologies to a larger scale, wider geographic scope and in real operations including more stakeholders, in order to better assess the benefits and caveats of possible deployments. The demonstrations are considered as the bridge to the deployment activities. There are calls aimed at SESAR 2020 members and a number of open calls. On December 18th of 2015, SJU published a restricted call on large scale demonstration activities under the call number H2020-SESAR-2015-2 (Work Area C), covering 7 topics.

At the close of the call, 7 proposals were received addressing Work Area C, VLDs. One of the proposals was ineligible as it failed to meet the eligibility criteria requiring at least three applicant Members to participate in the activity. Five projects were retained.

All the Grants were signed in the period from 30th September to 1st December 2016.

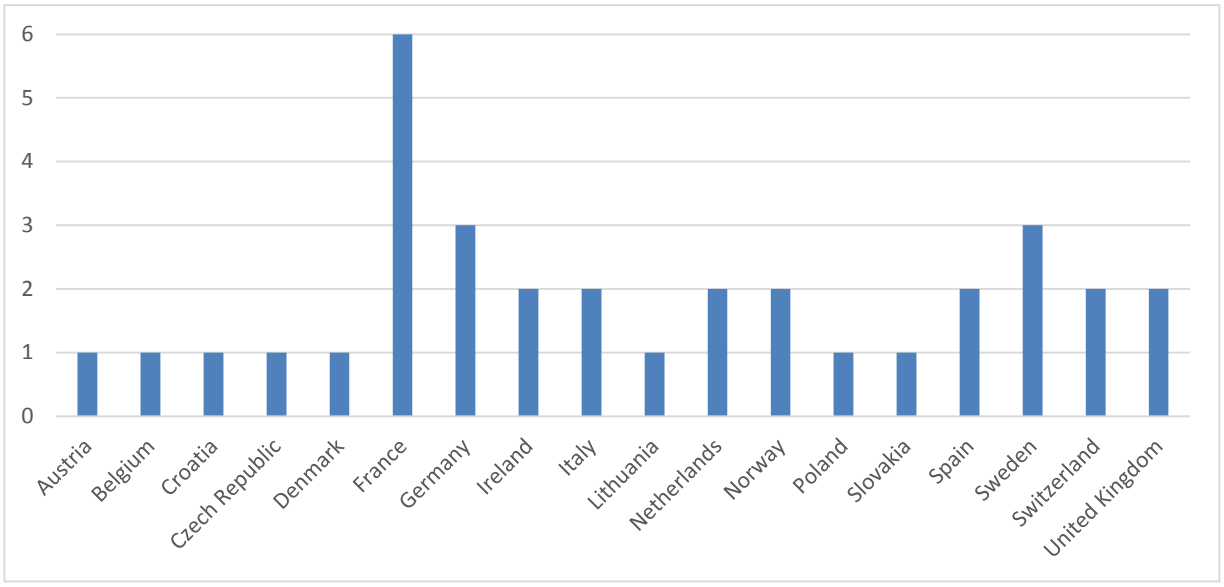


Figure 9. Beneficiaries (SJU members or partners in the SJU Member consortia), by country.

Figure 9 shows the distribution of beneficiaries by country. There are 34 beneficiaries, indicating that 4 SJU Members (or partners in SJU member consortia) do not participate in the restricted VLD projects.

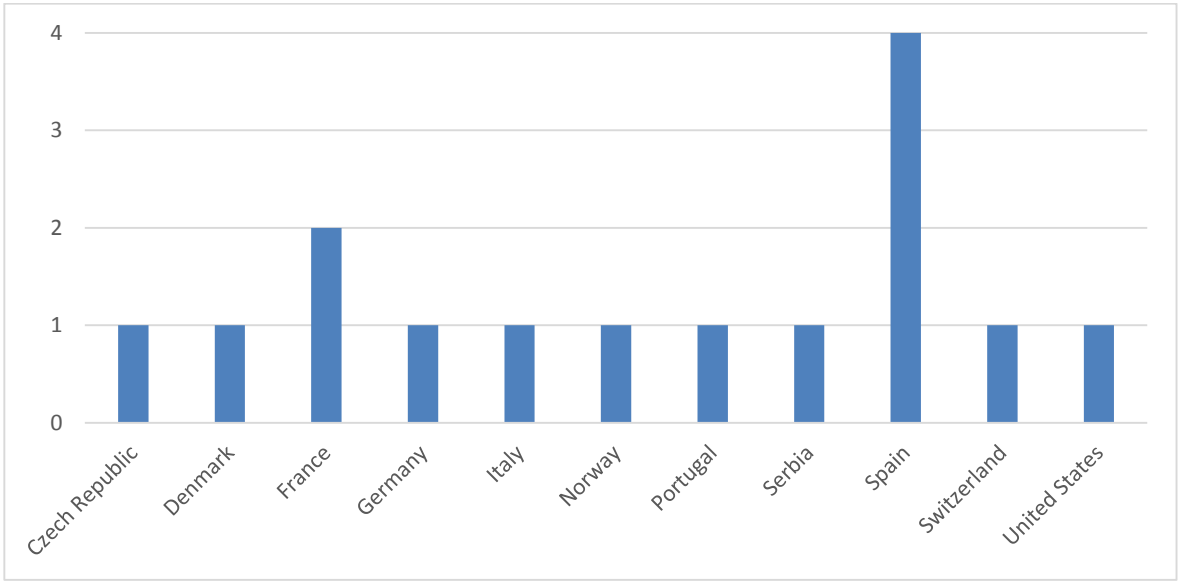


Figure 10. LTPs, by country.

Figure 10 shows the geographical distribution of LTPs participating in the awarded VLD projects.

Average Grant size across the five projects is €11.976.933,00, and the average requested EU funding is €7.541.912,38. Out of 43 M€ earmarked for this Work Area, 37,7 M€ were awarded.

On December 15th 2016, an open call for VLDs was launched, under the H2020-SESAR-2016-2 call. The call itself covers two Work Areas: Exploratory Research[20] and VLDs. The VLD Work Area consists of 10 topics, with the earmarked budget of €18 M.

6.5.3. Exploratory Research[21]

Exploratory Research (ER) concentrates on excellent science and initial applications for ATM with a low maturity (TRL 1-2). The condition for ER topics is that they provide input for the European ATM Master Plan.

Table 7. ER Calls.

Call Title	Submitted Proposals	Projects Approved	Call Budget
Exploratory Research call 1 (ER1), 2015	128	28	20.6 M€
Exploratory Research call 2 – RPAS (ER2-RPAS), 2016	59	9	9 M€
Exploratory Research call 3 (ER3)	N/A	N/A	10 M€

ER1 call was launched on 19th March 2015, with the call identifier of H2020-SESAR-2015-1. The call was closed on 25th June of 2015, with 128 proposals. Three proposals were ineligible and 123 were evaluated by independent experts who were paired with SJU ATM scientific expert representatives. There were 264 entities participating in the call, 66 of which (25%) were SMEs.

For ER1, 28 projects were selected. Applicants were informed on 16th November 2015 and the Grant Agreement Preparation (GAP) phase started in Q3 2015 and concluded in Q2 2016. The selected projects involve 83 beneficiaries and 2 LTPs. Eight of the projects are co-ordinated by SMEs. There are 13 SMEs (16%) in the consortia of the 28 awarded projects. The average grant size in this call was €779.138,71, and the average requested EU funding was €729.781,50. In total, €20,4 M of the ER budget is committed after the GA signing.

Figure 11 shows the distribution of beneficiaries of ER1 call by country.

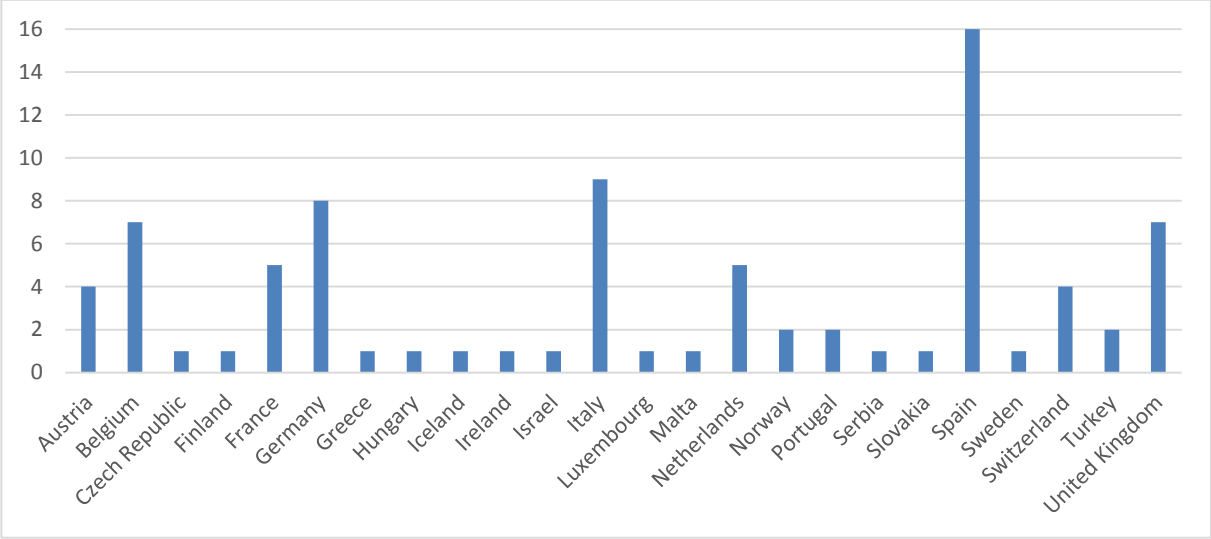


Figure 11. ER1 beneficiaries, by country.

[20] See section 6.5.3 for details on ER Work Area.

[21] Information taken from CAAR2016

The ER2 call with the objective to address unresolved problems across the ATM Research domain and to transfer the results of past research and apply them to new applications and/or novel technologies in the area of RPAS (drones). The call opened on 14th July 2016 and closed on 15th November 2016. There were 59 proposals submitted, of which one was withdrawn and two were considered ineligible. The remote evaluations took place in December 2016 and the central ones in January 2017, resulting in 9 selected projects. As the award of the grants and the project duration is after December 31st 2016, this is out of scope of this evaluation.

A third ER (open) call was launched on 15th December 2016 and it closed on 11th May 2017. The call covers two different Work Areas: 'Exploratory Research' covering 6 topics and 'Very Large Scale Demonstrations' covering a further 10 topics (for details on VLD, see section 6.5.2). Table 7 shows the budget foreseen for the ER topics in the call.

7. ANSWERS TO THE EVALUATION QUESTIONS

7.1. Main achievements and effectiveness of implementation

7.1.1. Main Achievements

The main achievements under SESAR2020 work programme up to end of 2016 are:

- Definition of the new work programme,
- The call for Membership,
- The calls for R&D activities,
- Launching the R&D activities.

These achievements are described in Section 6. This section provides a commentary based on the interviews, survey results and documents consulted on the effectiveness of these achievements.

Several stakeholders and stakeholder bodies provided the SJU with lessons learned documents at the closing of SESAR1 (e.g. SESAR Scientific Committee, 2016). From the programme content view, a significant number of the recommendations have been accepted and implemented.

The new Terms of Reference and the organisation of the Scientific Committee (see Section 7.2.1.2) addresses a majority of the recommendations on the ways of working and involvements submitted by the previous Scientific Committee (SESAR Scientific Committee, 2016). One of the recommendations regarded the "taking care of careers", that is to say of providing a career path from the undergraduate studies to the employment. SESAR1 funded many good Ph.D. students, however, no mechanisms were there to ensure their involvement in the future, unless directly employed by the industry. On the other hand, SJU Members have a hard time to employ the staff with the education appropriate for their purposes. Among other actions, in order to bridge this gap, the SJU launched a call for Knowledge Transfer Network (SESAR-ER3-01-2016: Knowledge Transfer Network (KTN)).

In our interviews with SESAR Members, the SESAR1 main programme was characterised as complex and very fragmented. It was composed of about 360 projects, divided into operational, technical and transversal projects. In the last years of SESAR1, the SJU embarked on rationalisation of the programme through the application of the "Solution" approach. "Solutions are operational and technological improvements developed by SESAR members and partners which aim to contribute to the modernisation of the European and global ATM system." (IAS , 2016). The Solution focuses on a bundle of operational improvements and enablers that are a part of a logical whole (from the deployment and finally operational point of view). As such, it linked two, and often more SESAR1 projects. Furthermore, the Solution approach made it easier to focus on deployable outcomes from the projects. The SJU divided the Solutions into Releases, whereby a Solution that passes the V3 maturity gate (TRLs 6 and 7), is released. Currently SESAR Catalogue contains 63 solutions (SJU, 2016a), the result of 5 Releases. Some of 63 solutions are a part of Pilot Common Project (COMMISSION IR (EU) No 716/2014, 2014), and are in the process of being deployed by SESAR Deployment Manager. Some solutions, like a Remote Tower, are already deployed by different stakeholders.

This consolidation exercise and the overhaul was applied to the Level 1 of European ATM Master Plan (SJU, 2015b), and the Multiannual Work Programme of SESAR 2020 (SJU, 2015a). Thus, the core of SESAR2020 programme, dedicated to the SJU members now consists of 20 projects (CSAs and RIAs) (SJU, 2016), each of the projects focuses on the set of solutions, integrating operational, technical and transversal areas needed for

these solutions. There are 5 VLDs (SJU members only), and 28 Exploratory Research (open calls) projects ongoing, results of the calls in 2015 and 2016.

Openness and transparency. As can be seen in the Section 6, the research programme lead by SJU includes the best players in the ATM in Europe. The SJU Members include 38 (37+Eurocontrol) entities which include all the major industry players, and now even research institutions (AT-ONE). It is important to note that the SJU membership does not include Universities and SMEs, due to the costs of becoming a Member which are prohibitive for this type of organisations. However, some of the Universities and many SMEs are listed as the LTPs to the members, and 78 out of 140 listed in Membership accession process are participating in the projects awarded under wave 1 (call H2020-SESAR-2015-2). In the SESAR2020, SJU shows the intent of strengthening the links with academia and SMEs, through the Scientific Committee, which would benefit the future of the ATM research in providing the input into the innovation pipeline.

The responders to the stakeholder and beneficiary surveys (Annexes F and G), indicate that they find the SJU website and other communication channels (LinkedIn and Twitter) containing sufficient information on the running projects, information needed to prepare calls. The overall rating of the SJU website is very positive.

Regarding the transparency of the preparation of the calls, the written responses indicate that the topics covered by the SJU are identified within the European ATM Master Plan which does have wide stakeholder involvement in the update process. However, it was also noted that:

- The process of defining the work programme for the Industrial Research is inclusive of the Membership but not the wider community.
- There is less dialogue concerning the nature of open calls (e.g. for the Exploratory Research) although others note involvement of ART and ASDA associations as sources of ideas. Most responses would support wider involvement still.

The Commission regularly asks the SJU to represent the wider EU community from research to deployment, from safety to standards and connecting to space. The SJU is a trusted partner in new and innovative research planning for the sector, including drones and cyber security. This ensures the transparency and relevance of the whole programme for all stakeholders, including many new entrants.

7.1.2. Effectiveness of implementation

SJU became a focal point of European ATM Research and Development. There are points that can be improved, but the consensus is that SESAR created the needed momentum at European level. For example, ANSPs collaborate among themselves, with the industry, and overall. When the core technology and changes are in question, the SJU serves as an arbiter and leader. The long term vision of R&D is laid out in the Master Plan, which SJU continues to maintain and update. In order to improve this task, in the SESAR 2020, SJU created Master Plan Committee (see Section 7.2.1.2).

The multi-annual work programme (SJU, 2015a), and consequently the SESAR 2020 is very much focused on developing close-to-market/deployment solutions, which are to be transferred to Deployment Phase (either the SESAR Deployment Manager (SDM) or other stakeholders with a local benefit). As already mentioned, some solutions from SESAR1 are already deployed, or are being deployed.

On one hand, this approach has some very positive aspects, like industrialisation, improvement of ATM, etc. On the other hand, strong focus on innovation deployment might undermine the previous step, which is research. Under H2020, a portion of the SJU budget is earmarked for the Exploratory Research and Very Large Demonstrations, which

is an improvement over SESAR1 in this particular area. The involvement of the academia in the overall SESAR programme continues to be the weakest link, albeit it got stronger in SESAR2020. In SESAR1, it was not clear how the research coming out of the WP E (exploratory research) could or would be transferred to the core SESAR projects. For the most part, the research results just got stored. In SESAR2020, the calls for ER are aligned with the core SESAR projects (the ones open only to members), the goal of which is to ease the uptake of research results. This is aligned with the SJU mandate to research and develop ATM solutions, thus having more of a development view, much less pure research. This in its turn leaves the "pure" ATM research (TRL 0 and 1) out of the funding loop, as there are no other funding sources available. Out of national programmes, only Germany and UK still finance some ATM research at the national level. Within H2020, the only ATM related funding is in SESAR 2020 (to avoid duplication, and to respect SJU remit as described in SJU Basic regulation). This is a consequence of the decisions taken outside of SJU, but could lead to the deterioration of the first link of innovation pipeline – research and consequently education for the ATM. Respondents to the stakeholder survey noted that as a stated role of the SJU is to coordinate all ATM R&D, both SJU and other research funding bodies should take into account that there is no other European funding available to support ATM Research outside SESAR.

The calls and topics have been agreed upon at the level of the Multi-annual Work Programme (SJU, 2015a), and the budgetary level (e.g. €85 million for ER). Multi-annual Work Programme is a result of consolidation of the SESAR1 programme and its results. As mentioned above, the SESAR2020 programme consolidated operational, technical and transversal themes into Solutions approach. On the other hand, more leeway is available in the Exploratory Research programme, along the topics that are needed to further the main SESAR mandate.

The calls attract all major players in the European ATM R&D, especially on the research side. The success rate for the ER call was lower than in the WP E (SESAR1) calls, but that is the consequence of increased competition. Increased competition is caused by the slow disappearance of other sources for this type of research (e.g. national funding), and by the observed need to be a part of SESAR as this is now perceived as a flag ship in ATM R&D.

SJU Members, Stakeholder representatives on the SESAR Admin Board and SJU Management have all been uniformly critical of the application of H2020 rules within the context of SESAR (see section 7.2.1.3 for more details). Preliminary findings from the beneficiary survey show that for academic and SME beneficiaries not much has changed from SESAR1 to SESAR2020 in terms of relationship and services offered by SJU, as in both programmes their participation was based on project-based Grant Agreements.

7.2. SESAR Joint Undertaking's performance in 2014 - 2016

7.2.1. SESAR JU mission and governance

7.2.1.1. Membership and participation

A three-phase membership process, described in Section 6.3.1, was initiated on the 9th July 2014 leading to 24 submissions of interest and the selection of 19 members (see Table 4) which represents extension of the original membership of 15 consortia/companies. In particular, inclusion of the B4 Consortia leads to greater involvement of ANSPs from Eastern Europe and will help to ensure SESAR solutions are applicable in all SES airspace.

In SESAR1, in addition to Full Members, two forms of associates were used: "Associate to the SJU" and "Associate to a Member of the SJU". Under H2020 rules, these forms of membership are no longer possible, being replaced by Linked Third Parties (LTPs).

Skyguide was previously an Associate to two Members (DSNA and DFS) and AT-One were an Associate to the SJU.

Overall SESAR Membership is representative of the key actors in developing and deploying ATM systems (ANSP, Airports and Manufacturers).

SESAR Membership does not address all interested stakeholders. Airspace Users and Regulators are not represented within the Membership. It should be noted that this is expected as these groups have not been traditionally involved in ATM research. Only one SME is included and there are no Universities. For the first time SESAR has a consortium (full) member that represents two of the largest ATM Research Organisation (AT-ONE).

In addition to Membership (and Linked Third Party), there are a number of other routes to involvement in SESAR:

- Stakeholder Members of the Admin Board (the Airspace User community has a 10% voting right to ensure their voice is heard in the steering of the programme).
- Open calls (in particular for the Exploratory Research) which are aimed at academia and SMEs.
- External Contracts: Article 10 of the SJU Statutes allows for external contracts to be used for SJU tasks. This mechanism has been used to establish following contracts with stakeholders to ensure their input to the programme.
  - Commercial Airspace Users
  - General Aviation
  - Staff
  - Regulators
  - Military
- Sub-contracting: Members sub-contract some elements of their contribution to their supply chain. This is the most common route for SME involvement in SJU activities.

When considering all available routes, the SESAR2020 will have a wide range of expertise available covering all relevant stakeholders, industry and academia.

7.2.1.2. Governance arrangements

The organs of the Joint Undertaking are defined in the Statutes as the Administrative Board and the Executive Director. The amended legislation did not change the role or composition of the Admin Board. The minutes and decisions of the Admin Board are published on the SJU web site. The SJU Statutes include specific provisions of managing conflicts of the interest.

In addition to Members, the Admin Board includes senior representatives of stakeholder groups:

- Military
- Airspace Users
- ANSPs (through CANSO)
- Manufacturers (through ASD)
- Airports (through ACI)
- Professional Staff

- Scientific Community

The responsibilities of the Admin Board are defined by Article 5 of the Statutes of the Joint Undertaking. The Admin Board Minutes and Decisions support a conclusion that the Admin Board fulfils this role. In Stakeholder interviews it was noted that the Admin Board approves audited accounts and therefore there is a significant delay in their approval by the Admin Board.

Article 11 of the Statutes allows the SJU to establish working groups to support "tasks required by Article 1(5) of the Regulation" (Council Regulation (EC) No 219/2007). Three such working groups have been established for SESAR2020:

Table 8. SJU Committees, under H2020.

Programme Committee	Senior representatives of the Members tasked to provide strategic as well as specialist technical and operational oversight and advice and support to the SJU Executive Director in the SESAR 2020 Programme delivery, covering the Industrial Research & Validation and Very Large Scale Demonstrations phases of the Programme that may result in specific actions in support of Programme steering.
Master Planning Committee	Senior stakeholder and institutional representatives tasked with providing advice on the maintenance, execution, and update of the European ATM Master Plan (the Master Plan) and will contribute to maintaining a strong connection between the SESAR development and deployment activities.
Scientific Committee	Senior academics tasked to provide advice and recommendations to the SJU Executive Director on the progress and scientific content of the implementation of the SESAR Development Phase including SESAR 2020 Research Programme, on its implementation, monitoring and evaluation of research activities including the necessary bridge between the SESAR 2020 Exploratory Research and SESAR 2020 Industrial Research Activities.

The SJU have strengthened the roles of the Master Planning Committee (previously SESAR Performance Partnership) and the Scientific Committee.

The Master Planning Committee now contains senior stakeholder representatives of ANSPs, Airspace users, Airports, Manufacturers, staff alongside representatives of the SES institutions (European Commission, Network Manager, EDA, EASA, and EUROCAE). It has a clearer mandate to consult widely when advising on key industry issues such as updates to the Master Plan and provisional contents of Common Projects.

The Scientific Committee has also been strengthened, in particular by inclusion of a member of the Programme Committee to ensure links between the Exploratory Research and Industrial Research.

In our interviews, members and stakeholders were supportive of these changes.

7.2.1.3. Application of the H2020 rules

SJU Members, Stakeholder representatives on the SESAR Admin Board and SJU Management have all been uniformly critical of the application of H2020 rules within the context of SESAR. Reported issues include:

- H2020 rules do not support the concept of "programme". The membership agreement is about implementing the Master Plan, not simply completing the R&D activities. The previous rules had more flexibility to allow the work programme to adapt to the changing needs, the change stemming either from the results of the execution of work programme or from external factors.
- H2020 rules do not support the concept of "consortia" as a single beneficiary (SJU Member), as was the case in SESAR1. This is particularly cumbersome when considering the reporting requirements. SESAR consortia have coordinators that would normally support the reporting by all members. With the Horizon2020 tool set each Member must log on separately to access the relevant information.
- There is a significant increase in administrative burden for both the SJU and Members. For example, the financial reporting of Members is required both by grant agreements and the membership agreement. These reporting requirements are not aligned either in time or content.
- There is no retention of IPR by the SJU to support deployment and standardisation activities.

Members have expressed considerable concern that adoption of H2020 rules have weakened the partnership approach. This is due to a sense that literal adherence to the individual Grant Agreements may not fulfil the goals of SESAR as a programme. Under SESAR1, Members feel there was a greater flexibility to respond to the "performance objectives" by steering the work done to the most promising areas, and closing the ones proven to be "dead-ends". This can require re-allocation of work during the execution of a grant agreement.

It should be noted that the reported issues are in comparison to the SESAR1 rules, which were specifically designed to support the partnership approach. Evaluation of the H2020 vis-a-vis FP7 rules forms part of the other TJU evaluations and in particular that of Clean Sky.

In general, we conclude that H2020 rules are not well suited to management of a policy focussed Joint Undertaking that is based on a genuine partnership. Retention of the previous rules would have been more beneficial particularly in terms of ensuring that the SJU was able to more efficiently apply lessons learnt from SESAR1.

7.2.1.4. Lessons learnt

Members of the SJU support the concept of SESAR as a centralising force for R&D and as a wider policy to support modernisation of ATM in Europe. The benefits from R&D perspective were reported as:

- Use of common methodologies leading to more harmonised research. This was achieved through application of the E-OCVM and the development of methodologies for transversal issues such as Cost-Benefit Analysis, safety case, human factors, etc.
- Greater integration of network operators (ANSPs, Airports, Airspace Users) in the R&D process.

The majority of replies to the surveys suggest that the same level of involvement and consequent accomplishments would not have been achieved without the SJU.

In restructuring the work programme from SESAR1 to SESAR2020, the SJU has created single projects that cover both operational and technical aspects. There is widespread support for this from the Members.

7.2.2. Operational effectiveness

As described in more detail in sections 3, 6.1, and 7.2.1, SJU is a 'Union body' under Articles 208 and 209 of the EU Financial Regulation. As such, it is subject to audits as any other Union body. In period 2014-2016, eleven audits (excluding the audits on annual accounts) have been performed, and no critical recommendations were issued (SJU, 2016). SJU reports on the audits and the actions undertaken to address recommendations coming from audits.

Furthermore, the audits so far have found that the SJU operates according to its legal framework, and no evidence was found to suggest otherwise in this evaluation.

Article 11 of the Statutes allows the SJU to establish working groups to support "tasks required by Article 1(5) of the Regulation" (Council Regulation (EC) No 219/2007). Three such working groups have been established for SESAR2020, and their Terms of Reference have been updated (see Table 8 for detailed description):

- Programme Committee,
- Master Planning Committee,
- Scientific Committee.

The intention behind remodelling these Committees is to empower each to contribute more, in a more efficient way to the SESAR Programme. For example, in SESAR1, Master Planning Committee was an ad-hoc group, created when the Master Plan update was in progress. In SESAR2020, the intention is to retain the same group of people that can give continuity to the process. As another example, the Scientific Committee of SESAR1 noted that their expertise was in general underutilised. The intention in SESAR2020 is to use the scientific input as much as possible. However, these Committees have started their work only in the 2017 (out of scope of this evaluation), as in the previous two years efforts were focused on the closure of SESAR1 projects, renewal of Membership, setup of calls for projects and their initiation. Thus, the good intentions are present, and are being implemented, the results will be seen in the future.

The beneficiary survey (see Annex G) responses indicate that the beneficiaries are satisfied by the provision of services from the SJU side. Most of the complaints were directed to the change in administrative rules and burdens with the introduction of Horizon 2020 rules (see 7.2.1.3 for more details). Furthermore, almost all respondents (62 out of 68) agree that this type of a public-private partnership in the area of the ATM research brings better results to all ATM stakeholders in Europe, through better collaboration of all the stakeholders, cross-border initiatives and a strong link between the R&D and the wider SES policy through the ATM Master Plan.

7.2.3. Operational efficiency

Regarding the timely execution of the functions, the SJU is within the set targets for most of the KPIs (targets are set at the Horizon 2020 level), as reported in Table 9.

Table 9. Scoreboard of Horizon 2020 KPIs regarding the timely execution of JU functions (source: (SJU, 2016))

REF	Name of H2020 KPI	Definition	2015	2016
8	Time to inform (TTI) all applicants of outcome of evaluation	Number and % of information letters sent to applicants within target (153 days) Average TTI (calendar days) Maximum TTI (calendar days)	123 (100%) Average 146 days (Maximum 147 days)22	27 (100%) Average 79 days (Maximum: 79 days) 23
9	Redress after evaluation/evaluation review	Number of redresses requested	0%	0%
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	n/a	32 out of 53 (60,4%) Average: 240 days (Maximum: 358 days) 24
11	Time to sign (TTS) from successful applicant letter	Number and % of grants signed within target (92 days) Average TTS in calendar days Maximum TTS in calendar days	n/a	6 out of 53 (11,3%) Average 126 days (Maximum: 214) 25
12	Time to pay (% on time) for pre-financing, interim payment & final payment	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	n/a	Grants pre-financing < 30 days

As can be seen, only the Time to inform (TTI) indicator has values in both years, as in both years there were calls the evaluation of which was closed and the applicants informed. On the other hand, other indicators have values only for 2016, which is due to the timeline of the calls (i.e. evaluations were finished in 2015, but the Grant Agreement preparation process run into 2016).

[22] Refers to call H2020-SESAR-2015-1

[23] Refers to call H2020-SESAR-2015-2

[24] Refers to calls H2020-SESAR-2015-1 and H2020-SESAR-2015-2

[25] Refers to call H2020-SESAR-2015-2

It is important to note that the maximum values of Time to grant (TTG) and Time to sign (TTS) indicators are higher (even substantially) than the target value. This was caused in part by the delay of the Membership renewal process, and in part by some issues around the availability, integration and use of H2020 IT systems and their dependent systems necessary for awarding grants, as well as delays in the legal and financial validation of grant beneficiaries (SJU, 2015). A portion of delay can be attributed to the learning curve and the SJU staff workload (overlap of the closure of SESAR1 and ramp up of SESAR 2020). The SJU has taken steps since, to ensure the compliance with the set targets, including reallocation of staff.

As the whole ramp up of SESAR 2020 suffered a delay, there is only one value of the Time to pay indicator – the average number of days for pre-financing, which is below the set target of 30 days.

The cost of the evaluation of the ER1 call was €122 000, which amounts to about €1000 per eligible proposal.

Table 10. Budget and management efficiency in 2015 and 2016.

Year	Budget S2020 (€)	Budget SESAR1 (€)	Staff	Budget per head (€)	Administrative expenses(€)	Percent of total budget
2015	51.470.000	255.000.000	41	7.474.878	7.683.406	2,51%
2016	56.769.225	100.097.171	44	3.565.145	7.730.226	4,93%

It is important to note that in the period 2013-2016, SJU managed the closure of SESAR1 and the ramp-up of SESAR2020, thus the budget it managed includes both SESAR and SESAR2020 portions. Overall, in the SESAR1 the running costs of SJU were foreseen to be about 5% of the total budget. At the closure of SESAR1, the SJU staff estimate that the actual costs will be closer to 3,5%, and the SJU estimates that these costs will not increase in SESAR2020.

On one hand, as already mentioned in the section 7.2.1.3, the introduction of the Horizon 2020 rules has been cited by survey respondents as the reason for the actual increase of the administrative burden especially for the SJU members. On the other hand, the SJU staff expressed the view that even though the introduction and the adaptation to the new rules indeed increased the burden, there is indication that this will abate in the future as the process is being adopted.

7.3. EU Added Value

The primary definition of EU Added Value is the level of leverage achieved. That is the level of private funding attracted by the EU funding. Leverage is calculated as Total leveraged funds divided by the Total EU Contribution. Table 11 provides the expected leverage values for SESAR1 and SESAR2020.

Table 11. Leverage Values for SESAR

	Industrial Research (SESAR1)	Industrial Research (SESAR2020)
EU Funding	€700 M	€500 M
EUROCONTROL	€700 M	€500 M
Industry Max	€700 M	€500 M
Industry Min	-	€214 M
Leverage	2	2 to 1.4

Under SESAR2020 the Industrial Research will be co-funded at a fixed rate of 70% of eligible costs as defined in the Horizon 2020 rules as opposed to the 50% of actual costs used in SESAR1. Given the change in co-funding arrangements the leverage of SESAR2020 could be as low as 1.4 – significantly lower that the value achieved by SESAR1.

However, the SJU is required to use actual costs when computing added value under their financial reporting responsibilities. Actual costs are understood to vary substantially from H2020 eligible costs for different companies with different overhead rates. The SJU believe from previous calculations that the leverage for SESAR2020 will be closer to 1.8 achieved for SESAR1, when calculated using actual costs.

The stakeholder survey requested feedback on whether the proposed value of 1.4 was a reasonable leverage. Half of respondents supported the value, with the remainder slightly favouring a lower value. Most respondents felt that a value between 1.4 and 2 demonstrated the importance of the partnership. Respondents also supported different leverage values for the different types of research.

In addition to attracting private funds in support of the R&D required to achieve the SES High Level Goals – SESAR has created additional EU-value, for example: improving technical interoperability with neighbouring areas and creating a brand representing European leadership in ATM development. These concepts are discussed further under Coherence and Relevance.

7.4. Coherence

This section considers the coherence of SESAR2020 at four different levels:

Level	Definition
Internal	The extent to which the partners within the SJU support a combined vision.
H2020	The extent to which the activities of the SJU are coherent with other actions within H2020.
External – Europe	The extent to which the activities of the SJU are coherent with wider EU policies and Programmes.
External - Global	The extent to which SESAR is consistent with and contribute to global interoperability through ICAO and other international programmes.

7.4.1. Internal coherence

Coherence within the SESAR programme is maintained through the European ATM Master Plan and the work programme. European ATM Master Plan was originally published in 2008 by the Definition Phase (SESAR Consortium, 2008), and was endorsed by the Council on 30th March 2009 (Council Decision 2009/320/EC).

Two significant updates have been developed by the SJU – in 2012 and 2015. A further version is expected in 2018. Each update has been recognised as a significant improvement on the previous – building on the results of the research programme and change in context due to socio-economic developments. The adoption of the European ATM Master Plan by the SJU Admin Board signifies support from:

- EU Member States whose approval the European Commission attains by vote of the Single Sky Committee prior to voting in the SJU Admin Board,
- EUROCONTROL Member States whose approval EUROCONTROL attains prior the voting in the Admin Board,
- The Industry Members of the SJU,
- The wider stakeholder community represented in the Admin Board. The stakeholder representatives have a veto on approval of the Master Plan[26]. During our interviews, it was made clear that this role is taken seriously. The Airspace User community in particular have provided detailed positions prior to the approval of each subsequent edition[27].

The European ATM Master Plan provides a long term strategic programme for ATM research and development in line with the requirements of the Single European Sky. The Master Plan does require periodic update to reflect both progress in R&D and evolution of the ATM sector. The latest version of the Master Plan for example includes Drones and Cyber Security as new issues to be tackled by the SJU.

The creation of a Master Planning Committee within the SJU will strengthen internal coherence by ensuring alignment of the future editions of the European ATM Master Plan with the performance expectations of ATM modernisation.

[26] Article 4 (6) of the Statutes of the Joint Undertaking.

[27] Eg Minutes of Admin Board 35 in December 2015

7.4.2. Coherence within H2020

The policy focus of SESAR JU places greater importance on coherence with EU funding available for SESAR deployment which is discussed in the next sub-section. There is however a growing need to ensure coherence with the transport JUs and wider Horizon 2020 programme, particularly in terms of:

- Fundamental Research
- Clean Sky
- Future transport policy

In terms of fundamental research, SESAR1 had a policy of "concentration" of ATM R&D which has proved effective in de-fragmenting ATM research and building partnerships with a focus on deployment. It was less successful in building long term relationships with academia and therefore in promoting new entrants to the industry. It is clear that SESAR would benefit from links to the wider H2020 programme on topics such as cyber security, information technology, machine learning, advanced displays and other technologies that may influence the next generation of ATM products. This should not however reduce the focus on delivering SESAR solutions for deployment in the short and medium term.

There is a clear complementarity between the SESAR work programme and that of Clean Sky. Both have at their heart the real need to reduce the environmental foot print of aviation. For Clean Sky, the core focus is on a "Green Air Transport System" that is greener fuels and engines, lighter parts and better wings. For SESAR it is about the efficiency of the ATM procedures – ensuring the aircraft are able to fly the most environmentally sustainable trajectory. There is of course an overlap – for example the aircraft's Flight Management System is the airborne element of the ATM system and rightly falls into both programmes. SESAR needs to understand the future capabilities of aircraft in order to ensure that their procedures are as good as possible; Clean Sky needs to understand the evolution of ATM from the SESAR perspective to ensure that their proposed flight controls are consistent. Responses to the stakeholder survey supported the complementary nature of the research conducted by SJU and Clean Sky.

Recent interviews indicated that the required coordination and communication between the JUs[28] is not always optimum, although there are also examples of good practice. In 2012, a joint review was organised with the support of independent SESAR and Clean Sky experts to check whether there was double funding of activities undertaken by Thales for SJU and CS on Flight Management Systems. It was shown that there was a clear and demonstrable separation of work and costs in Thales that avoided the possibility of double funding.

Moreover, regular meetings between the JUs are organised to discuss possible areas of collaboration. This process was formalised by a Memorandum of Cooperation (MoC) between the CS2 JU and the SESAR JU in October 2015 *to support*[29] *"sharing of best practices, to identify gaps and secure synergies in areas where, a joint approach would be needed in respective development, validation and demonstration activities. The cooperation will also enhance the definition of the performance targets, in particular for environmental targets*."

However, there is evidence that the collaboration between SJU and Clean Sky could be strengthened. During the interviews, it became clear that the SJU are not provided with

[28] Article 2(h) of the Clean Sky 2 Statutes (Annex 1 of Council Regulation 558/2014) requires CleanSky2 to liaise with the SJU – there is no reciprocal requirement in the SJU Regulation).

[29] SESAR JOINT UNDERTAKING SINGLE PROGRAMMING DOCUMENT (Years 2017 - 2019)

adequate opportunity to view Clean Sky calls. It is also noted that, where a Clean Sky call covers an area of overlap, viewing of call texts is insufficient to ensure value for money. SJU staff must be involved in the elaboration of the call text so that it is consistent with the SESAR work programme, clearly identifies the dependencies on, and opportunities to use SESAR results and validation platforms and is consistent with the wider SJU role to coordinate ATM evolution in international fora. The coordination between Clean Sky and the SJU needs to be strengthened.

Finally, SESAR is clearly and correctly embedded in the SES policy aimed at the modernisation of ATM in Europe. There are of course wider transport policy issues such as multi-modal operations, through ticketing and use of common assets such as Galileo. It is appropriate for the SJU to be tasked to ensure that the ATM interfaces to these wider policy areas are investigated.

7.4.3. External coherence – Europe

SESAR is recognised in the EU's 2011 White Paper (European Commission, 2011) and the Aviation Strategy[30] as a key enabler for the implementation of the Single European Sky. Figure 12 illustrates the performance gains targeted by the SJU.

Key performance area	SES High-Level Goals vs. 2005	Key performance indicator	SESAR ambition vs. baseline 2012	
			Absolute saving	Relative saving
Cost efficiency: ANS productivity	Reduce ATM services unit cost by 50% or more	• Gate-to-gate direct ANS cost per flight - Determined unit cost for en-route ANS* - Determined unit cost for terminal ANS*	EUR 290-380	30-40%
Operational efficiency	-	• Fuel burn per flight (tonne/flight) • Flight time per flight (min/flight)	4-8 min 0.25-0.5 tonne	3-6 % 5-10 %
Capacity	Enable 3-fold increase in ATM capacity	• Departure delay (min/dep) - En-route air traffic flow management delay* - Primary and reactionary delays all causes • Additional flights at congested airports (million) • Networkthroughput additional flights (million)	1-3 min 0.2-0.4 (million) 7.6-9.5 (million) Additional flights, not saving	10-30 % 5-10 %[1] 80-100 %[2]
Environment	Enable 10 % reduction in the effects flights have on the environment	• CO_2 emissions (tonne/flight) - Horizontal flight efficiency (actual trajectory)* - Vertical efficiency - Taxi-out phase	0.79-1.6 tonne	5-10 %
Safety	Improve safety by factor 10	• Accidents with ATM contribution	No increase in accidents	Improvement by a factor 3-4
Security	-	• ATM related security incidents resulting in traffic disruptions	No increase in incidents	

Metrics with monetary value in business view

* Targeted by the Performance Scheme

[1] Additional flights that can be accommodated at congested airports, representing 5-10 % of flights at congested airports (~31 % of14,4 (million) flights in 2035).
[2] Additional traffic accommodated in 2035 in comparison with 2012 and associated with ANSP productivity gains, enabled by SESAR. Note: Numbers are rounded.

Figure 12: Performance ambitions of SESAR (source: European ATM Master Plan)

The SJU is a full participant in the Single European Sky Policy area. They have developed close working relationships with all the other relevant agencies and organisation including the European Aviation Safety Agency (EASA), European Defence Agency (EDA), the European Space Agency (ESA), EUROCAE – the European Organisation for Aviation Standards and the SESAR Deployment Manager.

[30] https://ec.europa.eu/transport/modes/air/aviation-strategy_en

The importance of SESAR is further reflected in the inclusion of SESAR as a priority area within the Connecting European Facility (CEF)[31]. The SESAR Deployment Manager has developed a comprehensive Deployment Plan (SESAR Deployment Manager, 2016) for the Pilot Common Project which includes 23 SESAR Solutions over 6 ATM Functionalities:

- **AF1 Extended Arrival Management and Performance Based Navigation** in high density TMAs, which is expected to improve the precision of approach trajectory as well as to facilitate traffic sequencing at earlier stage, thus allowing to reduce fuel consumption and environmental impact in descent/arrival phases;
- **AF2 Airport Integration and Throughput**, which is expected to improve runway safety and throughput, ensuring benefits in terms of fuel consumption and delay reduction as well as airport and airspace capacity;
- **AF3 Flexible Airspace Management and Free Route**, which enable a more efficient use of airspace, thus providing significant benefits linked to fuel consumption and delay reduction;
- **AF4 Network Collaborative Management**, which is expected to improve the quality and the timeliness of the network information shared by all ATM stakeholders, thus ensuring significant benefits in terms of ANS (Air Navigation Service) productivity gains and delay cost savings;
- **AF5 iSWIM (initial System Wide Information Management)**: ground-ground integration and aeronautical data management & sharing, which consists of a set of services that are delivered and consumed through an IP-based network by SWIM enabled systems, enabling significant benefits in terms of ANS productivity;
- **AF6 Initial Trajectory Information Sharing:** air-ground integration towards i4D with enhanced Flight Data Processing performances, which is expected to improve predictability of aircraft trajectory for the benefit of both airspace users, Network Manager and ANSPs implying less tactical interventions and improved de-confliction situation. This would have a positive impact on ANS productivity, fuel saving and delay variability.

The SDM supported stakeholders responded to INEA calls in 2014 and 2015 leading to over $1Bn of investment in SESAR solutions in over projects and 25 countries. The Cost Benefit Analysis of the PCP estimated a potential net benefit of €1.7Bn (NPV)[32]. The importance of this link to deployment is echoed by stakeholders in the survey responses.

Going forward the SJU needs to work together with the SESAR Deployment Manager, the industry, the Commission and other bodies (e.g. EASA, NM, PRB) to ensure that the ATM Master Plan remains coherent with the performance expectations associated with ATM modernisation. Continued coherence will be demonstrated by successful deployment of SESAR solutions in future Common Projects.

[31] CEF: https://ec.europa.eu/inea/en/connecting-europe-facility/cef-transport/projects-by-transport-mode/sesar

[32] https://ec.europa.eu/transport/sites/transport/files/modes/air/sesar/doc/ec-716-2014_article4c_globalcba.pdf

7.4.4. External coherence – Global

At global level, ATM is regulated by the International Civil Aviation Organisation (ICAO). In particular, ICAO develops the Standards and Recommended Practices (SARPs) that define how Air Navigation Services are provided. SES builds on ICAO principles.

In order to support the modernisation of ATM globally, ICAO has developed a series of Global Air Navigation Plans (GANPs). For the fourth edition published in 2014, ICAO undertook significant work to reflect advances in Air Traffic Management – introducing the concept of Aviation System Block Upgrade (ASBU) as a way of describing the long term evolution of ATM. Europe, the EU and SESAR strongly supported this work. The resulting GANP and ASBUs reflect the SESAR work programme. The strong links between SESAR and ICAO have two beneficial effects:

- It ensures that SESAR and other regions remain synchronised.
- It ensures that SESAR solutions have a global market.

In addition to working with ICAO, the SESAR Joint Undertaking has developed a working relationship with the FAA on NextGen[33] under the auspices of the EU/USA Memorandum of Cooperation on Civil Aviation Research and Development (EC COM(2011) 44).[34]

In addition, the SJU has established cooperation with Brazil, Japan, China, Australia, Singapore, Africa the Gulf States[35] (SJU, 2016).

Further, the SJU supports its Members through active participation in global trade shows – helping to ensure the global competitiveness of the SESAR solutions.

7.5. Relevance

As discussed in Section 2.2, SESAR was initiated at the request of the industry to resolve a structural issue within Air Traffic Management. SESAR, as a part of the wider SES policy, aims to transform ATM from both a technological and organisational perspective.

The economic benefits of SESAR were established in 2011 in a macro-economic study as: "The on-time implementation of SESAR, compared with a scenario in which ATM is not modernised, would have a positive impact on GDP estimated at € 419 bn. This represents 0.16% of combined EU27 GDP over the considered period. SESAR would contribute by an additional 0.02 percentage point to EU27 annual GDP growth, with 328 000 new jobs and 50 million tons of CO2 emissions saved" (SJU, 2011).

This result continues to be relevant. Modernisation of the ATM is a key enabler of air transport and GDP growth.

However, it is now clear that the SES High Level Goals will not be achieved by 2020 as originally envisaged. A key factor is that traffic did not evolve as predicted in 2007. At that time, it was predicted that traffic would double by 2020 – this meant that the cost efficiency goal could be largely achieved by enabling the additional traffic without increasing overall costs. This would have led primarily to a focus on increasing air traffic controller productivity – that is doubling the air traffic controller's productivity.

Even with traffic growth returning, traffic is still not predicted to reach double the level of 2006 by 2030[36]. This has led to a shift in requirements placed on SESAR: rather than a

[33] NextGen: https://www.faa.gov/nextgen/

[34] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011PC0044&from=EN

[35] SJU CAAR2016 page 156

focus on building additional capacity, the focus is on cost-efficiency and environmental performance. The need is for a more flexible approach that can better optimise network resources to evolving demand. This type of approach is consistent with the long-term planning scenarios for air traffic management developed as part of the "Challenges to Growth 2013" project.[37]

The SES has also seen a shift from a prescriptive approach (SES1) to a performance approach (SES2). Achievement of the High Level Goals is therefore part of the wide SES policy including the role of the Performance Scheme, Network Manager and Functional Airspace Blocks.

The role of SESAR programme is to support the technological modernisation of ATM. The Development Phase supports this in three ways:

- By maintaining the European ATM Master Plan.
- By creating a cross-industry collaborative platform that goes beyond the R&D remit.
- By generating SESAR Solutions that are deployed either voluntarily on a local basis or as part of an EU mandate under the SESAR Deployment Manager.

As the SESAR1 work programme was conducted a technological shift occurred. The original ATM Master Plan was based on networking ATM systems using a common internet known as SWIM. SESAR now foresees SWIM as distributing services rather than just data. This will enable some ATM services to be provided as a "common service" across multiple service providers leading to lower implementation and operational costs.

The continued success of the SJU in the SESAR2020 work programme lies in building links with the deployment phase to ensure that SESAR solutions are deployed in a manner that best supports achievement of the SES high level goals.

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[36] http://www.eurocontrol.int/sites/default/files/article/content/documents/official-documents/reports/201306-challenges-of-growth-2013-task-4.pdf

[37] http://www.eurocontrol.int/sites/default/files/article//content/documents/official-documents/reports/201306-challenges-of-growth-2013-task-7.pdf

8. CONCLUSIONS

The SESAR Joint Undertaking was established in 2007 to manage the development phase of SESAR in accordance with the European ATM Master Plan with an overall budget of €2.1 Bn (€700m from the EU budget). In 2014, it was formally extended until 2024 with a further €1.585bn (including €585m from the EU Horizon 2020 budget).

This evaluation of the SJU covers the period from January 2015 to December 2016 operating under the Horizon 2020 budget. During this time:

- A new membership process has been successfully concluded, leading to the renewal of the majority of existing Members and an expanded membership of 19 Members covering 37 companies including Aeronautical Research establishments as full members for the first time. The European Commission and EUROCONTROL continue as founding members.
- A new work programme has been defined which has garnered strong support from the stakeholders for integrating operational and technical aspects into projects with a greater focus on delivering mature solutions with identified performance uplifts.
- Two calls for proposals have been completed leading to grants for:
  - 28 Exploratory Research projects
  - 20 Industrial and Validation projects
  - 5 Very Large Scale Demonstrations
- Two further calls have been launched:
  - ER2 focussing on Remotely Piloted Aircraft Systems (RPAS)
  - ER3-VLD an open call for Exploratory Research (application-based) and Very Large Scale Demonstrations
- By the end of 2017, the full work programme will be in the execution phase.

The evaluation of SESAR2020 has been dominated with the issues surrounding the application of H2020 rules to a policy-led SJU as opposed to an R&D-led Joint Technology Initiative (JTI). This situation appears exasperated by requiring the SJU to act as an EU-body[38] and follow rules designed for a JTI. This has led to unnecessary complexity and confusion as well as duplicated and overlapping reporting requirements for both the SJU and its Members.

At the core of the issue is the difficulty of using the H2020 procedures and tools to manage a collaborative research programme. This is best highlighted by the fact that the SJU Membership is often organised by consortia but grants are awarded to the constituent companies. Momentum created in the previous programme was lost to the transition to the new H2020 framework. In fact, one year was lost to these transition difficulties and a significantly increased workload was placed on the limited SJU resources which could only be overcome by changes in the type of staff employed bringing further organisation pressure. It is testament to the efficiency and capability of the SJU and the wider partnership that this period was managed successfully.

[38] Article 208 of the Financial Regulation EU Agency.

Beyond the application of the H2020 rules, our evaluation demonstrates that the SJU took the opportunity of the extension to apply lessons learned from the SESAR 1 programme and thereby strengthen SESAR2020:

- The SESAR2020 programme for industrial research and validation, to be performed by the Members, is now focussed around 25 projects, each with a defined set of "solutions" that will be matured towards deployment.
- The projects now integrate operational and technical aspects (in SESAR1 these aspects were in separate projects). This will encourage even closer relationships between service providers and suppliers leading to stronger solutions closer to deployment.

These developments will strengthen the innovation pipeline within the SJU remit. Further:

- A greater emphasis on Very Large Demonstrators (VLDs) will increase the evidence available to support industrialisation of SESAR solutions. VLDs will be conducted by both Members and external stakeholders thus increasing likelihood of stakeholder buy-in and deployment. This will improve the transparency and feedback for the ATM modernisation lifecycle at the core of the wider SESAR programme.
- The extension of Exploratory Research will encourage greater participation of academia and SMEs within the work programme. In addition, the new programme structure should enable ideas to move from Exploratory Research to the core SESAR programme, through Demonstration at pilot sites for ideas with high potential having either strong political or stakeholder support.
-

The SJU has also used the opportunity to strengthen the governance arrangements:

- The New Master Planning Committee will provide a basis for ensuring even stronger stakeholder support for updates to the European ATM Master Plan.
- The Revised Scientific committee will further support pull through of advanced research in to the main programme.

These developments will help strengthen the links to both the academic research community and the deployment phase.

These findings are supported by the positive feedback received during interviews and in the various surveys conducted as part of the evaluation.

Throughout our evaluation SJU Members and ATM Stakeholders have highlighted the importance of **SESAR and the SJU as key enablers for the implementation of the wider SES policy**:

- Network investors (the airlines, airports and ANSPs) are confident that SESAR is delivering the necessary solutions to achieve ATM modernisation.
- ANSPs and Airports are benefiting from "working together" leading to partnerships beyond SJU scope (e.g. Borealis, COOPANS, ITec).
- Manufacturers support the SJU because it provides access to operational stakeholders and hence improves their R&D leading to products with marketability and hence return on investment.
- Whilst the wider supply chain of the manufacturers (and large ANSPs) is not directly represented in the SJU Membership, they are active in SESAR work

programme through subcontracting and other arrangements (for example Linked Third Parties under H2020). The SJU has therefore led to a wide and inclusive participation in ATM R&D.

Whilst there is wide support for the main focus of the programme on developing and maturing solutions for deployment (high TRL research) this has led to an issue in SESAR1 with improving pull through of low TRL research and building stronger links with the scientific community. Further, the policy of concentrating R&D in the SJU limited the opportunities for academia in ATM R&D (due the limited Exploratory Research budget in SJU, especially in the SESAR1 period, and limited funding from national sources). This would not be sustainable in the long term as it would restrict the availability of trained staff for future developments. SJU is aware of the issue and it is being addressed through the higher budget for ER in SESAR2020 with respect to SESAR1, the call for Knowledge Transfer Network and stronger involvement of the Scientific Committee.

In terms of the main evaluation Criteria:

Effectiveness	The SJU has been extremely effective in organising the activities of the SESAR Development phase. This includes maintenance of the Master Plan, delivering the R&D programme and building international links to ensure global interoperability and European leadership in ATM solutions. The new work programme is likely to strengthen execution of the programme and increase the quality of the research performed and results generated. The new programme is solution-oriented and integrates operational and technical aspects. The governance arrangements have also been strengthened compared to SESAR1 with greater emphasis placed on achieving wider involvement of the full range of stakeholders in maintenance of the ATM Master Plan.
Efficiency	There is currently limited evidence available to gauge the efficiency of the SJU under Horizon 2020 rules, as only a limited part of the programme has been just launched in the period the evaluation is looking at. The SJU has engaged extra staff with the requisite knowledge to deal with the additional burden. Current metrics indicate transition issues from SESAR1, this was due to an initial lack of knowledge in the SJU and the Members of the H2020 rules, procedures, and tools as well as the lack of maturity in those rules, procedures and tools which caused some delays. The SJU has already taken corrective action e.g. the additional administrative staff and performance levels have returned to the excellent levels of SESAR1. However, action is required by the Commission to reduce the burden of the overlaps and inconsistencies between reporting requirements on EU-bodies and those stemming from Horizon 2020 on both the SJU and its Members.
EU Added Value	The application of a fixed co-funding rate of 70% based on Horizon 2020 rules as opposed to the 50% of actual costs used under SESAR1 leads to the change of expected leverage from 2 in SESAR1, to 1.4 for SESAR2020. SESAR1 achieved a leverage value of 1.8. The true EU-added value of the SJU is as enabler of the much more significant benefits of implementing the Single European

	Sky.
Coherence	The activities of the SJU have been evaluated as being coherent at four levels: • Internal – through maintenance of the Master Plan. • Horizon 2020 – though ACARE and Clean Sky. • EU – through the strong policy link with the SES, Transport White Paper and Aviation Strategy as well as links with other agencies and organisations such as EASA, EDA, ESA and EUROCAE. • Globally – through strong links with ICAO, the FAA (NextGen) and other national and regional programmes.
Relevance	The work of the SJU has continued relevance. The SJU has created a strong public-private partnership, committed to achieving the SES High Level Goals, as reinforced by successive European ATM Master Plan updates. The value of SESAR as a modernisation programme is now beginning to take hold, with the successful launch of the Deployment Phase (through SESAR Deployment Manager), leading to actual deployment of SESAR solutions. Continued relevance requires industry wide stakeholder consensus to be maintained through Master Plan Update campaigns.
Openness and Transparency	The work of the SJU is considered to be open and transparent. SJU publications are well received – particularly the European ATM Roadmap and SESAR Solutions Catalogue which together define the objective and results of the SESAR Development Phase. Each solution is supported by a detailed set of documentation (Solution Pack) designed to support implementation including safety cases and references to standards and regulatory material. Under SESAR2020 the SJU is strengthening link to standardisation and reducing the implementation ”gap”. The SJU promotes SESAR at trade shows and other public events and is active on social media with a positive presence on LinkedIn and Twitter. The SJU is often now representing the wider EU community from research to deployment, from safety to standards and connecting to space. The SJU is increasingly trusted by the EC to be the lead on new and innovative research planning for the sector, including drones and cyber security. This ensures the transparency and relevance of the whole programme for all stakeholders, including many new entrants.

9. RECOMMENDATIONS

Overall our conclusions are positive and reinforce the findings of the previous evaluations SESAR1 and the evaluation performed in support of the extension of the SJU in 2014.

9.1. SESAR1 Recommendations

The evaluation of SESAR1, published alongside this evaluation, highlighted three areas of improvement relating to how the activities of the SJU can support the longer-term role of SESAR as a modernisation programme with a strong link the Single European Sky policy area:

- 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.

For Recommendation 1, the main focus was to ensure that the partnership approach was also adopted for updates to the European ATM Master Plan to ensure such campaigns are as open and transparent as possible. In this regard, the new Master Plan Committee is encouraging and should lead to greater involvement of a wider range of stakeholders in Master Plan updates. Communication events and working arrangements must also ensure that a wide range of voices are heard during update campaigns.

The second recommendation focussed on strengthening the three layers of the European ATM Masterplan to ensure they are consistent with the solutions being matured. The SESAR2020 work programme has a renewed focus on delivering ATM as a set of services, (see for example PJ10 in Annex B). This concept could facilitate a change in the way ATM services are delivered and hence support achievement of the SES cost-efficiency goals. This can only be achieved if they are supported by a service-oriented Enterprise Architecture that support definition of services. The recommendation to ensure that all layers of the Master Plan use a common "solutions" based language remains valid, but the extension of this to a simplified Enterprise Architecture would support management of the SJU R&D Programme and an improved link to the Deployment Phase.

The third recommendation focussed on the need to improve links to academia to ensure a steady supply of new ideas and staff. The additional budget for Exploratory Research and strengthening of the Scientific Committee are positive in terms of building greater links to academia, but further outreach to academia is required. Further action is necessary to determine if and how ER results influence the future IR programme.

9.2. SESAR2020 Recommendations

Following the evaluation of SESAR2020 we have two further recommendations:

Recommendation 4: Resolve issues with application of H2020

The application of H2020 rules has clearly been problematic during the transition from SESAR1 to SESAR2020. No evidence has been provided that H2020 rules have simplified the management of the SJU. Serious concerns have been raised during the interviews and survey responses that they are not appropriate for the management of programme. These issues need to be addressed.

In particular, the Commission should:

- In the short term, provide a derogation allowing the SJU to make multi-annual commitments such that grant agreements can cover funds not yet allocated to the SJU. This will remove the need for annual amendments to grant agreements.
- In the short term, modify the H2020 tools to allow grant coordinators to group beneficiaries in support the "consortia" concept used for SJU Membership.
- In the longer term, rethink the application of H2020 rules and how they could be adapted to better reflect the management of a programme with shifting priorities and need to direct research efforts to emerging problems.

Rec 5: Take steps to further close the industrialisation gap

During the interview process stakeholders strongly supported the continuation of SESAR, both the development phase under the SJU management and the deployment phase led by the SESAR Deployment Manager. The common belief is that the ATM modernisation lifecycle, and hence achievement of the SES goals, could be successful if these two elements work in tandem.

Whilst success for the SJU can be measured by the number of successfully matured solutions; success for the overall SESAR programme must mean solutions are successfully deployed. The current scope of the SJU and SDM activities have created what is referred to as the "industrialisation gap". This is created by the SJU programme ending at TRL6 (or E-OCVM V3) and the SESAR Deployment Manager requiring solutions at TRL8 (or E-OCVM V5). The industrialisation gap includes activities such as standardisation and the developing evidence for certification.

The SESAR2020 programme closes the gap compared to SESAR1 in two crucial areas:

- There is greater support for standardisation activities. Part of the exploitation of the new projects is for team members to actively work within the standards groups (and in particular EUROCAE working groups).
- The VLDs will provide evidence for certification so long as they are defined in an appropriate manner.

However more can still be done to manage this "gap" and we believe that future options for the SJU should be as open as possible.

For example, providing public funds to initial or pilot deployments on the basis that the work done to achieve certification supports development of Means of Compliance and other standards and certification material hence reducing the risk and cost of future deployments. Such an activity cannot currently be funded by the SJU or the SDM with sufficient co-funding. However, we believe such activities would be beneficial to improving the success of SESAR and future options such as providing CEF funds to the SJU to support such activities or even combining the roles of the SJU and SDM under one organisation with a range of financial instruments to support exploratory research, industrial research, industrialisation and deployment should be investigated.

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11. ANNEX A: ACRONYMS

Acronym	Definition
4D	Four dimensional
A6	A6 Deployment Manager Alliance
ACC	Area control centres
A-CDM	Airport Collaborative Decision Making
ACI	Airports Council International
AIRM	ATM Information Reference Model
AMAN/DMAN	Integrated arrival and departure management
ANS	Air Navigation Services
ANSP	Air Navigation Service Provider
AOC	Air Operations centre
AOP	Airport Operation Plan
APANPIRG	Asia/Pacific Air Navigation Planning and Implementation Regional Group
APOC	Airport operation centre
APV	Approach Procedures with Vertical Guidance
ASBU	Aviation System Block Upgrade
ASD	Aerospace and Defence Industries Association of Europe
A-SMGCS	Advanced-Surface Movement Guidance and Control Systems
ASPA	Airborne spacing
ATC	Air Traffic Control
ATCO	Air Traffic Controller
ATFCM	Air Traffic Flow and Capacity Management
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
ATSEP	Air traffic safety electronics personnel
CANSO	Civil Air Navigation Services Organisation
CDA	Continuous descent approach
CDM	Collaborative Decision Making
CEF	Connecting Europe Facility
CNS	Communication, Navigation, Surveillance
CONOPS	Concept of Operations
cPPP	contractual Public-Private Partnership
CS	Clean Sky
CSA	Coordination Support Action
EASA	European Aviation Safety Agency
EC	European Commission
EDA	European Defence Agency
E-OCVM	European Operational Concept Validation Methodology
ER	Exploratory Research
ESARRS	EUROCONTROL's Safety Regulatory Requirements
EU	European Union
FAA	Federal Aviation Authority
FAB	Functional Airspace Block

Acronym	Definition
FCH	Fuel Cells and Hydrogen
FDP	Flight Data Processor
FOC	Flight Operations Centre
FP6	Framework Programme 6
FP7	Framework Programme 7
GA	Grant Agreement
GANP	Global Air Navigation Plan
GAP	Grant Agreement Preparation
GNSS	Global Navigation Satellite System
H2020	Horizon 2020
IA	Innovation Action
ICAO	International Civil Aviation Organisation
IMI	Innovative Medicines Initiative
IPR	Intellectual Property Rights
IR	Implementing Rule
IR&V	Industrial Research
ISRM	Information Service Model
JU	Joint Undertaking
KPI	Key Performance Indicator
LTP	Linked Third Parties
MAWP	MultiAnnual Work Programme
MET	Meteorological
MFA	Multilateral Framework Agreement
MoC	Memorandum of Cooperation
NOTAM	Notice to Airmen
NSA	National Supervisory Authority
OFA	Operational Focus Area
PC	Programme Committee
PHARE	Programme for Harmonised ATM Research in EUROCONTROL
PPP	Public Private Partnership
PRB	Performance Review Board
R&D	Research and Development
R&I	Research and Innovation
RBT	Reference Business Trajectory
RDP	Radar Data Processes
RIA	Research and Innovation Action
RNAV	Area navigation
RPAS	Remotely Piloted Aircraft Systems
S2R	Shift to Rail
SARP	Standards and Recommended Practices
SC	Scientific Committee
SDM	SESAR Deployment Manager
SES	Single European Sky
SES1	First Single European Sky legislative package

Acronym	Definition
SES2	Second Single European Sky legislative package
SESAR	Single European Sky ATM Research
SJU	SESAR Joint Undertaking
SME	Small and Medium-sized Enterprise
SoA	Service Oriented Approach
SPP	SESAR Performance Partnership
SRIA	Strategic Research and Innovation Agenda
SWIM	System Wide Information Management
TJU	Transport Joint Undertaking
TMA	Terminal Manoeuvring Areas
TOR	Terms of Reference
TRL	Technology Readiness Level
TWP	Transport White Paper
UDPP	User Driven Prioritisation Process
V	Validation phase (in E-OCVM)
V&VI	Verification and Validation Infrastructure
VLD	Very Large Demonstration
WOC	Wing Operations Centre
WP E	Workpackage E

12. ANNEX B: SESAR2020 PROGRAMME DESCRIPTION

12.1. Overview

At the end of 2016, there were 53 projects running, depicted in the work-breakdown structure below. The breakdown and the description of the various projects has been taken from the draft of SESAR JU Consolidated Annual Activity Report 2016 (SJU, 2016).

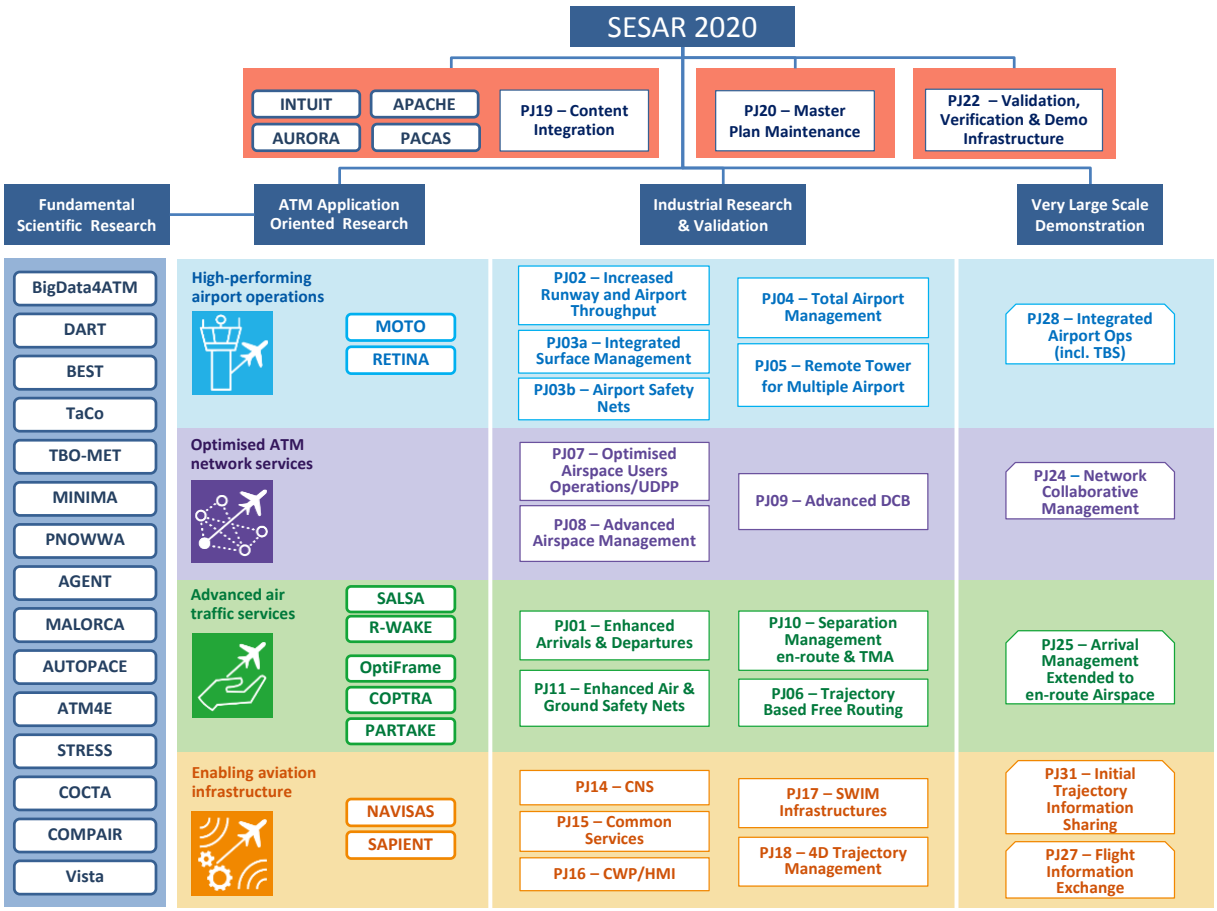

Figure 13. SESAR 2020 Programme (source: (SJU, 2016))

12.2. Transversal activities

Ref.	Project title	Short Topic/Project Description	Type of Action	Max. total co-financing value (in €)
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

12.3. Optimised Network Services

Ref.	Project title	Short Topic Description	Type of Action	Max. total co-financing value (in €)
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
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

12.4. High Performing Airport Operations

Ref.	Project title	Short Topic Description	Type of Action	Max. total co-financing value (in €)
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.3a	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.3b	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

12.5. Advanced Air Traffic Services

Ref.	Project title	Short Topic Description	Type of Action	Max. total co-financing value (in €)
PJ.01	Enhanced Arrivals and Departures	Addresses interaction between Traffic Synchronisation and DCB within the extended horizon. Potential information integration needs and balancing mechanisms to be investigated and developed.	RIA	17.521.324
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

12.6. Enabling Aviation infrastructure[39]

Ref.	Project title	Short Topic Description	Type of Action	Max. total co-financing value (in €)
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. GA/R and Remotely Piloted Aircraft Systems (RPAS) needs will also be integrated within CNS solutions development.	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	

12.7. ER projects - ATM Excellent Science & Outreach research

Topic Description	Projects	Max. total co-financing value (in €)
Automation, Robotics and Autonomy	AUTOPACE 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
	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.	599.993

[39] Project PJ1.13 'Air Vehicle Systems', which was foreseen in the H2020-SESAR-2015-2 call conditions, was not awarded and is therefore not part of the 20 IR projects

Topic Description	Projects	Max. total co-financing value (in €)
	AGENT 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
	STRESS 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
	MINIMA will research new human-automation interaction design concepts.	582.780
Complexity, Data Science and Information Management	BigData4ATM 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
	DART (Data-driven AiRcraft Trajectory prediction research) explores the applicability of data science and complexity science techniques to the ATM domain.	598.524
	MALORCA project proposes a general, cheap and effective solution to automate re-learning, adaptation and customisation process to new environments, taking advantage of the large amount of speech data available in the ATM world.	538.104
	BEST will determine how semantic technologies can be used effectively to maximise the benefits of adopting SWIM.	593.129
Environment & Meteorology	TBO-MET project addresses the problem of analysing and quantifying the effects of meteorological uncertainty in Trajectory Based Operations.	488.750
	ATM4E 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
	PNOWWA project will produce methods for the probabilistic short-term forecasting of winter weather and enable the assessment of the uncertainty in the ground part of 4D trajectories.	597.500
Economics & Legal Change in ATM	COCTA project proposes coordinated economic measures aiming to pre-emptively reconcile air traffic demand and airspace capacity.	534.158
	Vista 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
	COMPAIR 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

12.8. ER projects - ATM Applications oriented research

Topic Description	Projects	Max. total co-financing value (in €)
High Performing Airport Operations	MOTO will perform research on ATM Human Performance of using two senses: sight and hearing in the context of remote tower operations.	999.000
	RETINA 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
Advanced Air Traffic Services / Separation Management and Separation Standards	SALSA is an exploratory research project relating to multi-source ADS-B system.	995.064
	R-WAKE 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)	OptiFrame will research a number of fundamental questions related to TBO, a key element of future ATM operating concepts.	727.501
	COPTRA aims to propose, in a TBO environment, an efficient method to build probabilistic traffic forecasts on the basis of flight trajectory predictions.	999.391
	PARTAKE 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
CNS & Enabling Infrastructure	NAVISAS 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
	SAPIENT 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
Innovative ATM Architecture, Performance & Validation	PACAS will model and analyse changes at different layers of the ATM system to support change management, while capturing how architectural and design choices influence the overall system.	998.355
	INTUIT 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
	AURORA will propose advanced metrics to assess the operational efficiency of the ATM system.	829.313
	APACHE 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

13. ANNEX C: SESAR2020 SOLUTIONS

13.1. High Performing Airport Operations

13.1.1. Wake turbulence separation optimisation

The work refers to the use of downlinked information from aircraft to predict wake vortex and determine appropriate wake-vortex minima dynamically, thereby optimising runway delivery.

SJU reference: Wake turbulence separation optimisation (PJ.02-01)

13.1.2. Enhanced arrival procedures enabled by satellite technologies

The work makes use of satellite navigation and augmentation capabilities, such as GBAS and satellite-based augmentation systems (SBAS), to enhance landing performance and to facilitate advanced arrival procedures (e.g. curved approaches, glide slope increase, displaced runway threshold). By doing so, noise is reduced while runway occupancy time (ROT) is optimised. The aim is to also reduce the need for separation for wake vortex avoidance.

SJU reference: Enhanced arrival procedures (PJ.02-02)

13.1.3. Minimum-pair separations based on required surveillance performance (RSP)

The work refers to the application (by air traffic control) of non-wake turbulence pair wise separation (PWS) of 2 nautical miles for arrivals on final approach (at the point that the leading aircraft in the pair crosses the runway threshold), based upon RSP.

SJU reference: Minimum-pair separations based on required surveillance performance

(RSP) (PJ.02-03)

13.1.4. Independent rotorcraft operations at airports

The work refers to RC specific approach procedures and SBAS based point-in-space (PinS), which aim to improve access to secondary airports in low-visibility conditions.

SJU reference: Independent rotorcraft operations at airports (PJ.02- 05)

13.1.5. Improved access into secondary airports in low-visibility conditions

Improved access into secondary airports in low-visibility conditions will be possible thanks to the introduction of new airborne capabilities, such as RNP and global navigation satellite system (GNSS)-based landing systems.

SJU reference: Improved access into secondary airports in low-visibility conditions (PJ.02-06)

13.1.6. Traffic optimisation on single and multiple runway airports

This work refers to a system that enables tower and approach controllers to optimise runway operations arrival and/or departure spacing and make the best use of minimum separations, runway occupancy, runway capacity and airport capacity.

SJU reference: Traffic optimisation on single and multiple runway airports (PJ.02-08)

13.1.7. Enhanced terminal area for efficient curved operations

The work refers to curved segment approaches as close to the runway as possible to optimise procedures in terms of fuel consumption or noise abatement. Using geometric vertical navigation guidance in the TMA will facilitate a more efficient transition from barometric to geometric vertical navigation.

SJU reference: Enhanced terminal area for efficient curved operations (PJ.02-11)

13.1.8. Enhanced guidance assistance to aircraft and vehicles on the airport surface combined with routing

The work sees the extension of the A-SMGCS routing function to avoid potential traffic conflicts, an improved use of AMAN and DMAN information and integration with total airport management procedures. It includes the exchange of virtual stop bar identifiers and status between air traffic controllers and flight crews to improve safety in low-visibility conditions. The exchange of information between air traffic control and vehicles/aircrafts will be improved with the use of airport datalink and other guidance means.

SJU reference: Enhanced guidance assistance to aircraft and vehicles on the airport surface combined with routing (PJ.03a-01)

13.1.9. Enhanced navigation accuracy in low-visibility conditions on airport surfaces

The work refers to 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).

SJU reference: Enhanced navigation and accuracy in low-visibility conditions on the airport surface (PJ.03a-03)

13.1.10. Enhanced visual operations

The work refers to enhanced vision systems (EVS) and synthetic vision systems (SVS), which will be developed to enable more efficient taxi, take-off and landing operations in low-visibility conditions. This is applicable to all platforms — even if main airline platforms have autoland capabilities to facilitate approaches in low-visibility conditions, they have no capability to facilitate taxi and take-off in order to maintain airport capacity.

SJU reference: Enhanced visual operations (PJ.03a-04)

13.1.11. Integration of drone operations at airports

The work facilitates the operation of drones at airports and their integration into an environment, which is currently dominated by manned aviation. To the maximum extent possible, drones will have to comply with the existing rules and regulations. The solution includes the particular requirements of remotely-piloted operations, and will describe their specificities with respect to manned operations, providing operational requirements for technological developments that could mitigate them.

SJU reference: Surface operations by remotely-piloted aircraft systems (RPAS) (PJ.03a-09)

13.1.12. Enhanced airport safety nets for controllers

These safety alerts for controllers detect potential and actual conflicting situations, incursions and non-conformance to procedures or air traffic control clearances, involving mobiles (and stationary traffic) on runways, taxiways and in the apron, stand and gates area, as well as unauthorised and unidentified traffic. Controllers are provided in all cases with the appropriate alerts.

SJU reference: Enhanced airport safety nets for controllers (PJ.03b-01)

13.1.13. Conformance monitoring safety nets for pilots

The work provides conformance monitoring safety alerts for the flight crew (either generated by the on-board system or uplinked from the controller alerting system) when the system detects a non-compliance with airport configuration (e.g. closed runway, non-compliant taxiway, restricted area, etc.) as well as non-conformance to procedures or clearances.

SJU reference: Conformance monitoring safety nets for pilots (PJ.03b-03)

13.1.14. Traffic alerts for pilots for airport operations

Traffic alerts for pilots for airport operations refer to enhancing on-board systems in order to detect potential and actual risks of collision with other traffic during runway and taxiway operations, non-compliance with airport configuration (e.g. closed runway, non-compliant taxiway, and restricted areas). In all cases the flight crew are provided with appropriate alerts.

SJU reference: Traffic alerts for pilots for airport operations (PJ.03b-05)

13.1.15. Safety support tools for runway excursions

This work provides controllers and/or pilots with the appropriate alerts where there is a risk of runway excursion (take-off and landing).

SJU reference: Safety support tools for runway excursions (PJ.03b-06)

13.1.16. Enhanced collaborative airport performance planning and monitoring

The work extends the airport performance monitoring process to the airport landside and ground access processes with a view to improving the planning and timely execution of airside operations. Specifically, the work sees the development of rationalise dashboard(s) fed with all landside and airside key performance indicators and covering total airport management processes.

SJU reference: Enhanced collaborative airport performance planning and monitoring (PJ.04-01)

13.1.17. Enhanced collaborative airport performance management

This work sees the full integration of the AOP into the NOP, moving towards a total airport DCB process. This involves, among other things, a proactive assessment of the total airport capacity available, including terminal, stand, manoeuvring area, taxiway and runway capacities, and taking into account the prevailing and/or forecast weather and other operational conditions.

SJU reference: Enhanced collaborative airport performance management (PJ.04-02)

13.1.18. Remotely-provided air traffic services for multiple airports

This work refers to the provision of airport control services or airport flight information services for more than one airport by a single controller from a remote location. It includes further development of the CWP and MET information from multiple airports. This work goes beyond the scope of solution #52 (two small aerodromes).

SJU reference: Remotely-provided air traffic services for multiple aerodromes (PJ.05-02)

13.1.19. Flexible and dynamic allocation of remote tower modules

This work will enable the provision of remote tower services to a large number of airports with a flexible and dynamic allocation of airports connected to different remote tower facilities over time depending on needs. It includes the development of remote tower control supervisor and support systems, and advanced and more cost efficient automation functions. It also sees connecting flow management between remotely connected airports and the development of tools and features for a flexible planning of all aerodromes connected to remote tower services.

SJU reference: Remotely provided air traffic services from a remote tower centre with a flexible allocation of aerodromes to remote tower modules (PJ.05-03)

13.2. Advance air traffic services

13.2.1. Extended arrival management across overlapping AMAN operations

This work integrates information from multiple arrival management systems, enabled by SWIM, operating out to extended ranges into en-route sectors using local traffic/ sector information and balancing the needs of each AMAN. The work addresses the interaction between traffic synchronisation and DCB, including the identification of integration needs, and CTA in high density/complexity TMAs.

SJU reference: Extended arrival management with overlapping AMAN operations and interaction with DCB and CTA (PJ.01-01)

13.2.2. Improving traffic flow around airports using arrival and departure management information

The work sees TMA traffic managed in near real time, taking advantage of predicted demand information provided by arrival and departure management systems from one or multiple airports. This allows the identification and resolution of complex interacting traffic flows in the TMA and on the runway, through the use of AMAN and DMAN flow adjustments and ground holdings.

SJU reference: Use of arrival and departure management information for traffic optimisation within the TMA (PJ.01-02)

13.2.3. Dynamic and enhanced routes and airspace

This work brings together vertical and lateral profile issues in both the en-route and TMA phases of flight, with a view to creating an end-to-end optimised profile and ensuring transition between free route and fixed route airspace. The solution will be supported by new controller tools and enhanced airborne functionalities.

SJU reference: Dynamic and enhanced routes and airspace (PJ.01-03)

13.2.4. Airborne spacing flight deck interval management

This work refers to new ASAS spacing interval management sequencing and merging (ASPA IM S&M) manoeuvres encompassing the potential use of lateral manoeuvres and involving more complex geometries where a designated target aircraft may not be flying direct to the merge point.

SJU reference: Airborne spacing flight deck interval management (PJ.01-05)

13.2.5. Enhanced rotorcraft and general aviation operations around airports

This work further develops the simultaneous non-interfering (SNI) concept of operations to allow RC and GA to operate to and from airports without conflicting with fixed-wing traffic or requiring runway slots.

SJU reference: Enhanced rotorcraft and general aviation operations in the TMA (PJ.01-06)

13.2.6. Assisted visual separation

This work refers to cockpit display of traffic information (CDTI) assisted visual separation (CAVS) and CDTI assisted pilot procedure (CAPP) applications that enable aircraft to separate each other visually in marginal visual conditions and that facilitate transitions from IFR operations to CAVS during approach.

SJU reference: Approach improvement through assisted visual separation (PJ.01-07)

13.2.7. Optimised traffic management to enable free routing in high and very high complexity environments

This work enables airspace users to plan flight trajectories without reference to a fixed route network or published directs within high and very high-complexity environments so they can optimise their associated flights in line with their individual operator business needs or military requirements.

SJU reference: Optimised traffic management to enable free routing in high and very high complexity environments (PJ.06-01)

13.2.8. Performance-based free routing in lower airspace

Management of performance-based free routing in lower airspace sees the application of free route for airspace users beyond what is prescribed in the Pilot Common Project (below FL310), improving predictability, efficiency and flexibility for a wider range of different airspace users.

SJU reference: Management of performance-based free routing in lower airspace (PJ.06-02)

13.2.9. Improved controller team configuration

This work sees the extension of sector team operations beyond team structures of one planning controller and two tactical controllers both in en-route and TMA in order to optimise flight profiles, minimise delays and improve ANSP cost efficiencies while taking into account intrinsic uncertainty in the trajectory.

SJU reference: High productivity controller team organisation (PJ.10-01a)

13.2.10. Flight-centric air traffic control

The work sees the provision of ground-based automated support for managing separation provision across several sectors in order to optimise the use of larger sectors. Rather than managing the entire traffic within a given sector, with this solution air traffic control is responsible for a certain number of aircraft throughout their flight segment within a larger airspace or along flows of traffic.

SJU reference: Flight-centric air traffic control (PJ.10-01b)

13.2.11. Collaborative control

This work refers to coordination by exception rather than coordination by procedure and is facilitated by advanced controller tools, reducing the need for coordination agreements, fewer boundary constraints and the ability to combine sectors into multisector planner teams.

SJU reference: Collaborative control (PJ.10-01c)

13.2.12. Improved performance in the provision of separation

The work aims to improve the separation (tactical layer) in the en-route and TMA operational environments through improved ground trajectory prediction. This is achieved using existing information on lateral and vertical clearances that are known by the ground system, airborne information and data derived from meteorological services.

SJU reference: Improved performance in the provision of separation (PJ.10-02a)

13.2.13. Advanced separation management

This work aims to further improve the quality of services of separation management in the en-route and TMA operational environments by introducing automation mechanisms and integrating additional information (ATC intent, aircraft intent).

SJU reference: Advanced separation management (PJ.10-02b)

13.2.14. Enabling drones to comply with air traffic control

This work provides the technical capability or procedural means to allow drones to comply with air traffic control instructions.

SJU reference: Integration of RPAS under instrument flight rules (IFR) (PJ.10-05)

13.2.15. Tooling controllers for the future

This work refers to the development of advanced tools and concepts that will help to remove the qualification constraints imposed on controllers for controlling a single volume of airspace. This approach would allow controllers to operate in any airspace classified as a particular type.

SJU reference: Generic (non-geographical) controller validations (PJ.10-06)

13.2.16. Enhanced airborne collision avoidance for standard commercial air transport operations

This work refers to the use of ACAS Xa, an airborne collision avoidance system which takes advantage of optimised resolution advisories and of additional surveillance data, without changing the cockpit interface (i.e. same alerts and presentation in the current TCAS).

SJU reference: Enhanced airborne collision avoidance for commercial air transport normal operations - ACAS Xa (PJ.11-A1)

13.2.17. Enhanced airborne collision avoidance for drone operations

This work aims to provide airborne collision avoidance to drones, building on optimised resolution advisories and additional surveillance data, while taking into account the operational specificities of drones (the additional surveillance sources could be ADS-B but also any other sensor installed on the drones).

SJU reference: Enhanced airborne collision avoidance for RPAS – ACAS Xu (PJ.11-A2)

13.2.18. Enhanced airborne collision avoidance for specific commercial air transport operations

This work builds on optimised resolution advisories and additional surveillance data, while avoiding unnecessary triggering of resolution advisories (RAs) in new separation modes (e.g. ASAS), in particular if lower separation minima are considered.

SJU reference: Enhanced airborne collision avoidance for commercial air transport specific operations – ACAS Xo (PJ.11-A3)

13.2.19. Enhanced airborne collision avoidance for general aviation and rotorcraft

This work takes into account their limited capability to carry equipment and their operational specificities.

SJU reference: Enhanced airborne collision avoidance for general aviation and rotorcraft – ACAS Xp (PJ.11-A4)

13.2.20. Enhanced ground-based safety nets adapted to future operations

This work refers to ground-based safety nets for SESAR future trajectory management and new separation modes through the use of wider more widespread information sharing and new surveillance means.

SJU reference: Enhanced ground-based safety nets adapted to future operations (PJ.11-G1)

13.3. Optimised ATM network services

13.3.1. Addressing airspace users' needs within the Network

This work refers to the development of processes related to the flight operation centre (FOC) aimed at managing and updating the shared business trajectory, and fully integrating FOCs in the ATM Network processes. The processes respond to the need to accommodate individual airspace users' business needs and priorities without compromising the performance of the overall ATM system nor the performance of all stakeholders.

SJU reference: Airspace user processes for trajectory definition (PJ.07-01)

13.3.2. Airspace user fleet prioritisation and preferences

The work sees the extension of airspace user capabilities, through the UDPP, allowing them to recommend a priority order request to the Network Manager and appropriate airport authorities for flights affected by delays on departure, arrival and en-route, and to share preferences with other ATM stakeholders in capacity-constrained situations.

SJU reference: Airspace user fleet prioritisation and preferences (PJ.07-02)

13.3.3. Addressing military user needs within the Network

This work refers to the full integration of the wing operations centre (WOC) within the ATM system and the updating of WOC processes for the management of the shared and reference mission trajectory (SMT/RMT). These processes respond to the need to accommodate individual military airspace user needs and priorities without compromising the overall ATM system and the performance of all stakeholders.

SJU reference: Mission trajectory-driven processes (PJ.07-03)

13.3.4. Management of dynamic airspace configurations

This work refers to the development of the process, procedures and tools related to dynamic airspace configuration (DAC), supporting dynamic mobile areas of Type 1 and Type 2. It consists of activating airspace configurations through an integrated collaborative decision making process, at national, sub-regional and regional levels; a seamless and coordinated approach to airspace configuration, from planning to execution phases. In doing so, the work allows the Network to continuously adapt to demand pattern changes in a free route environment and air traffic control sectors configurations adapted to dynamic TMA boundaries and both fixed and dynamic elements.

SJU reference: Management of dynamic airspace configurations (PJ.08-01)

13.3.5. Dynamic airspace configuration supporting moving areas

This work extends the management of DAV to support dynamic mobile areas (DMA Type 3). This includes an impact assessment and the integration in the DAC process of areas that are potentially unsafe due to weather phenomena that can evolve in four dimensions.

SJU reference: Dynamic airspace configuration supporting moving areas (PJ.08-02)

13.3.6. Network prediction and performance

This work consists of improved traffic and demand forecasts based on a shared business trajectory and the computation of confidence indexes. Prediction of DCB constraints and complexity issues are based on the definition of metrics and algorithms for prediction, detection and assessment of traffic complexity, thus improving the accuracy and credibility of the diagnosis and awareness of hotspots.

SJU reference: Network prediction and performance (PJ.09-01)

13.3.7. Integrated local DCB processes

This work sees the seamless integration of local network management with extended air traffic control planning and arrival management activities in short-term and execution phases. The work will improve the efficiency of ATM resource management, as well as the effectiveness of complexity resolutions by closing the gap between local network management and extended ATC planning.

SJU reference: Integrated local DCB processes (PJ.09-02)

13.3.8. Collaborative network management

This work allows for network management based on transparency, performance targets and agreed control mechanisms. The work enables a real-time visualisation of the evolving AOP/NOP planning environment (such as demand pattern and capacity bottlenecks) to support airspace user and local planning activities.

SJU reference: Collaborative network management functions (PJ.09-03)

13.4. Enabling aviation infrastructure

13.4.1. CNS environment evolution

This work aims at identifying potential technological/functional synergies across the CNS domains to benefit from common system/infrastructure capabilities for both ground and airborne segments. The goal is to evaluate and define evolutionary steps towards an efficient and reliable integrated CNS provision.

SJU reference: CNS environment evolution (PJ.14-01-01)

13.4.2. Future communication infrastructure (FCI) terrestrial datalink

The work covers L-band digital aeronautical communications system (L-DACS) and digital voice communications.

SJU reference: Future communication infrastructure (FCI) terrestrial datalink (PJ.14-02-01)

13.4.3. FCI datalink

This work enables data communications in oceanic and remote regions and is complementary to terrestrial systems. The work will be carried out in cooperation with the European Space Agency Iris programme.

SJU reference: FCI datalink (PJ.14-02-02)

13.4.4. FCI network technologies

This work sees the migration towards Internet protocol, enabling network-centric SWIM architectures and military interfacing.

SJU reference: FCI network technologies (PJ.14-02-04)

13.4.5. New ADS-B services for general aviation

Development of new services similar to flight information system-broadcast (FIS-B) to support ADS-B solutions for general aviation.

SJU reference: Development of new services similar to FIS-B to support ADS-B solutions for general aviation (PJ.14-02-05)

13.4.6. AeroMACS integration in to the ground ATM infrastructure

This work trials the deployment of AeroMACS at airport(s) with multiple mobile users, integrating AeroMACS on vehicles and EFB equipped aircraft. The aim is to support validation of other potential usages of the AeroMACS data link to support especially digital voice communication and multilink and to prepare/support the consideration of the AeroMACS enabler in demonstrating the AeroMACS capabilities with involving airport(s) and airlines.

SJU reference: Operationally validated AeroMACS development (PJ.14-02-06)

13.4.7. GBAS for complex runway environments

The work sees the application of GBAS CAT III L1 (GBAS approach service type (GAST-D)) in order to maximise the benefits of GBAS technology down to CAT II/III minima.

SJU reference: GBAS (PJ.14-03-01)

13.4.8. Multi-constellation/Multi-frequency (MC/MF) GNSS

Multi-constellation/Multi-frequency (MC/MF) GNSS refers to standardisation developments for multi-constellation GNSS.

SJU reference: Multi-constellation/Multi-frequency (MC/MF) GNSS (PJ.14-03-02)

13.4.9. Alternative position, navigation and timing (A-PNT)

This work covers fall-back capabilities in case of GNSS unavailability. A-PNT options could include distance measuring equipment (DME)/inertial reference system (IRS) hybridisation, multilateration and L-DACS mode N.

SJU reference: Alternative position, navigation and timing (A-PNT) (PJ.14-03-04)

13.4.10. Surveillance performance monitoring

This work refers to the development of a new surveillance system-wide area multilateration (WAM), multi-static primary surveillance radar (MSPSR), integrated CNS (ICNS) and space-based ADS-B.

SJU reference: Surveillance performance monitoring (PJ.14-04-01)

13.4.11. Cooperative and non-cooperative surveillance

This sees the new use and evolution of cooperative and non-cooperative surveillance for ATM and A-SMGCS purposes.

SJU reference: Cooperative and non-cooperative surveillance (PJ.14-04-03)

13.4.12. Sub-regional demand capacity balancing service

This service aims at facilitating an improved usage of the airspace at sub-regional level and facilitate tactical interventions when necessary, ensuring that any potential disruptions could be correctly managed. The scope also includes an AOP common service to facilitate the integration of AOP information into the NOP.

SJU reference: Sub-regional demand capacity balancing service (PJ.15-01)

13.4.13. Delay sharing service

This work aims to enable AMAN functionalities to operate within an extended horizon to provide local and overall arrival sequences for planning and tactical operational purposes in a cross-border environment.

SJU reference: Delay sharing service (PJ.15-02)

13.4.14. Trajectory prediction service

This work aims at computing and distributing an accurate and consistent 4D trajectory and update as the flight progresses. The output could be used during different flight phases, such as an initial reference trajectory in the planning phase, as input for DCM during the tactical phase or to facilitate transfers during the operations phase.

SJU reference: Trajectory prediction service (PJ.15-08)

13.4.15. Static aeronautical data service

This work provides static aeronautical data in digital form to be used by different ATM systems (e.g. safety nets). The output is an AIXM-compliant dataset whose subsets can be retrieved by individual requests demanding specific geographical areas, attributes or functional features.

SJU reference: Static aeronautical data service (PJ.15-10)

13.4.16. Aeronautical digital map service

The work provides digital maps ready to be used by different ATM systems (e.g. safety nets) when performing separation functions. The output is highly customisable in order to meet the different requirements from the consumers and easily convertible among different digital formats, as AIXM, GML, XML, etc.

SJU reference: Aeronautical digital map service (PJ.15-11)

13.4.17. Towards virtualisation

The work provides an operating environment in which different air traffic service units, even across different ANSPs, can appear as a single unit and can be subject to operational and technical interoperability. Based on the virtual centre concept, the CWP/ HMI needs to interface with one or more information service providers or consumers.

SJU reference: Work station, service interface definition and virtual centre concept (PJ.16-03)

13.4.18. Data centre services for virtual centres

The work aims to provide air traffic services using standardised operating methods, procedures and technical equipment. The service would be seen as a unique system from the consumer’s perspective, rather than the current fragmented situation.

SJU reference: Data centre services for virtual centres (PJ.15-09)

13.4.19. Advanced human machine interface (HMI) technologies

This work aims to increase the efficiency of service provision through the development of new human machine interface (HMI) interaction modes in relation to other SESAR Solutions (including new user interface technologies, such as speech recognition, multitouch and gaze detection).

SJU reference: Workstation, Controller productivity (PJ.16-04)

13.4.20. Air-ground advisory information sharing (SWIM TI purple profile)

This work supports ATM operational improvements that depend on A/G information exchanges to enable better situational awareness and collaborative decision-making. This includes the specification of technical architecture and functions that are required to achieve full interoperability between air and ground SWIM segments and meet the safety and performance requirements required by airborne operations.

SJU reference: Air-ground advisory information sharing (SWIM TI purple profile) (PJ.17-01)

13.4.21. Ground-ground civil-military information sharing (SWIM TI green profile)

This work ensures that protocols and data models used in military systems can be interfaced with SWIM with adequate quality of service levels maintained. It will complement the air-ground advisory information sharing (SWIM TI purple profile) for advisory services.

SJU reference: Ground-ground civil-military information sharing (SWIM TI green profile) (PJ.17-03)

13.4.22. Improved mission trajectories

The work sees the integration of mission trajectories into the TBO environment throughout all phases of trajectory planning and execution (SMT/RMT). Enhanced mission trajectory will be subject to trajectory management processes and contain 4D targets and ATM constraints.

SJU reference: Mission trajectories (PJ.18-01)

13.4.23. Integration of trajectory management processes in planning and execution

This work refers to the management, negotiation and sharing of the SBT/SMT, as well as the management, updating, revision and sharing of the RBT/RMT, and finally the transition from the SBT/SMT to the RBT/RMT. The solution consolidates the extension of the trajectory and flight plan information exchange and delivers the technical solution to provide the infrastructure enabling seamless operation and trajectory sharing in response to the need of the SESAR Solutions.

SJU reference: Integration of trajectory management processes in planning and execution (PJ.18-02)

13.4.24. Improved trajectory management through data sharing

This work will allow greater flexibility to meet the full 4D trajectory management requirements and is expected to come with further proposals on operational, technical and institutional aspects of how aeronautical data should be identified and exchanged.

SJU reference: Management and sharing of data used in trajectory (AIM, METEO) (PJ.18-04)

13.4.25. Performance-based trajectory prediction

This refers to data exchange between air and ground and the use of other sources in order to support all advanced operational processes required in SESAR 2020. The work looks at how the trajectory predictions for ATC, FOC and NM can be improved, taking into account all possible data sources (legacy or not).

SJU reference: Performance-based trajectory prediction (PJ.18-06)

14. ANNEX D: BIBLIOGRAPHY

14.1. Legislation

1) 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)

2) 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)

3) 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

4) REGULATION (EU) No 1291/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2013 establishing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020) and repealing Decision No 1982/2006/EC

5) COMMISSION IMPLEMENTING REGULATION (EU) No 409/2013 of 3 May 2013 on the definition of common projects, the establishment of governance and the identification of incentives supporting the implementation of the European Air Traffic Management Master Plan

6) COMMISSION IMPLEMENTING REGULATION (EU) No 716/2014 of 27 June 2014 on the establishment of the Pilot Common Project supporting the implementation of the European Air Traffic Management Master Plan

7) REGULATION (EC) No 549/2004 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 10 March 2004 laying down the framework for the creation of the single European sky (the framework Regulation)

8) REGULATION (EC) No 550/2004 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 10 March 2004 on the provision of air navigation services in the single European sky (the service provision Regulation)

9) REGULATION (EC) No 551/2004 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 10 March 2004 on the organisation and use of the airspace in the single European sky (the airspace Regulation)

10) REGULATION (EC) No 552/2004 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 10 March 2004 on the interoperability of the European Air Traffic Management network (the interoperability Regulation)

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21) SESAME CBA and Governance: Assessment of options, benefits and associated costs of SESAME Programme for the definition of the future air traffic management system, Final Report. Steer Davies Gleave. (2005).

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14.3. SJU Annual Reports

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60) Job Description: Chief ATM

61) Job Description: Chief Development & Delivery

62) Job Description: Chief Strategy & External Affairs

63) Job Description: Chief Administration Affairs

64) Job Description: Chief Economist & Master Planning

65) Terms of Reference Master Planning Committee

66) Terms of Reference Scientific Committee

67) Terms of Reference Programme Committee

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(see http://www.sesarju.eu/discover-sesar/governance/adbmeetings)

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(see http://www.sesarju.eu/discover-sesar/governance/adbmeetings)

70) Lessons Learnt Scientific Committee

71) Lessons Leant Programme Committee

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14.7. External References

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83) Challenges of Growth 2013 Task 4: European Air Traffic in 2035, EUROCONTROL, 2013

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15. ANNEX E: INTERVIEWS

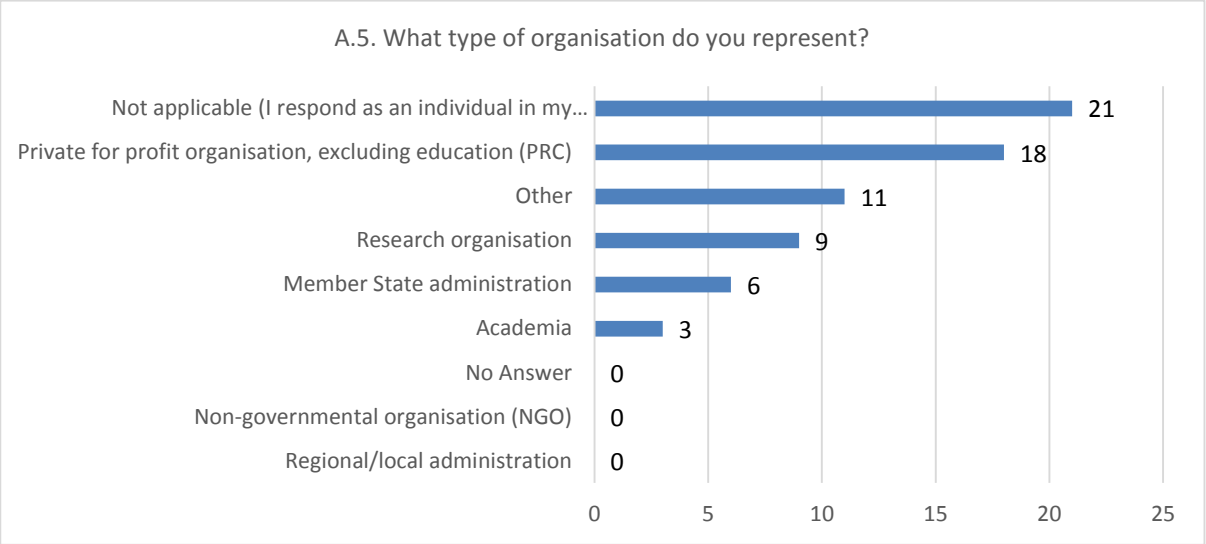
Name	Organisation	Role in SESAR	Date
Florian Guillermet	SJU	Executive Director	24th April 8th March 1st June
Peter Hotham	SJU	Deputy Executive Director	2nd March 31st May
David Bowen	SJU	Chief ATM	2nd March 31st May
Benoit Fonck	SJU	Chief Development & Delivery	2nd March 30th May
Micheal Standar	SJU	Chief Strategy & External Affairs	2nd March
José Calvo Fresno	SJU	Chief Administration Affairs	2nd March 30th May
Alain Siebert	SJU	Chief Economist & Master Planning	1st March
Maurizio Casteletti	EC	Head of SES Unit	1st March
Marco De Sciscio	EC	SESAR Policy Officer	1st March
Octavian Vasile	EC	SESAR Policy Officer	1st March
Nicolas Warinsko	SDM	Deputy Executive Director	2nd March
Russel Dudley	ERA	Admin Board Alternate	7th March
Vincent De Veroy	ASD	Admin Board Member	7th March
Luc Laveyne	ACI	Admin Board Member	8th March
Panos Siliotis	ACI	Admin Board Alternate	8th March
Giovanni Russo	SEAC	Admin Board Member	8th March
Thomas Buchanan	Skyguide	Admin Board Member	8th March
Dirk Kugler	AT-ONE	Admin Board Member	9th March
Miriam le Fevre Hansen	COOPANS	Admin Board Member	9th March
Ralph Bertsch	DLR	Admin Board Member	20th March
Stefano Porfiri	Leonardo	Admin Board Member	22nd March
Peter Heckler	TUB	Scientific Committee	27th March
Philippe Merlot	EUROCONTROL	Admin Board member	31st May
Jean Marion Marinescu	EP	TRAN Rapporteur for SES	June

16. ANNEX F: RESULTS OF THE STAKEHOLDER SURVEY

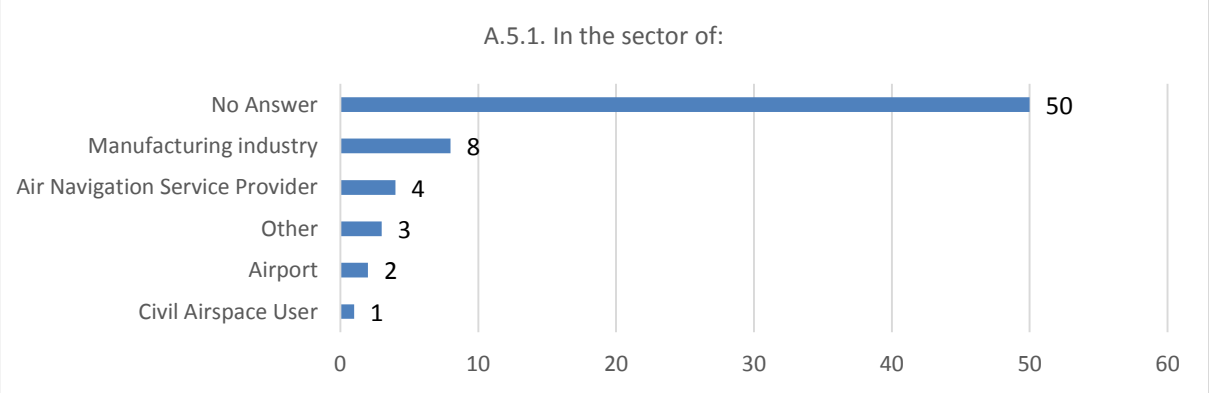
16.1. Context

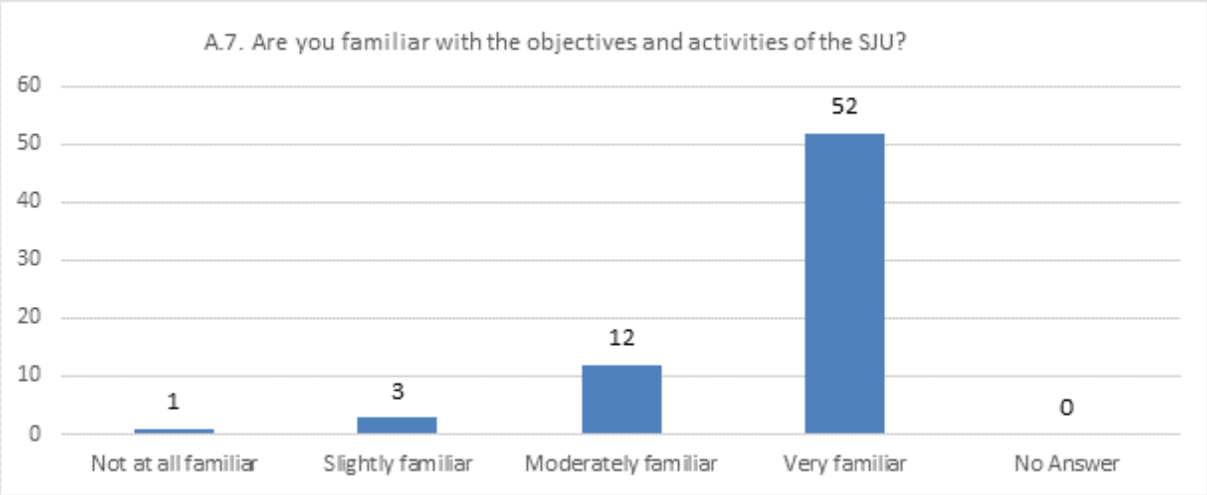
The European Commission launched an on-line public survey in December 2016 covering all seven Joint Undertakings. 68 respondents replied to the questions relating to SESAR (32 responded in a personal capacity and 36 in a professional capacity (for example on behalf of their organisation. Only 4% of responses represented SMEs.

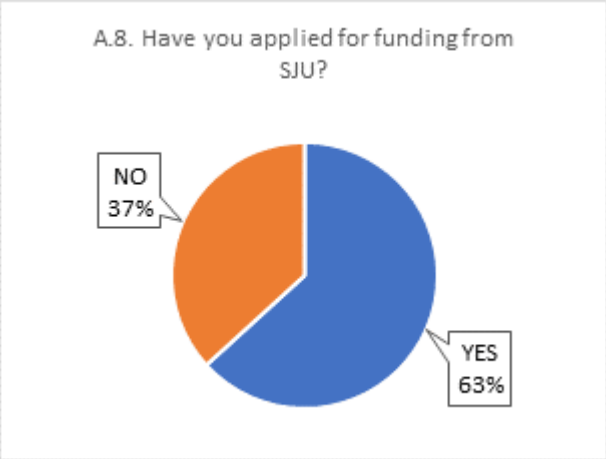
16.2. Part A: Respondents, Familiarity with SESAR and Role in SESAR

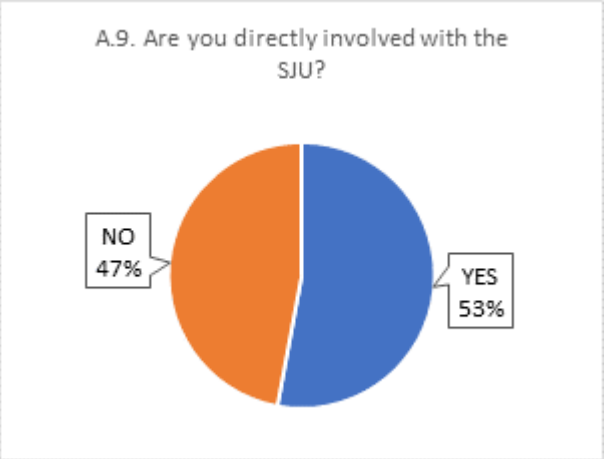


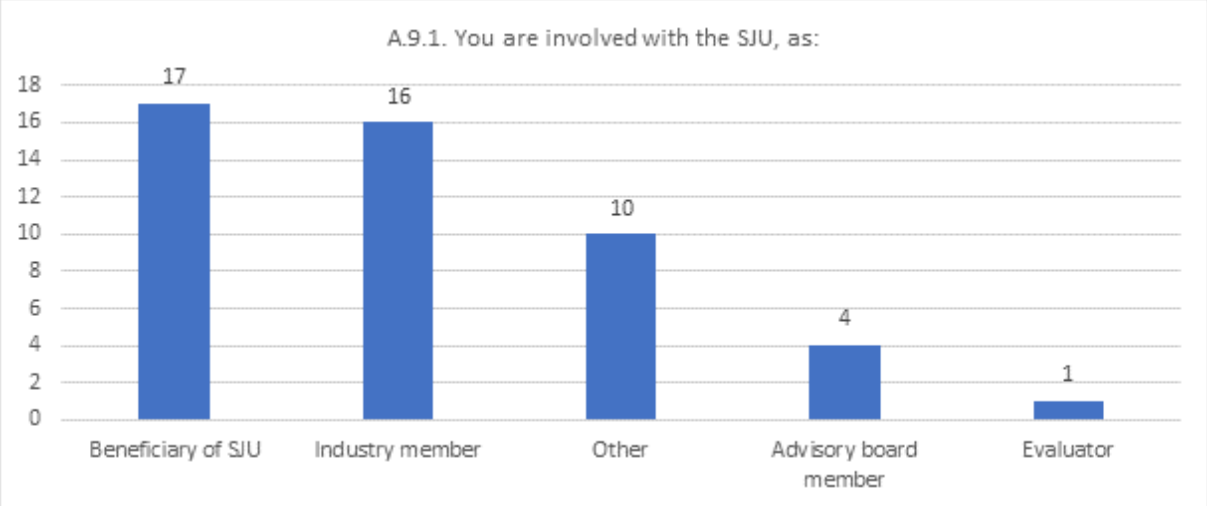
Charts below represents the type and sectors of organisations presented in the survey:




A.7. Are you familiar with the objectives and activities of the SJU?
60
50
40
30
20
10
0
1
3
12
52
0
Not at all familiar
Slightly familiar
Moderately familiar
Very familiar
No Answer

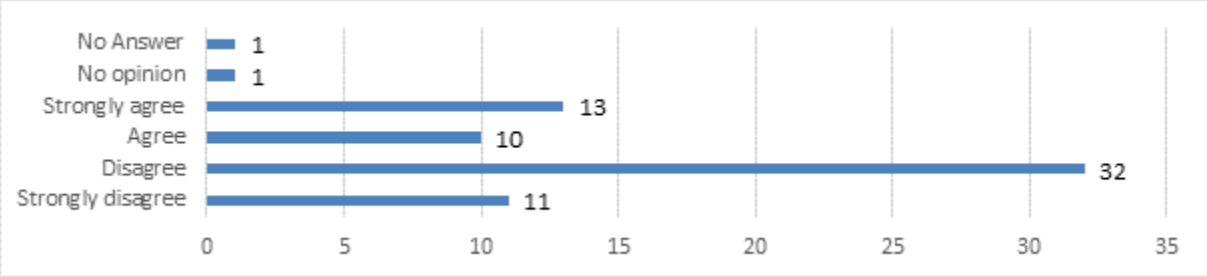

A.8. Have you applied for funding from SJU?
NO 37%
YES 63%


A.9. Are you directly involved with the SJU?
NO 47%
YES 53%

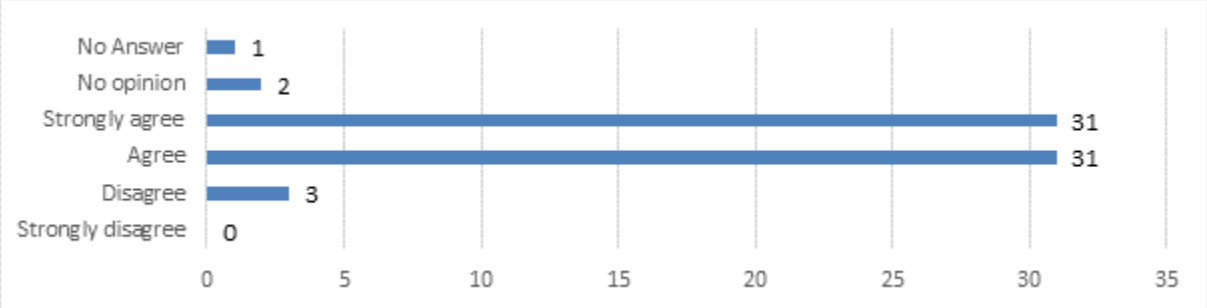

A.9.1. You are involved with the SJU, as:
18
16
14
12
10
8
6
4
2
0
17
16
10
4
1
Beneficiary of SJU
Industry member
Other
Advisory board member
Evaluator

16.3. Part B: European Added Value

B.1 In your view, could the ATM industry along with other possible actors at national level but without the involvement of the EU, develop innovative and interoperable solutions in order to modernise and harmonise the European ATM system?



B.2. Do you agree with the EU cooperating with industry in the context of a public-private partnership so that the ATM research brings better results to all ATM stakeholders in Europe?



B.3. What is the European added value of this public-private partnership?

Value	Responses					
	Not important at all	Not important	Important	Very Important	No opinion	No answer
B.3.1. Better use of available funding	2	10	19	**31**	0	6
B.3.2. Integration of European research	1	1	23	**36**	1	6
B.3.3. More cross border cooperation	2	1	16	**41**	2	6
B.3.4. More cross-sector/interdisciplinary/ multi-stakeholder cooperation	2	3	22	**34**	1	6
B.3.5. Quicker adoption of standards	1	8	**27**	21	4	7
B.3.6. Knowledge pooling and sharing	0	7	**34**	18	3	6
B.3.7. Better access to research results	1	13	**26**	20	2	6

B.3.8. Incentives for companies to share expertise	0	12	**28**	20	2	6
B.3.9. Better support of the Union policies	1	9	**27**	24	1	6
B.3.10. Facilitation of industrialization and deployment process	1	6	22	**30**	3	6
B.3.11. Research risk sharing and mitigation	3	6	**26**	**26**	1	6
B.3.12. Improved cooperation with 3rd countries	2	12	**31**	13	4	6
B.3.13. Better market access	2	12	**31**	11	6	6

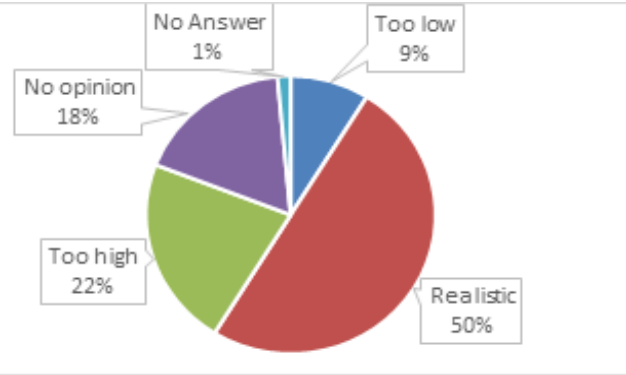
Responses to the open part of the question fell in to three broad categories:

- The creation of a common platform to share information and experiences, this was beyond just R&D and should be taken to include improved stakeholder interactions at an operational level (5 responses)
- The cross-border nature of the SJU creating inter-state synergies (3 responses)
- Creation of a strong link between the R&D and the wider SES policy in particular through the master plan (8 responses)

In addition, three responses indicated that the link to innovation (low TRL research) needed to be strengthened.

B.5. "Leverage effect" is defined as the ratio between the total contributions provided by the members of the JU other than the EU and the EU contribution. For the SJU there are no specific minimum expected leverage, but currently, for the activities foreseen under Horizon 2020, the ratio stands at 1.41 (€825 M invested by Members against a €500 M EU contribution).

The current minimum leverage effect foreseen of 1.41 is. Is this realistic?



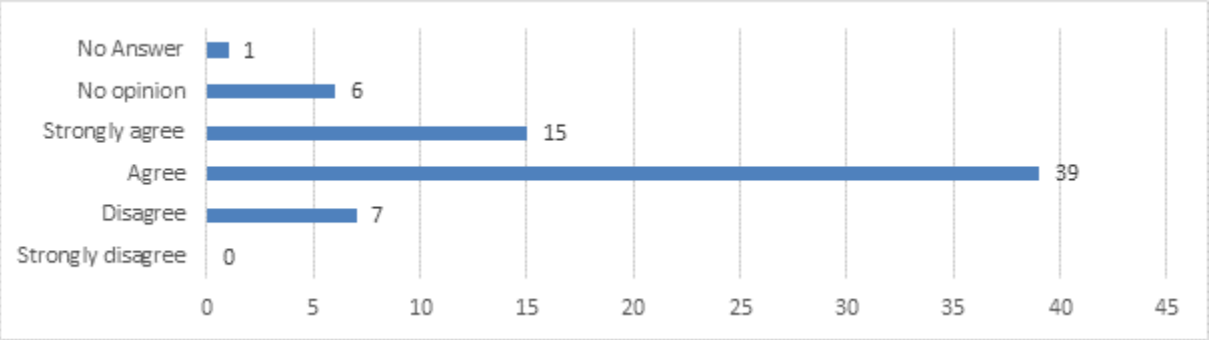
In the open part of the question sixteen answers included a proposed level:

Proposed Leverage	Rationale	Answers
2	To reduce member's dependency on EU funding	1
1.5 to 1.9	No rationale provided	2
1.41	Current level seems about right	3
1.4 to 1.3	As beneficiaries are large companies rather than SMES	3
1	Due to the high overheads of participation To correspond to NextGen where industry costs are covered in full	7

Answers that did not provide level tended to indicate that:

- Different levels are needed for different types of participation (e.g. higher for lower level TRL work)
- That overall level is too high (eg the level of co-financing from the Commission to too low).

B.6 Do you consider that SJU contributes to economic growth and job creation in the EU?



In open part of the question, the vast majority of written responses (29) felt that the link to deployment of new ATM systems in line with the SES policy goals creates jobs and economic growth. The McKinsey Macro-Economic Study was references as supporting evidence. Most written answers provide strong support for the policy link enjoyed by the SJU.

The other answers fell into three categories:

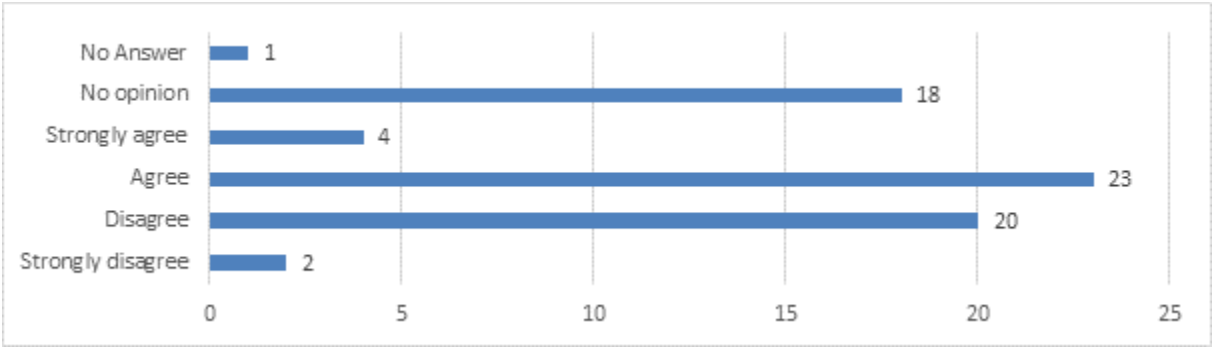
- Those who felt that R&D up to TRL6 itself does not create job (2 responses)
- Those who felt that SESAR created short term jobs for Members (4 responses)
- Those who felt that SESAR would in the end reduce jobs by creating a less labour intensive industry (2 responses)

16.4. Part C: Openness - Transparency

C.1 Do you consider that the SJU website provides the general public and potential participants with easy access to information?

Value	Responses					
	Strongly disagree	Disagree	Agree	Strongly agree	No opinion	No answer
C.1.1. The SJU website provides easy and effective access to information to the public	4	8	**28**	24	2	2
C.1.2. The SJU website provides easily accessible and sufficient information about its funded projects	4	12	**31**	14	5	2
C.1.3. The SJU website provides effective access to information and sufficient guidance to interested organisations facilitating their participation in proposals	4	13	**29**	16	4	2
C.1.4. The SJU website provides easy and effective access to knowledge generated by the projects funded under this JU	6	16	**23**	11	9	3

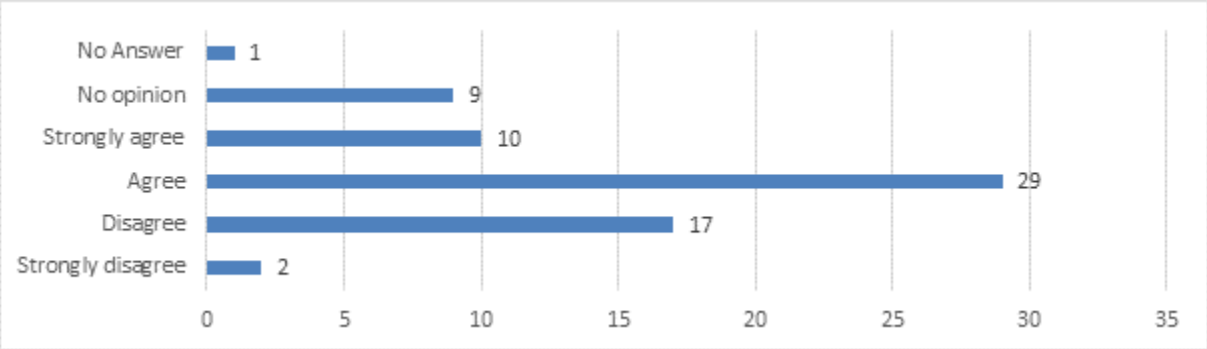
C.2 Do you consider that the SJU encourages the participation of SMEs?



In written responses, it was noted that:

- SMEs tend to be involved through the supply chain of members, and that many had been involved via this route in SESAR1.
- The direct involvement of SMEs is restricted to exploratory research.
- That there are no specific SJU initiatives to encourage SME participation.
- The costs (particularly of Membership) and administrative burden are too high for SME direct involvement.

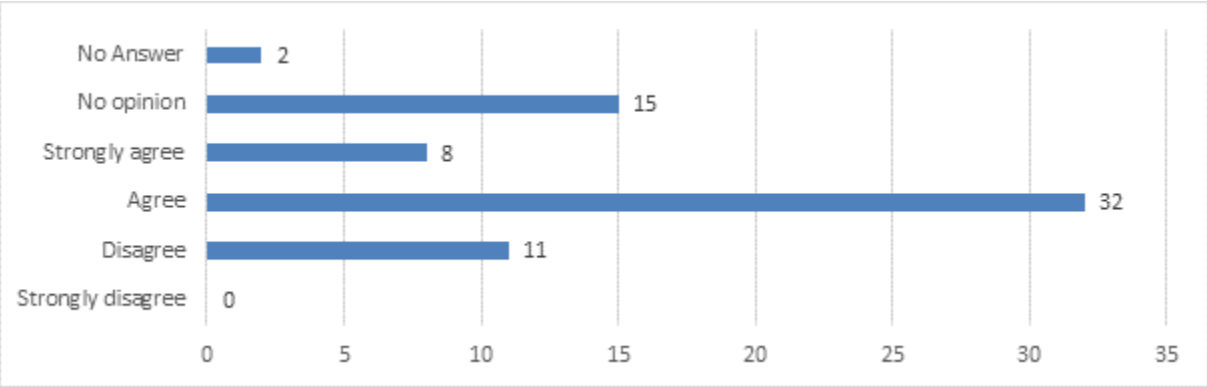
C.3 Do you consider that the current way of defining topics for the calls of proposals is open and inclusive?



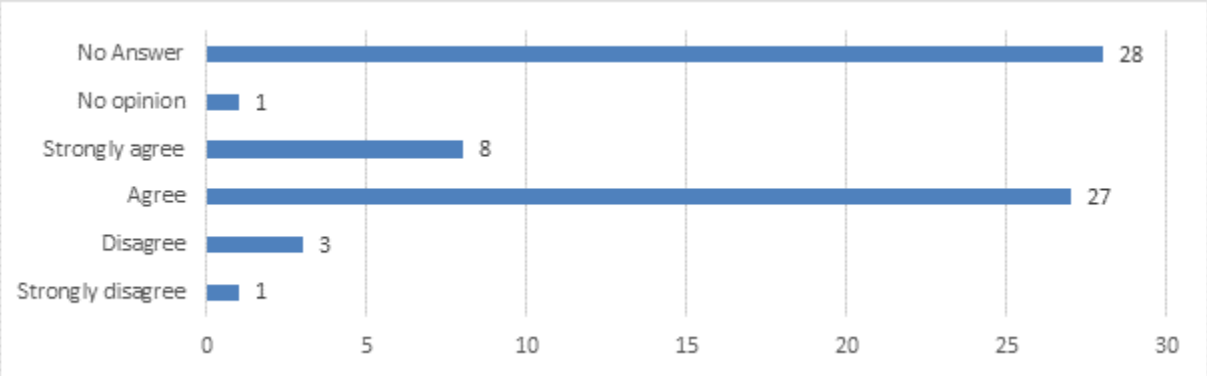
The written responses indicate that the topics covered by the SJU are identified within the European ATM Master Plan which does have wide stakeholder involvement in the update process. However, it was also noted that:

- The process of defining the work programme for the Industrial Research is inclusive of the Membership but not the wider community. Most responses are supportive of this process.
- There is less dialogue concerning the nature of open calls (e.g. for the Exploratory Research) although others note involvement of ART and ASDA as sources of ideas. Most responses would support wider involvement still.

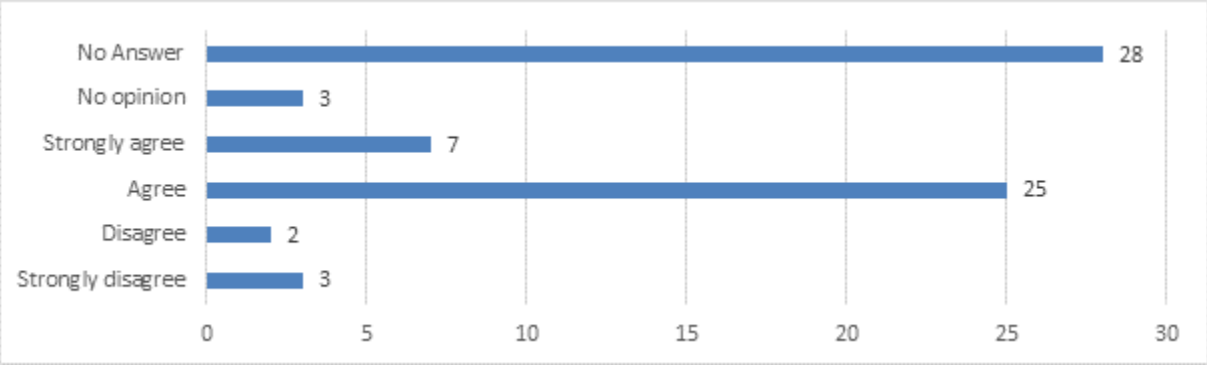
C.4. Do you consider that the budget split between members' activities (max. 70% of EU funding to the SJU) and non-members activities (min. 30% of EU funding to the SJU) is appropriate to ensure a wide participation of the sector at large?



C.5 Do you consider that SJU organises a sound and fair proposal evaluation system based on both scientific and technological excellence and industrial relevance?



C.5.1 Do you consider that the communication of the evaluation results and the feedback provided to the applicants is effective and meaningful?

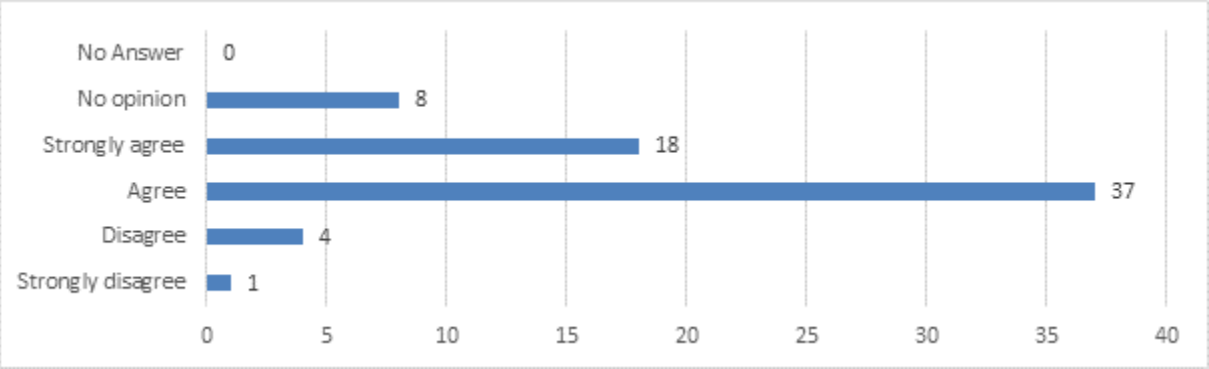


In the open part of the question the five respondents who disagreed with the feedback being effective and meaningful felt that the evaluation criteria were obscure and that more information could be provided. None are full members of the SJU. Full Members tended to have a more positive view of the evaluation process.

16.5. Part D: Relevance, Coherence and Effectiveness

D.1. The research and development agenda of the SJU is set out in the European ATM Master Plan following a comprehensive planning exercise carried out in cooperation with the European Commission, Member States, various aviation stakeholders and SJU Members.

Do you think that this framework is the most appropriate for defining the European Research & Innovation agenda for ATM?



D.2 In your view how effective has SJU been in terms of:

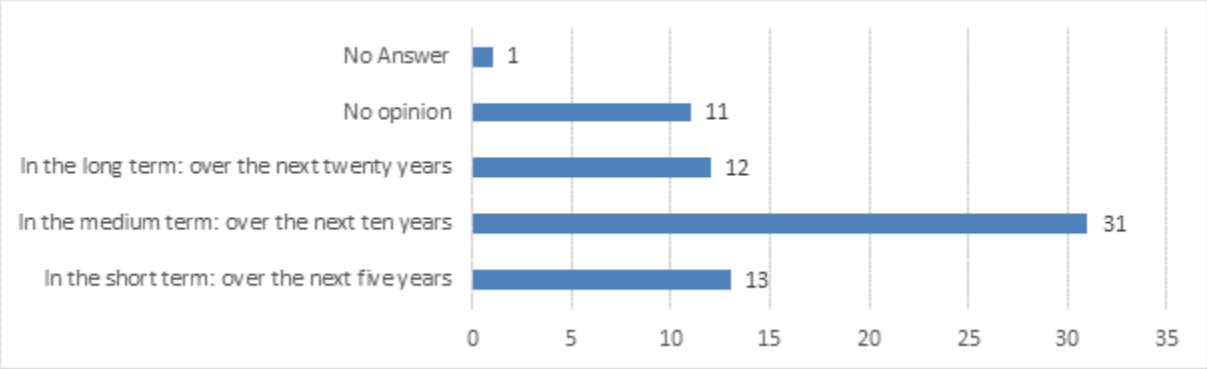
Value	Responses					
	Not at all effective	Somewhat effective	Very effective		No opinion	No answer
D.2.1. Supporting the development of ATM solutions	1	26	**34**		4	3
D.2.2. Accelerating ATM research	4	**32**	26		3	3
D.2.3. Validating SESAR solutions	4	20	**37**		3	4
D.2.4. Supporting the transition to standardisation and industrialisation	4	23	**25**		4	3
D.2.5. Resolving existing technical limitations (e.g. inter-operability problems)	6	**43**	12		4	3
D.2.6. Mitigating risks linked to innovation	3	**41**	16		4	3
D.2.7. Aligning ATM Research to the Single European Sky policy	2	21	**37**		5	3
D.2.8. Transitioning from FP7 to Horizon 2020 environment	8	**34**	16		7	3

In the open part of the question 32% of the respondents felt that the SJU should undertake additional tasks. Of the 18 suggestions provided, eight related to the integration of Drones/UAS into civilian airspace. Four suggested broad "technology watch" task to ensure links to wider research and establish the future programme.

Four related to improved integration of the SJU in the wider policy area of the SES including providing improved linkage to deployment and standardisation. It was also suggested that the SJU should have been more active role "during the "cooperative bid" / negotiation phase, to mitigate big industrial partners taking advantage of their position and often not getting the best technological solution for the European community as a result".

The final suggestion was to strengthen the Scientific Committee.

D.4 Do you think that the SJU can contribute towards improving the competitiveness and industrial leadership of Europe in the ATM sector?



Reasons provided for short term leadership included:

- The SESAR Solutions Catalogue demonstrating real European knowledge
- The Pilot Common Project demonstrating the practicality of the solutions
- The role of SESAR in closing the gap between R&D and deployment
- Role of the SJU in promoting SESAR at ICAO, with the FAA and other regions

Reasons provided for short term leadership included:

- A good balance between incremental technologies and more disruptive technologies
- The time required to industrialisation the outputs of the SJU
- The length of the innovation lifecycle
- The static nature of service provision within ATM
- Concerns over future deployment due to difficulties with VDL2 deployment

Reasons provided for long term leadership included:

- The traditional slow timeframes for modernisation of ATM, particularly in terms of standardisation
- The need to educate other regions on the SESAR solutions
- The lack of pull-through from other industries (for example security)
- The need for wider commitment to the necessary change.

D.5. Which would you consider as major benefits of participating in a SESAR JU project?

Value	Responses					
	Strongly disagree	Disagree	Agree	Strongly agree	No opinion	No answer
D.5.1 Financial support for innovative research and development	1	4	21	**40**	2	0
D.5.2 Greater visibility across Europe/Reputation	2	1	28	**35**	2	0
D.5.3 Enhanced access to new markets, business opportunities and funding sources	1	12	**25**	19	11	0
D.5.4 Inclusion in open innovation networks, with direct contact to leading researchers in universities and the industry	1	7	**27**	26	7	0

In the open question the following additional benefits were mentioned:

- Collaborative environment supporting cross border understanding and cooperation (12 responses)
- Fostering of innovation (2 responses)
- Reduction in time to market for new products (1 response)

It is important to note that the benefits of collaboration are to the wider ATM industry and not just to R&D.

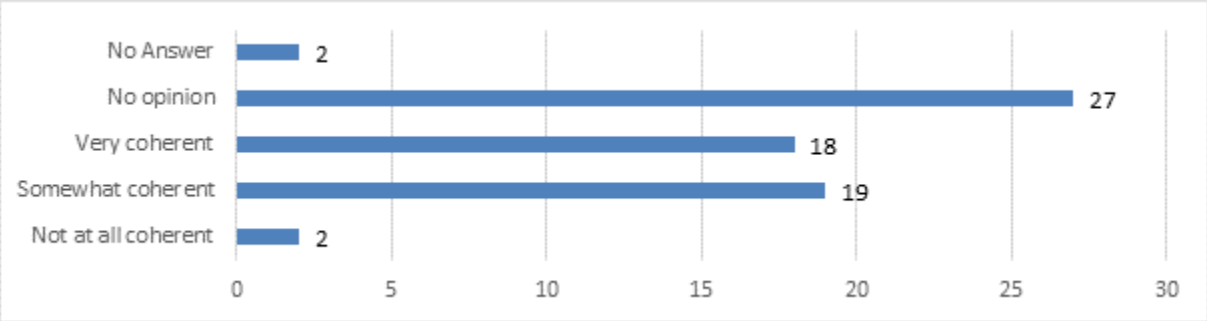
D.7 Do you consider that SJU projects have resulted in specific scientific and/or technological successes?

75% of respondents felt the SJU projects had resulted in scientific and/or technological success. The areas mentioned most frequently were:

- Time Based Separation
- Airport Collaborative Decision Making and Airport Integration with the Network
- Remote Towers
- Extended Arrival Management
- SWIM
- Satellite Communications
- i4D

In addition, it was noted that the SJUs support of VDL2 response was a positive role with an important technological enhancement.

D.8 To what extent are the activities of the SJU coherent with other activities of the Horizon 2020 programme?



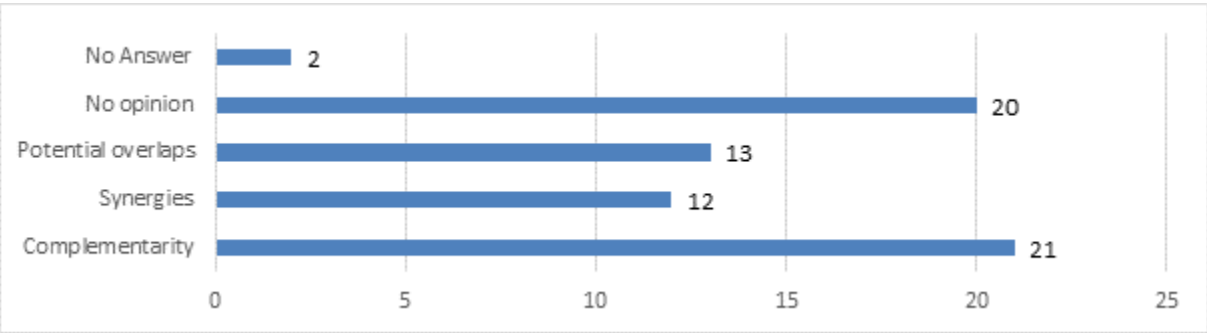
From the open part of the question it is clear that there was insufficient knowledge from most respondents on the wider Horizon 2020 programme to answer the question.

The two responses stating that SJU activities are not coherent with the Horizon 2020 programme are critical of their inclusion in Horizon2020

The rationale for "somewhat coherent" was that more could be done to build synergies with the other transport JUs (in particular Clean sky) and other areas such as cyber security, robotics and machine learning.

The rationale for "very coherent" was either that SJU is coherent because it follows the H2020 rules or because of existing links with Clean Sky. A number of respondents also pointed out that both SESAR and H2020 are consistent with the EU Transport Policy and are therefore coherent.

D.9. What is the relation of the SJU with other Union funding programmes and/or with similar international, national or intergovernmental programmes?

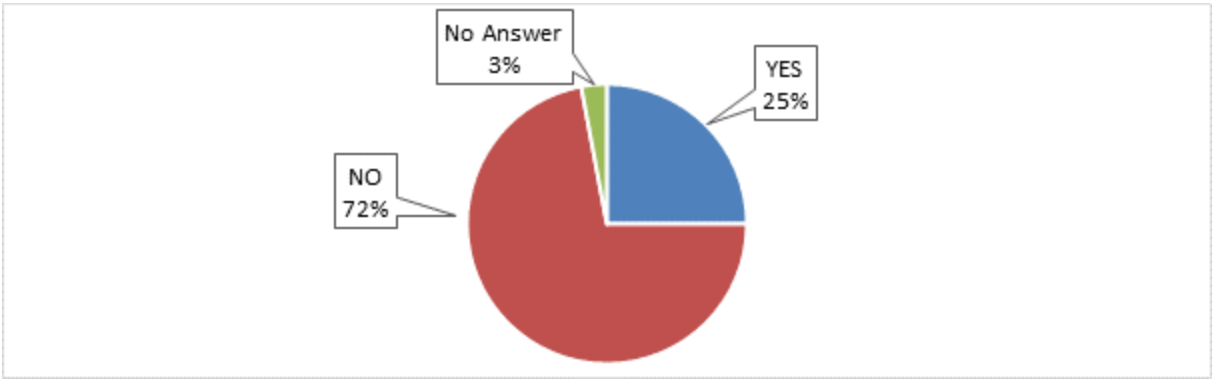


The following table summarises the justifications provided.

Answer	Justification
Potential Overlaps	The projects GAMMA, SANDRA and ARIEL are listed as potential overlaps Both Clean Sky and SJU have worked on helicopter flight procedures.
Synergies	Links to Clean Sky Links to the German National Programme (where some funding is made available for topics not considered within SESAR, with some evidence of cross fertilisation)
Complementarity	The strong link between SJU activities and those of the SESAR Deployment Manager funded through the Connecting Europe Facility The links between SJU and other EU bodies such as EASA and EDA The links between SJU and international bodies such as FAA (NextGen) and Japan (CARATS)

Respondents also noted that as a stated role of the SJU is to coordinate all ATM R&D that there is no other European funding available to support ATM Research outside SESAR.

D.10. Do you have any experience in combining different sources of EU funds and/or with national funds for research and over the innovation value chain?

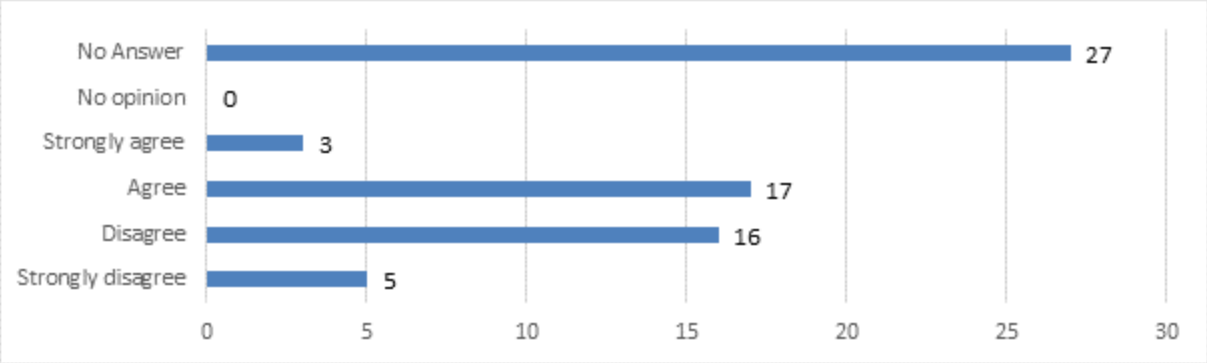


Most of the open text answers indicated the difficulty in achieving complementary financing from multiple sources. There were two positive responses:

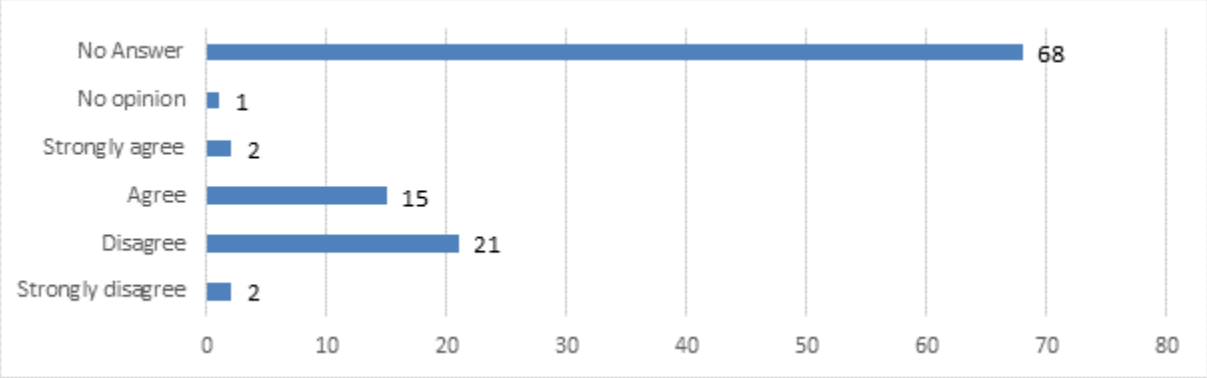
- Due to the complementarity over similar topics, similar research topics can be efficiently developed by using at the same time funding from CS2, SESAR and national funds.
- COST framework is a generally good idea - to bring together and to an extent facilitate joint work of researchers from different countries addressing similar research topics (often with national research grants). Establishing networks (or centres) of excellence within several research fields also seems like a possibly fruitful framework.

16.6. Part E: Efficiency

E.1 When you applied for funding from the SJU, did you think that the application procedure was straightforward and simple?



E.2 When you applied for funding from the SJU, was the administrative burden for preparing the proposal within acceptable limits?



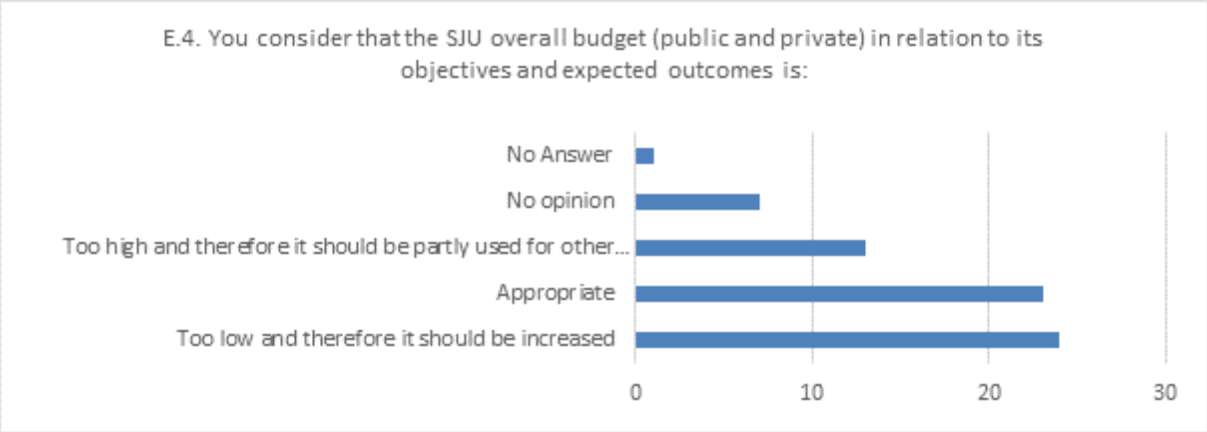
E.3 Can you make any suggestions for improvements or simplifications to the application procedure?

Twenty-six percent of respondents felt that imporvements were possible. The following suggestions for were provided:

- Remove the additional complexity introduced by the Horizon 2020 rules over those used for SESAR1.
- Reduce the complexity of the required proposals
- Reduce the complexity of the funding rules
- Provide alternative approaches to Membership (as was the case under SESAR1)
- Remove the duplication between the grant award process and the application process.
- Adapt the participant portal to support consortia operating within a project. The tool is not adapted to the need of the SJU or its members.

Nearly all respondents providing a comment expressed concern over the application of Horizon 2020 rules which were seen as costly and time consuming.

E.4. You consider that the SJU overall budget (public and private) in relation to its objectives and expected outcomes is:



The following table summarises the rationale provided.

Answer	Justification
Too High	• Funding programmes looking at lower TRL Levels like the Exploratory Research part of the SJU as well as the conventional funding of ATM related Topics as part of the Horizon 2020 Programme should be increased. Otherwise there is a big danger that Europe does not generate enough new ideas related to ATM for the future beyond current SESAR (x3) • Results are not sufficient to justify increased budget.
Appropriate	• The main issue in European ATM modernization is deployment and overcoming national barriers, monopolistic interests and non-willingness of change resistant ATM actors • Funding for Exploratory Research is not sufficient and quite often attacked by subjects which not really innovative such as RPAS • The SJU overall budget is appropriate. It seems, however, that there is too much funding for parallel developments, thus fragmenting the efforts (and probably the results), and not enough funding for truly innovative research.
Too Low	• A higher budget is required due to the complexity and difficulty of the overall task of modernising European ATM • Reduction of public budget between SESAR1 and SESAR2020 has resulted in lower Member contributions and a prioritisation of work which means some Members are not contributing in all areas they wished to. • Greater funds are required for the Exploratory Research.

The answers do follow pattern of Member wanting more money for Industrial Research and non-Members want more money for Exploratory Research.

16.7. Part F: Overall

Respondents were asked to provide any final comments. The following unique responses were provided.

This partnership is the example of a good cooperation between Brussels and the aviation community in the service of air passengers.
Efficiency in large programmes sometimes quite low; some Partners only look for funding and do provide only Minimum contributions; EU oversight could be stricter in such cases. number of Partners should be restricted because otherwise Management Overhead can be quite heavy.
The management costs of EU funded projects from preparation to dissemination are still very high as compared to US. Deliverables are considered the financial spreadsheets instead of the results by themselves.
To continue successfully supporting industry in establishing the Single European Sky, the SESAR JU should fully embrace the challenge of Drones insertion in the airspace, both in terms of airspace insertion for certified and specific drones, and in terms of UTM (Unmanned traffic management). Given the challenges ahead and the evolution of technologies, the SJU should undertake the preparation of SESAR 3 without waiting for the end of SESAR 2020.
SJU has been and is still a strong tool to bring together all key actors from R&D to manufacturing industry in a coherent programme strengthening quality of validation and shortening path to deployment
H2020 funding are great to support short term improvements and in the case of SESAR SJU to support the implementation of a regulation. But we cannot consider that this objective will sustain jobs and maintain the place of the European industry in front of giant like Google, Microsoft and even Facebook which already started to develop ATM solutions. It maintains jobs for the short term but what next?
The SJU provides a vital role in bringing together the key stakeholders to work collaboratively to deliver the SESAR Solutions in support of the ATM Master Plan and SES.
International collaboration with the USA (NextGen), Japan (CARATS) or other countries like Australia should be supported in a similar way that H2020 can support collaborative projects with non EU members or associated countries.
JTI are important catalysts for industry participation and industry interests in Horizon 2020. The JTIs have become important parts of the European innovation system. It is important to ensure that all calls through JTIs involving Horizon 2020 funding are open for all potential participants, and to avoid tendencies of "closed clubs". JTIs should be open and transparent from their inception, not only when they are formally constituted. It's important to keep a balance between the amount of funding channelled through these initiatives and traditional calls.
SESAR, as a JTI under H2020, should also comply with the same level of transparency (e.g., financial reporting in the eCORDA database with the same level of detail as other H2020 programmes).
Ensuring larger diffusion of SJU publications addressing work achieved and results obtained could be an incentive for members at contributing more to the undertaking. In general, access to and sharing of knowledge outside SJU members is deficient. This is an additional hurdle for external participants in open calls. SESAR provides a sort of “label”, i.e. an informal recognition that is useful to members. Most of SJU calls are limited to members, which is a useless and even critical in novel technological areas. Technology evaluator of Clean Sky could be used transversally by SJUs.

17. ANNEX G: RESULTS OF THE PROJECT COORDINATORS SURVEY

17.1. Context

The Beneficiary Survey was distributed to 179 organisations on 2nd February 2017 with a response date of 24th February 2017. There were 49 replies.

The questions cover the seven areas:

- Part A: Role within SESAR (4 part questions)
- Part B: The application process (16 part questions, 2 open)
- Part C: Grant finalisation phase (8 part questions, 2 open)
- Part D: Communications and Interactions with SJU (27 part questions, 2 open)
- Part E: Overall performance of the SJU (4 part questions, 2 open)
- Part F: Project Objective and Impact (10 part questions, 2 open)
- Part G: Content of the overall programme (4 part questions 1 open)

The survey was anonymous, the experts evaluating the answers are not aware of who provided each answer. This leads to difficulty in assigning views to particular stakeholder groups (e.g. research community, Manufacturer, service provider, service user – e.g. airline). From the questions/answers provided it has not been possible to determine fully is the respondent was a Member of the SJU or a participant in an open call. This reduces the usefulness of the survey results.

Further although the survey introduction requested feedback on the entire lifecycle of SESAR, in general the questions are not specific to SESAR1 or SESAR2020. In most cases when analysing the answers it is not possible to draw a distinction between the phases of the SESAR. In most cases, it is assumed that answers refer to the recent calls under SESAR2020 and Horizon 2020 rules. Limited value can therefore be attached to the survey results for the final evaluation of SESAR1.

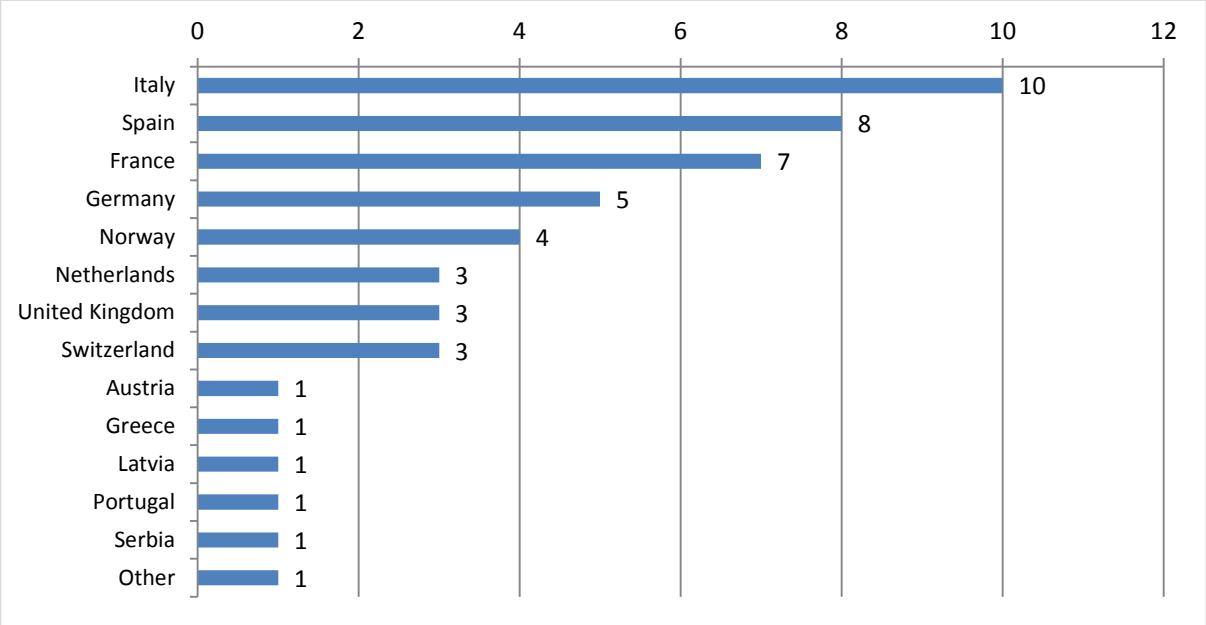
The following sections provide a summary of the answers provided. Answers to open questions are provided "as-is" except for corrections to spelling and removal of information that could identify the respondent.

17.2. Part A: Information About You

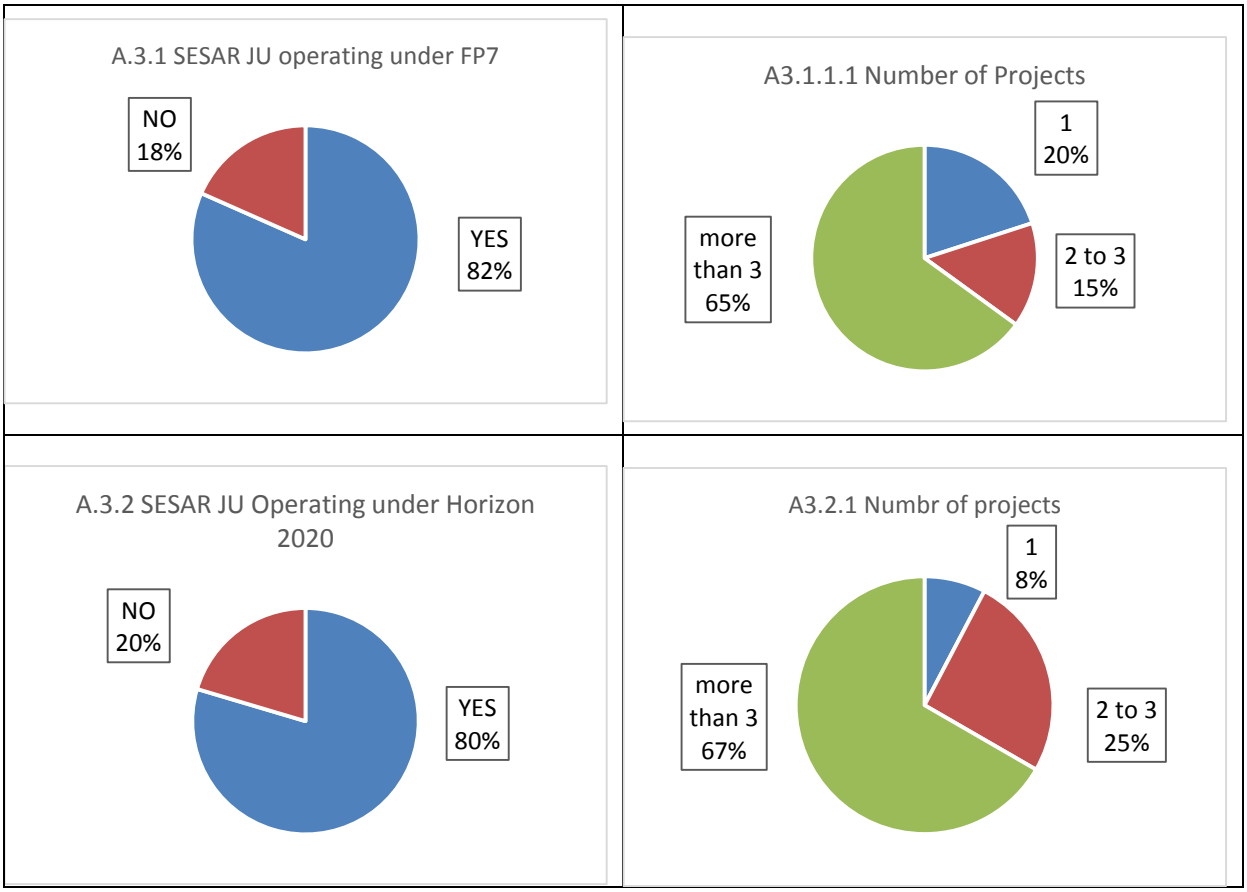
A.1 The organisation to which your research team belongs is a…

	Count	%
Academia (University or higher education institution)	7	14.3
Public or government sector, e.g. research performing organisation	10	20.4
Private, not-for-profit sector, e.g. research foundation	6	12.2
Private industry (including SMEs) benefitting/having benefitted from SESAR JU funding	16	32.6
Private industry contributing/having contributed in-kind to SESAR project(s)	9	18.4
Other	1	2.0
Total	49	

A.2 Please enter your current country where your research team is based

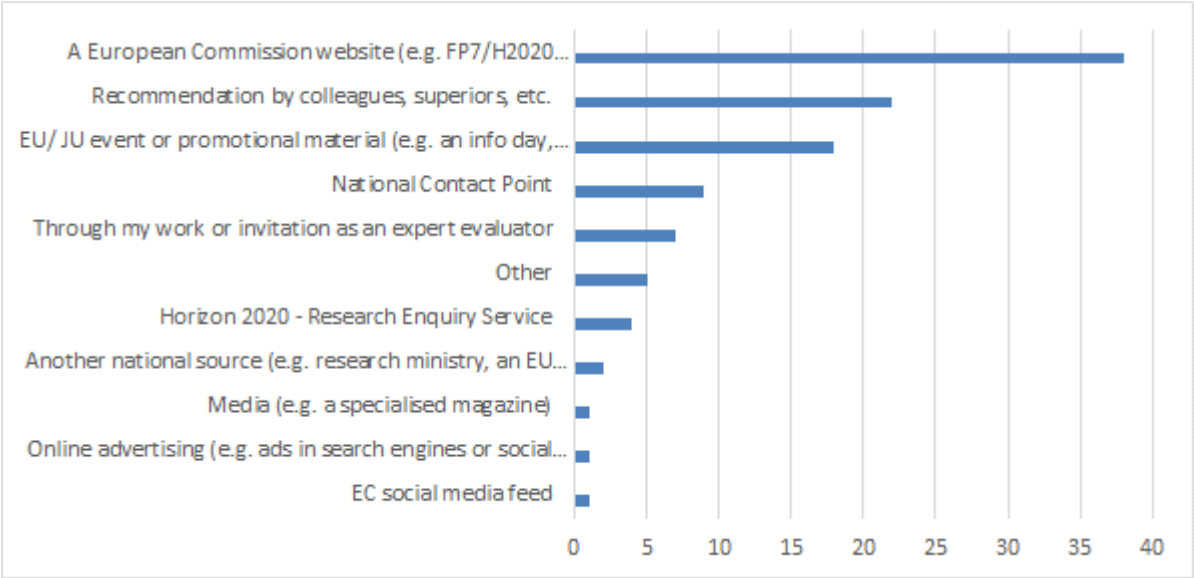


A.3 Is/was you or your research team involved in any of the following programmes?



NOTE: 33 respondents worked in SESAR1 and SESAR2020; 3 worked in neither.

A.4 What are your main channels of information on SESAR JU opportunities?



17.3. Part B: Application process

B.1 Please assess the following practical aspects of application process:

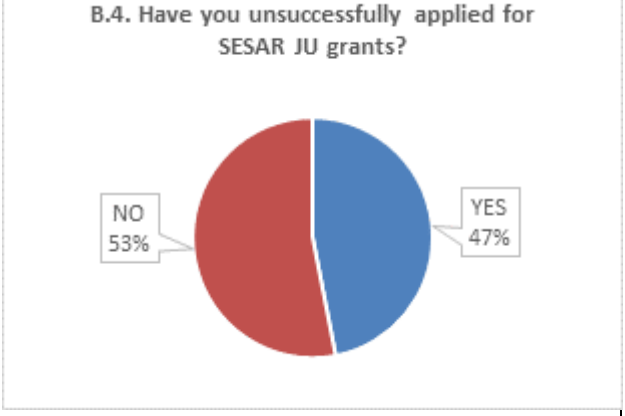
	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
B.1.1. Information for applicants was easy to find (e.g. about the call objectives, eligibility and selection criteria, documentation needed, etc.)	20	19	7	1
B.1.2. Information for applicants was clear (e.g. about the call objectives, eligibility and selection criteria, documentation needed, etc.)	19	19	6	4
B.1.3. I knew who to contact for any question(s) I had or where to get help when preparing my application	16	22	7	2
B.1.4. I knew who to contact for any question(s) I had or where to get help when submitting my application	20	16	8	2
B.1.5. The requirements for application process were reasonable and proportionate (e.g. the volume of proposal, requirements for supporting documents, etc.)	15	19	11	3
B.1.6. The evaluation process was clear and transparent	16	23	4	5
B.1.7. The electronic tool used for submitting the application was user-friendly	11	18	11	3

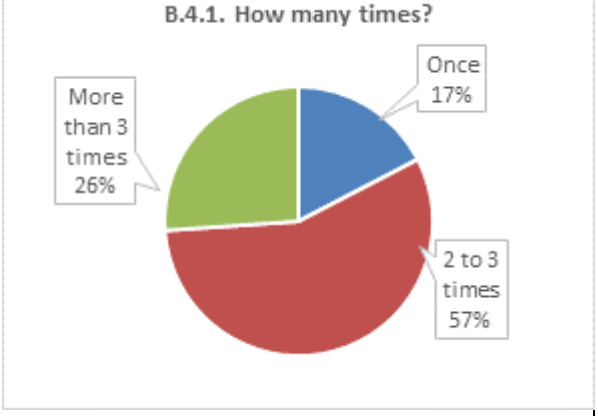
B.2 Open Question: Practical aspects of application process not mentioned above.

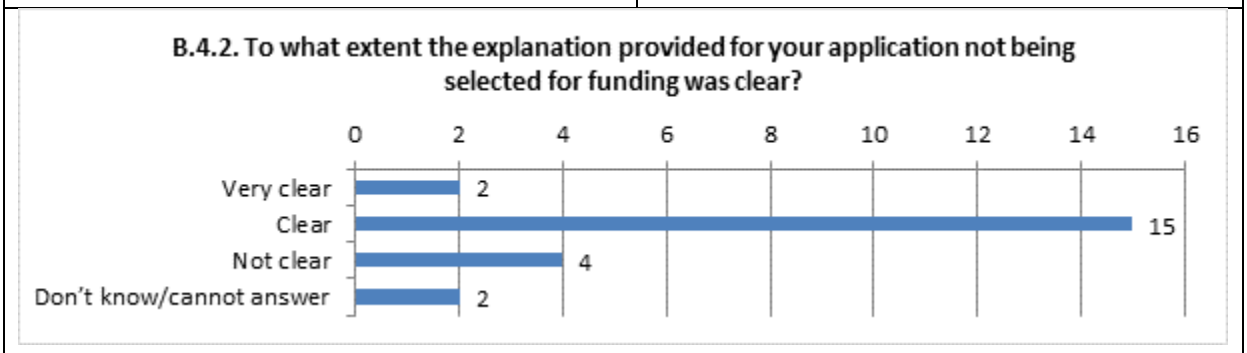
Private industry contributing/having contributed in-kind to SESAR project(s)
The formal answering during the bidding process was sometimes lengthy. However, it seems (more) difficult for a longer research programme in the framework of H2020 than under FP7. Nevertheless, the information exchange was as transparent as possible and better than for other calls (e.g. CEF).
More stability of tools is required and should only aim at diminishing 'bureaucracy'! Due to complexity of ATM, Industrial Research requires continuity over period of time (going form V1,V2, V3, ...) and actors based on heavy and trusted coordination. Indicator/criteria for the convergence of actors should be considered as key while not impairing innovative thinking and introduction of newcomers/new actors.
Private industry (including SMEs) benefitting/having benefitted from SESAR JU funding
Some difficulty was experienced in fully understanding the registration and application requirements but familiarisation has helped overcome minor issues.
The main difficulty in the SESAR 2020 process was the EC decision to combine the SES Regulation with the H2020 regulation, partly contradicting with each other. H2020 puts additional administrative burden on the SJU members, resulting in less available budget for industrial work. H2020 did not consider the specialities of the SJU setup with consortia being SJU members by its own. The solution how a member being a consortia can be part of a specific action together with other members has only be found in the last minute and created a high level of uncertainty and high effort on SJU member side
More information about the selection process would be very helpful: is the JU contributing to it and with which role ? Are the reviewers informed or aware of the JU priorities ? Information about the reviewers would also be useful: how many are them ? Level of experience ? experience field ? etc. All these factors affect the evaluation of the proposal and should be taken into account when preparing it.
Most appreciated was the "light" submission process for SESAR1 IFTDA or LSDA projects. The administrative burden required by H2020 rules is unfortunately drastically increased...
We had a Consortium of 15 Members exceeding the 375k€ threshold requiring an audit. Some Members however had a strategic role but with limited contribution (less than 30k€). For those Members, the audit process/cost was disproportionate in respect to the contribution.
I found the call text for exploratory research projects confusing. The projects should be exploratory, low TRLs, but the call text was very technology oriented, providing some examples, which could be taken as defining the scope, or just as examples.
Private, not-for-profit sector, e.g. research foundation
When I submitted my proposal approx. ten minutes before the deadline, a revised version of Part A was successfully uploaded. However, the "submit" button did not respond after several minutes, meaning that the revised version of Part A (although uploaded) was not included in the submitted proposal.
The volume of the proposals is absolutely absurd; a lot of the information that have to be included are useless and are not related to the scientific excellence. For instance, at the end you have to include 10 pages about the management of the consortium; which has nothing to do with the wiliness of the partners to work together. The evaluation process is far from transparent. It is not strange to get conflicting comments; and in general a project is rejected or accepted (thus M of € are distributed) based on 5 lines of comments.
The process for SESAR1 (FP7) was run by SJU and this was also the expectations for SESAR 2020. This changed along the road and created a lot of uncertainty before it was finally clear that H2020 rules were to be followed almost completely. The period before the Call was announced was too long (preparation phase). A lot of problems aligning the JU membership and the H2020 beneficiaries (i.e. who should be allowed to apply to the closed Call)
In H2020 it was not clear what was the difference with the earlier process under FP7.
bugs in the tool which caused some delay for the finalisation of applications
H2020 rules not flexible enough
In few cases, answers to specific questions are difficult to find. Furthermore, some improvements to the on-line manual could be introduced, collecting most relevant doubts from the FAQs.
Academia (University or higher education institution)
as university (public body) some administrative required documents were difficult to obtain

B.3 How would you assess the overall timeliness of the following processes during the application stage?

	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
B.3.1. The time period from the call deadline to the time the outcome of the proposal was announced to you (i.e. time-to-inform)	5	26	13	2
B.3.2. The time period from the announcement of your proposal's outcome to the time you signed the grant agreement (i.e. time-to-contract)	2	28	11	5
B.3.3. The overall time period from submission of the proposal to signature of the grant agreement (i.e. time-to-grant)	2	23	14	5







B.5 Open Question: Comments regarding the application phase of SESAR JU grants

Private industry contributing/having contributed in-kind to SESAR project(s)
The implication of the H2020 framework on the set-up of the PPP was well underestimated (probably from all involved parties). It's less of an SJU issue but rather the quite strict H2020 rules which cause a lot of administrative burden without any content work (e.g. all consortium members need to be beneficiaries even if only one of them participates in a project).
Where as independent expert used in the process is not questioned, independent experts in the area of 'industrial research' in ATM encompassing knowledge of both air and ground industry should not be selected from university/research centres experts network. Role of JUs should be broaden in this matter with adequate control mechanism.
Private industry (including SMEs) benefitting/having benefitted from SESAR JU funding
A better guidance through the process in such a complex environment with 2 partly contradicting regulations would be helpful, Better alignment between the different departments within EC is essential for efficient proposal preparation
The SESAR2020 rules have resulted in a significantly increased complexity over SESAR1 in the preparation of grants.
In the last call (the one published on 15 December 2016) there is no information about the expected size of the projects. This is a useful input that is normally available for other H2020 calls.
A clear shorter sum-up document would be very useful, allowing to perform more efficient application of grants.
Private, not-for-profit sector, e.g. research foundation
Following the technical problem mentioned above (submit button failed), I immediately lodged a complaint. I received a formal acknowledgement with a statement that I would receive a formal answer to the complaint within one month. Despite sending numerous reminders, no response was ever received (other than email saying "you will receive a response in due course"). I continued to complain right up to the stage where the grant agreement was signed, but NEVER received a reply.
The applicants put a lot of effort into the preparatory work (e.g. preparing Description of Work, took part in negotiations, etc.) which took years and was not funded.
Public or government sector, e.g. research performing organisation
Success chances by about 5-10% are much too low. Application effort is very high compared to the success rate.
Rejection of a full project and lack of negotiation is inappropriate (e.g. Drone activity in PJ13)
Few doubts experienced in managing the need for Consortia partners to have an Audit Certificate on the final cost statement.

17.4. Part C: Grant finalisation phase

C.1. To what extent do you agree with the following statements about the practicalities of the process of finalising the grant?

	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
C.1.1. The JU staff assigned to my project in the grant preparation phase were easy to contact and responsive	25	11	5	1
C.1.2. Requests from the JU were clear (e.g. for proposal modification, providing missing information, etc.)	15	20	9	0
C.1.3. The electronic tools used in the contracting process were user-friendly	8	20	12	4
C.1.4. The electronic tools used for the validation of beneficiaries were user-friendly	10	14	9	3
C.1.5. The process of validating the beneficiaries was smooth and required reasonable effort	11	10	11	4

C.2. Open Question: Practical aspects of grant finalisation phase not mentioned above

Private industry contributing/having contributed in-kind to SESAR project(s)
Feedback during time dedicated to the validation of beneficiaries would have been highly appreciated from the reception of documents until outcome (positive or negative). No information is provided, no delay until the assessment, no communication possible. You might even not know whether the documents have been received.
Private industry contributing/having contributed in-kind to SESAR project(s)
It links to comment in B.5.1: administrative effort seems sometimes not appropriate when not contributing but still "beneficiary" with 0 effort/grant.
Seems that focus was given too much on formalities during the evaluation process, and not the content of the proposals. This resulted in useless effort for adapting text, paragraphs although from content perspective everything was clear (e.g. a point was missing somewhere and has been requested to be changed)
A very significant amount of time has been lost in finding workaround to many IT issues (e.g. re-collection of lost information, denied validation due to minor typos, case sensitive fields, etc...). Still much room for improvement!
We had to send twice our documents to the EU, as our first ones were lost. Very complicated process with LEAR and Signatory
Ethics deliverables were added, with too short descriptions to understand what they were about and a non-realistic timeline of submission, not linked with the project overall timeline.
Private, not-for-profit sector, e.g. research foundation
The information requested about justification of "other direct costs" made no sense. Detailed information was already provided in the proposal justifying costs for ALL partners (even those with less than 15% of personnel costs), but we were asked to provide specific details for those over 15%. This led to meaningless repetition of information that was already present, and seemed very much like a bureaucratic process gone completely mad, providing no useful information.
It was very unclear all procedures related to consortia which were JU Members, since each partner of the consortium was not allowed to apply to any Project (until this was changed/corrected)
Public or government sector, e.g. research performing organisation
Electronic signatures by CEOs via a portal is not easy.

C.4. Open Question: comments and suggestions on simplification and service improvement

Private industry contributing/having contributed in-kind to SESAR project(s)
The SJU staff involved in the process were helpful and communicative.
Additional effort for ethics requirement, additional review time slot and huge general effort to manage especially small funding Projects is not known and planned when submitting the proposal.
This would be worth investing in a more User friendly interface !
Private industry (including SMEs) benefitting/having benefitted from SESAR JU funding
Ethics requirements and understanding was really poor.
The issue with the 50M€ funding of SJU seems artificial and created a lot of extra work. Could have been handled more effective
The tools should be ready (debugged) before applying the process and more stable over time.
Public or government sector, e.g. research performing organisation
Prohibit use of email with no reply address, message exchange through the portal is too heavy (connection, navigation, etc.)

17.5. Part D: Communication and interaction with you

D.1 How useful were the following methods of communication used by the SESAR?

Method	Very useful	Slightly useful	Not useful
D.1.1. E-mail contact	34	11	2
D.1.2. Telephone contact	22	10	4
D.1.3. Face-to-face contact (meetings, events)	26	10	4
D.1.4. Recorded messages (e.g. video briefings)	1	5	3
D.1.5. Live web briefings (with a chat function)	8	9	4
D.1.6. Information available on JU's website	9	23	6

D.1.7. Open Question: Please describe for which purposes you used these communication channels

Private industry contributing/having contributed in-kind to SESAR project(s)
These channels of communications are being used as part of the on-going study projects execution as well as to be informed of the developments and related opportunities for contribution in the future
Clarification purpose, checking assumptions, advice. Communication channel with SJU is prompt and reactive.
To clarify administrative and technical details during the contract execution
Private industry (including SMEs) benefitting/having benefitted from SESAR JU funding
High level contact to the SJU' per telephone for clarifying important strategic question where typically the PJ officers had no insight into transversal topics across all PJs
Doubts in the preparation of the proposal
Management of SESAR projects, preparation of new grants, ...
We mainly used e-mail and telephone contact for communicating with our SJU project officer, communication has always been fluent and all the officers have been very responsive.
Gate review preparation and use of the SJU extranet for sharing documents with the project
Many contacts happened via ECAS, but the messaging system is clumsy, so many threads moved to

move to email to be more efficient.
These were the communication channels during 5 years working with the SJU.
Private, not-for-profit sector, e.g. research foundation
Discussions about details needing clarification for finalisation of the grant.
To find out the requirements for the application and partners
Public or government sector, e.g. research performing organisation
Resolution of various issues and bugs of the portal
Direct phone call and Face-to-face meetings have been used for planned Gate meetings, and to manage needs for changes to grant (i.e., extension of the project).
The SESAR JU has demonstrated to be very willing to assist, however using only a limited amount of channels. Any questions about opportunities would be directed towards the Q&A-email address. This meant that face-to-face meetings and questions through telephone were not answered. The challenge with the Q&A is that it takes a while for answers to be provided, delaying the proposal process significantly.

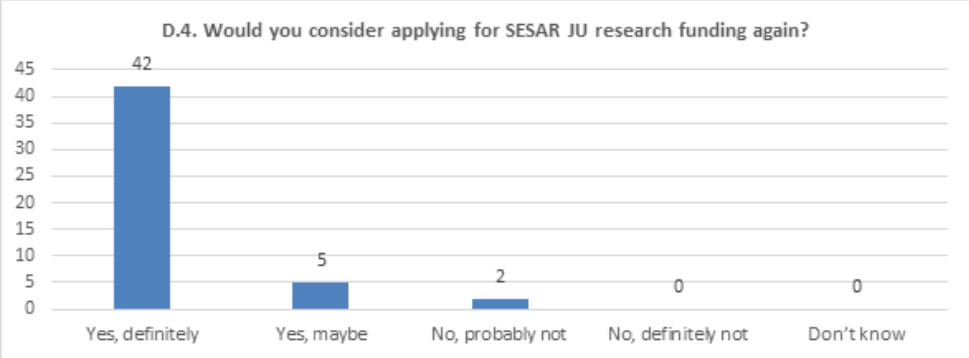
D.2. How important do you think the following factors are when you deal with the JU?

Factor	Very important	Slightly important	Slightly unimportant	Very unimportant
D.2.1. Clarity about the JU's procedures	29	13	2	2
D.2.2. The JU's website and communication materials	18	20	5	3
D.2.3. Accessibility and clarity of information provided by the JU	25	19	2	0
D.2.4. The JU's ability to perform the service promptly, accurately and transparently	27	17	1	1
D.2.5. The JU's willingness to help you and provide personal attention	27	13	1	4
D.2.6. The knowledge the SJU employees possess	29	11	4	2
D.2.7. The willingness to help, courtesy and cooperation of the JU's employees	31	13	1	0

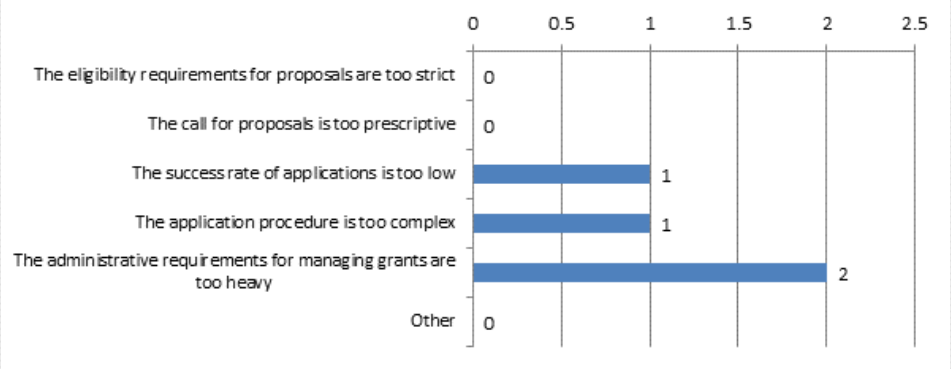
D.3. Based on your experience, how much do you dis/agree with the following statements about the performance of the JU's actual services it provides?

Factor	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
D.3.1. The JU's website and information materials are visually appealing and user-friendly	17	21	6	0
D.3.2. Information provided by the JU is easily accessible	9	25	9	0
D.3.3. The JU methods of communication provide relevant and useful information	12	27	5	0
D.3.4. Events organised by the JU are useful (information days, project meetings, information visits, etc.)	20	17	4	1
D.3.5. The JU strives to provide excellent programme management and high quality service	23	17	4	2
D.3.6. The JU's procedures are transparent	20	16	7	3
D.3.7. The JU's documents do not contain mistakes or errors	15	20	5	2
D.3.8. The JU's employees are committed to doing quality work and provide a prompt service	28	14	1	0
D.3.9. Employees in the JU are knowledgeable and competent	26	14	2	2
D.3.10. Employees in the JU are consistently courteous and always willing	28	15	1	0

to help				
D.3.11. Employees in the JU are cooperative and give personal attention	29	12	2	0
D.3.12. When you have a problem, the JU shows a sincere interest in solving it	25	17	1	0



D2.4 Would you consider applying for SESAR JU research funding again?



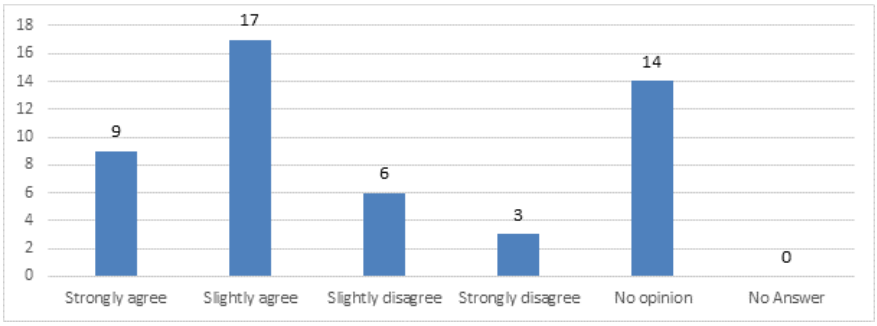
D.5. Which are the main reasons for your answer?

Rationale provided by the two respondents that would probably not re-apply:

I am responsible for a small, simple project with a limited budget. However, my impression is that SJU procedures apply the same techniques as would be relevant for a very much larger and more complex. The level of detail of planning is out of proportion with the project. The frequency of financial reporting (every 6 months) is excessive. Feedback on deliverables has had a very strong focus on bureaucratic details, and very little on actual content. Criteria for assessment of deliverables was made available only after submission, rather than before. The whole experience is demotivating.
Processes are too much top down. 1000 different Guidelines and Project Management rules make projects too bureaucratic Projects instead of Research Projects. Politics rules over content

17.6. Part E: Overall performance of JU

E.1. In general, the second generation of the JU presents an improvement compared to its predecessor under FP7



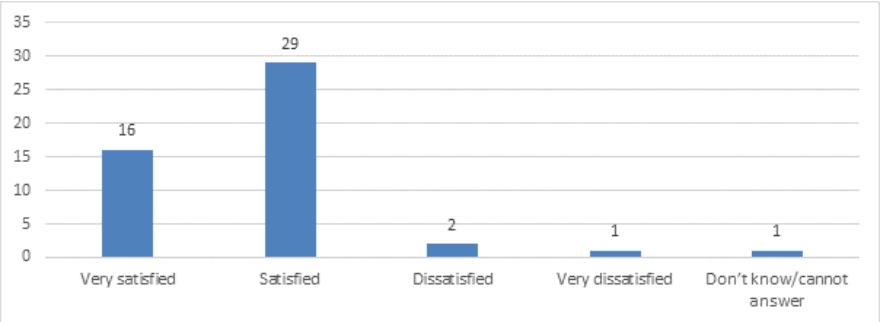
Note: Members of the SJU were more inclined to disagree with the statement than non-Members. Disagreement appears to be a result of H2020 rules adding overhead and complexity

E.1.1. Open Question: Please use this space to provide a reason for your opinion

Strongly disagree	The combination of SJU membership under the SES legislation and the H2020 regulation resulted in additional burden for SJU members, inefficient application process, high preparation effort and delay of at least 1,5-2 years before the community was able to start working
	H2020 rules is felt as a more bureaucratic step, less flexible and adapted JUs (Industrial research) and to SESAR JU and its members for coping with the ATM complexity (technical wise and actors wise). For various reason, the 'PPP' nature could not be recognised as special and definitively different form traditional research, and, mechanism to strict application of H2020 could not been avoided!
	If the comparison is between SESAR1 and SESAR2020 financial framework, H2020 rules are not made for a PPP. So the new financial framework is not an improvement but a big overhead
Slightly disagree	Horizon 2020 framework does not really support JUs and the coordination of dependent projects
	It's not about the SJU or the people working there, it's more about the H2020 framework not being appropriate for this kind of research programme.
	Procedures applied by SESAR JU under FP7, also if non-standard with respect to other FP projects, were mainly focused on technical advancements, while administrative and procedural aspects were simpler than those of other FP7 projects. This was a positive aspect in my opinion with respect to new situation.
	the SJU has now fully adopted the H2020 working mechanisms, but still maintains some aspects of the old SJU. I would recommend a full transition to H2020. This has resulted in some unnecessary lengthy processes, and duplication of documents.
Slightly Agree	Improved project structure but additional H2020 rules sometimes contradictory
	The FP7 SJU was already working well, and it continues to be working well under H2020. We are mainly involved in SESAR Exploratory Research. We've seen an improvement regarding links between SESAR Exploratory Research and Industrial Research, but there is still room for improvement in this respect.
	The programme itself is an improvement. However, it remains difficult to actively participate if research establishments do not have a significant and dedicated budget. Compared to the funding rules under FP7, those under Horizon 2020 have strongly increased the financial contribution that organisations are required to bring themselves, making it more difficult for such organisations, to participate to H2020.
	More direct contact and personalised assistance in FP7. Clearer aims of the Work programme.
Agr gly on	Better communication, same administrative processes as H2020 (VERY IMPORTANT) and same tools to support proposal preparation

	More transparent and procedures aligned with H2020
	much better structured; methods clear from beginning; very good partnership established
	The second JU is much more Professional and predictable

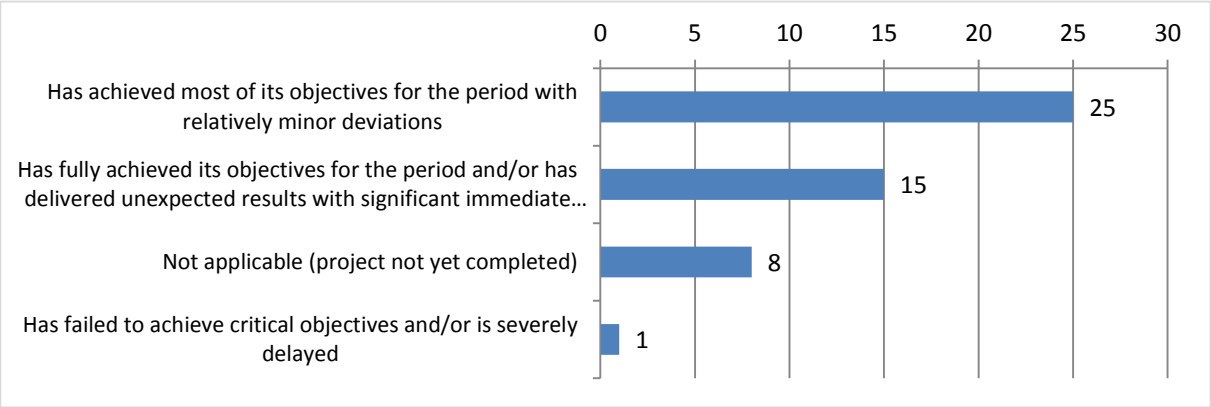
E.2. Overall, how satisfied are you with the JU's services?



E.3. Open Question: General comments or suggestions about the process of applying to the JU, or its management or administration, which have not been addressed in this survey?

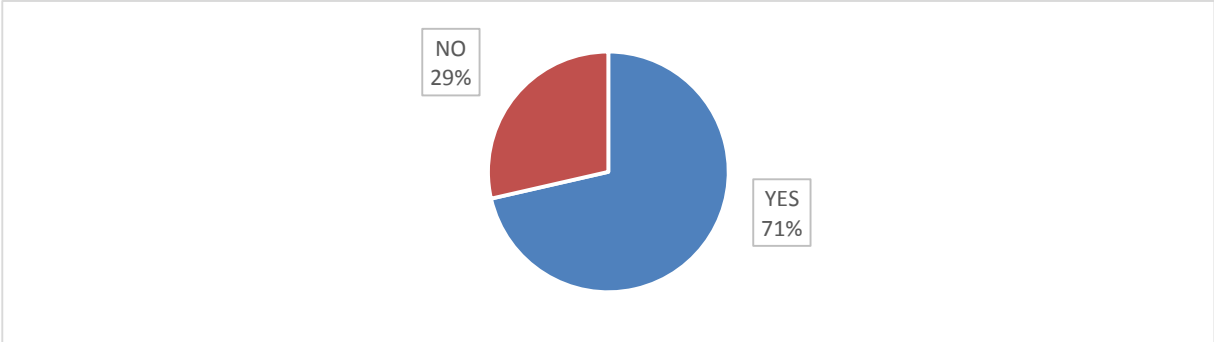
Private industry contributing/having contributed in-kind to SESAR project(s)
Rules and requests are not fully transparent and consistently applied along all the projects of the program
It's not really about the SJU but rather its "placement" in H2020 which seems not to fit. The SJU and (most of) its people are still more or less the same but the regulatory and administrative framework is completely different.
Overall balance / duties between service providers and industry should be improved and mechanism to enforce 'progress' towards more innovative solution should be incentive at funding access level.
Private industry (including SMEs) benefitting/having benefitted from SESAR JU funding
Some improvements in the SJU extranet to better identify valid information from obsolete documents (e.g. multiple versions of documents, etc...)
Information about the calls for proposals should be announced earlier: the calendar of H2020 calls is known more in advance and draft programmes are typically circulated well before the call, which allows participants to better plan their work. This is more difficult to do with SESAR Exploratory Research calls, which lack a clear calendar. Also, visibility about ongoing projects should be improved.
As compared to previous SESAR projects, there seems to be less attention to the actual technical-scientific work and more to the formal bureaucratic aspects. This may be due to the workload of POs. There was also a process of providing support from independent experts, which was very useful and it is no longer in place. The interaction with the domain experts is sometimes too superficial.
Private, not-for-profit sector, e.g. research foundation
Throughout one of my projects, I was asked by SJU people to align with other activities done within the SJU (in the main stream). Nevertheless, we were not able to access to ANY SJU reserved documents. It was plainly impossible.
Public or government sector, e.g. research performing organisation
Less complicated top down Management processes and a bottom up Partner/funding competition. With IR/VLD the Partners and their funding was decided before the Project plan and the Partners contribution were known.
The strict application of H2020 rules is sometimes not optimal for a Joint Undertaking (more overhead)
Full Budget delegation to the SJU should avoid annual grant agreements
A possible field for improvements, specific instruments better supporting partner's identification and partnership composition for proposals submission.
SJU could and should answer questions more quickly, without the delay encountered when using the official Q&A-tool.

17.7. Part F: Overview of the project(s) objectives and impacts



F.1. Overall, the project:

F.2. Did the project(s) directly contribute (expected to contribute) to new products and



services for your organisation?

F.2.1. Please provide your view to the following aspects:

	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
F.2.1.1. Project directly contributed (expected to contribute) to new products and services for your organisation	12	21	1	0
F.2.1.2. The developed products and services have been taken up (expected to be taken up) in the mainstream JU activity	9	12	7	2

Note: All responses from industry providing an in-kind contribution agreed with both statement. Disagreement appears to be linked with specific WP E activities.

F.2.2. Please use this space to write about other aspects not mentioned above

Private industry contributing/having contributed in-kind to SESAR project(s)
Taking the current project as an example, the steer and support from SESAR JU so far has been noteworthy, particularly for the motivating us to develop the project outcome to achieve potential candidacy for future deployment mission (DM). It clearly demonstrates that the objectives of JU is same as the industry, actively seeking to take the study outcomes for industrialization and operational realization.
In applied research (manage through Industrial research and VLD) which is the aim of SJU, members representing the service providers should involve more operational people and augment creativity for ATM transformation (and automation). This is key to restore Airspace Users confidence.
Private industry (including SMEs) benefitting/having benefitted from SESAR JU funding
For Question F2.1.: some activities contributed directly to new products, others are far away from productization
Project was focussed on basic research, difficult to have a direct contribution to new products and services
LSDA and VLDs are of special value to support the preparation of new products, as a unique opportunity to bring together industry and end-users in a live operational context.
This answer depends on the type of projects. No structured link with the mainstream JU activity is currently there.
Private, not-for-profit sector, e.g. research foundation
In spite of several interesting results (as a proof of that, I've been invited to give several talks in events), it seems that the mainstream SJU has just stored and forgot them...
Public or government sector, e.g. research performing organisation
Some projects, e.g. IMET, did achieve interesting results unexpected in the proposal period, but as a result of this did not achieve all intended goals. These results, although adopted by industry (Sabre), are yet to be incorporated in new NLR services and/or products.

F.3 Based on your experience, how much do you agree/ disagree with the following statements about the impact of the project(s) to your organisation?

	Strongly agree	Slightly agree	Slightly disagree	Strongly disagree
F.3.1. Project was (is) aligned to the core business of my organisation	25	20	3	1
F.3.2. Project led (is expected to lead) to the establishment of new business relationships for my organisation	16	24	5	2
F.3.3. Project augmented (expected to augment) the capability of my organisation	14	30	3	1
F.3.4. Project required (will require) the development of new skills in my organisation	11	20	13	2

F.4. Open Question: General comments about the project(s) objectives and impacts

Private industry contributing/having contributed in-kind to SESAR project(s)
There's a wide variety of projects in both SESAR1 and SESAR2020 where the best case is reflected in F.3. above. There were also many cases where old research was done again or topics were only addressed to keep people busy.
Project is leading to a study outcome that recommends how best the space based aircraft surveillance technology could help in the airspace management, in particular for aircraft separation minima. Persistent and global aircraft surveillance is now deemed an important requirement both for the safety and economic/operational performance improvements. The outcome of the study will give deeper insights into the service and performance requirements to meet the future ATM.
The consortia setup promoted by the SJU (e.g. airlines and ANSPs) promote the mutual cooperation beyond the project life,
Private industry (including SMEs) benefitting/having benefitted from SESAR JU funding
Project's objectives were to demonstrate potential effectiveness on RNP APCH operations, and based on its results airline has started process to add RNP APCH operations in operations and ATC is planning RNP APCH implementation in the airport where demonstration took place.
The TOPMET and TOPLINK projects have been key to support the launch of a new product within industry. Thanks for the real support provided by the SJU !
Public or government sector, e.g. research performing organisation
The process of identifying objectives of the core SJU partners has been a little confused. It could be useful to have a clear process more easily accessible to also small partners.
ATM still seems to regard MET support to ATM R&D a low priority. For instance, WP-E.02.40 "IMET" as well as WP11.2 "Meteorological Services" clearly illustrate how meteorological information can be used beneficially in ATM decision support. Compliments to SJU for addressing MET already in the early stages of SESAR2020 (PJ18.04).

17.8. Part G: Level of satisfaction with the content of the programme

	Very satisfied	Satisfied	Dissatisfied	Very dissatisfied
G.1. How satisfied are you with the SESAR JU programme content in respect to its state-of the-art?	11	33	3	0
G.2. How satisfied are you with the SESAR JU programme content in respect to its relevance for the European aviation industry and society?	13	31	4	0
G.3. How satisfied are you with the prescriptiveness of the calls for proposals?	3	35	7	0

G.4. Open Question: Please use this space to provide a reason for your opinion

Responses ordered by level of satisfaction from Very Satisfied to Dissatisfied	
	Considering the amount of own investment required from industry, it is key to ensure: - the adequate flexibility in projects' contents and partnerships - the minimum possible administrative overhead in managing projects
	Initial performance improvement ambitions set too high in some cases.
	Having the SESAR R&D program a very very wide scope in a relatively short period of time, it's not reasonable to expect that all different R&D elements can be delivered with the contents and within the time initially planned. In order to avoid failures in the industrialization phases a sound R&D V&V process should not be under evaluated. THE SJU approach to promote very large demonstration campaigns is a sound risk reduction measure.
	The sometimes too extensive amount of documentation (and thus the significant effort required to keep up-to-date with latest status) is reason for not selecting "Very satisfied" option.
	Maybe there is room for an overall lessons learned page (or forum) on the SJU extranet, where details of problems encountered in the process (of SESAR) are presented (or discussed).
	Regarding answer to G.3.: The Airspace User involvement in the SESAR2020 program seem unclear, with the need for multiple applications (eg by projects). It seems also unclear for some projects how to involve Airspace Users experts. While the organization of Airspace User involvement has always been a complex matter, it is important that end user involvement is considered early enough to ensure the quality, objectiveness and suitability of the solutions.
	Ground industry (service provider, manufacturing) is 'shy' in proposing innovative operational improvements, not providing convincing roadmap and not showing sufficient trust and openness between them (competition remains at stake). Involvement of non industrial organisation into the industrial research and VLD is felt inappropriate
	The approach is very technology driven and too conservative. There is little space for more disruptive proposals and no good link with the mainstream SJU activities. In many validation exercises, there is an unresolved tension between an engineering approach and a scientific approach. This tension may pollute the quality of both, especially when the scientific requirements come from non-academic partners. The Demo Activities show a better balance, with a clear technological focus.

18. ANNEX H: CROSS TJU FINDINGS

18.1. Purpose

As part of the evaluation of the Transport Joint Undertakings (Clean Sky, SESAR and Shift2Rail) Prof. Michael Dooms performed a cross-TJU evaluation which is fully described in an internal working paper. This annex summarises the main findings.

18.2. Policy linkages of the TJUs

All evaluation reports assessed the specific policy intervention logic for the TJUs and provided the broader link with both the Transport White Paper (TWP) (European Commission, 2011) as well as other elements in the EC transport policy such as the Connecting Europe Facility (CEF) and initiatives affecting the specific transport modes (e.g. The aviation strategy for Clean Sky and SESAR and Fourth Railway Package for S2R).

All three TJUs clearly have strong policy links and are mentioned in the TWP (Shift2Rail did not exist when the TWP was written but it is recognised as an enabler of rail policy in the 2016 implementation report).

Clean Sky is less well represented in the policy documentation than the SESAR and Shift2Rail, despite being a key enabler to sustainable growth in Air Transport through the development of greener technologies.

All three TJU evaluations highlight the success of the JU instrument in mobilising public and private funds to secure solutions to societal issues. The EU should continue to promote JUs as an appropriate instrument for large scale R&D programmes having a common objective.

Recommendations:

- The European Commission should promote both SESAR and Clean Sky as enablers for achieving sustainable aviation growth in relevant policy papers.
- The European Commission should continue to promote JUs as a suitable instrument for mobilising public and private funds for specific R&D programmes.

18.3. Use of KPIs

The analysis of KPIs considered three distinct levels: micro, meso and macro.

The **micro level** essentially entails various KPIs related to project management, budget execution and programme specific KPIs such as gender participation, SME participation, country breakdown, mandated by the H2020 rules. These KPIs are standardised through the H2020 reporting requirements, but all three JUs consider them difficult to collect through the use of H2020 IT tools, leading to duplicated efforts in developing additional tools.

It is recommended that the Commission take steps to reduce this burden by streamlining the reporting process and ensuring the tools are fit for purpose.

The **meso-level**, which essentially refers to the sector or industry specific competitiveness of respectively air and rail transport. All TJUs formulate strategic objectives in their legal mission and vision on the enhancement of the competitiveness of the EU air and rail transport (manufacturing/supply chain) industry. Here, KPIs, including

international / global benchmarks on the competitiveness of the respective industries, are relatively underrepresented or absent all together.

As these industries (and the EU in general) are increasingly under pressure from a global competition point of view, and given the EU's strategy towards an industrial renaissance (EC, 2014), it is advisable to start the development and implementation of KPIs which are able to monitor the global competitiveness of the EU versus the world (and/or major competitors such as e.g. China and the US) for the air and rail industry. Suggestions of KPIs are to be found in the context of e.g. number of patents, industry export intensities, size and growth of manufacturing industries, global market shares in exports, etc.

The **macro-level**, which consists of social, environmental and economic impacts of the programs conducted. Both Clean Sky and SESAR have high level objectives to define their expected benefit to society. The approaches followed by Cleans Sky and SESAR are distinct but appropriate to their objectives.

Clean Sky makes use of the Technology Demonstrator to measure the potential impacts of deploying the developed solutions (see Figure H1).

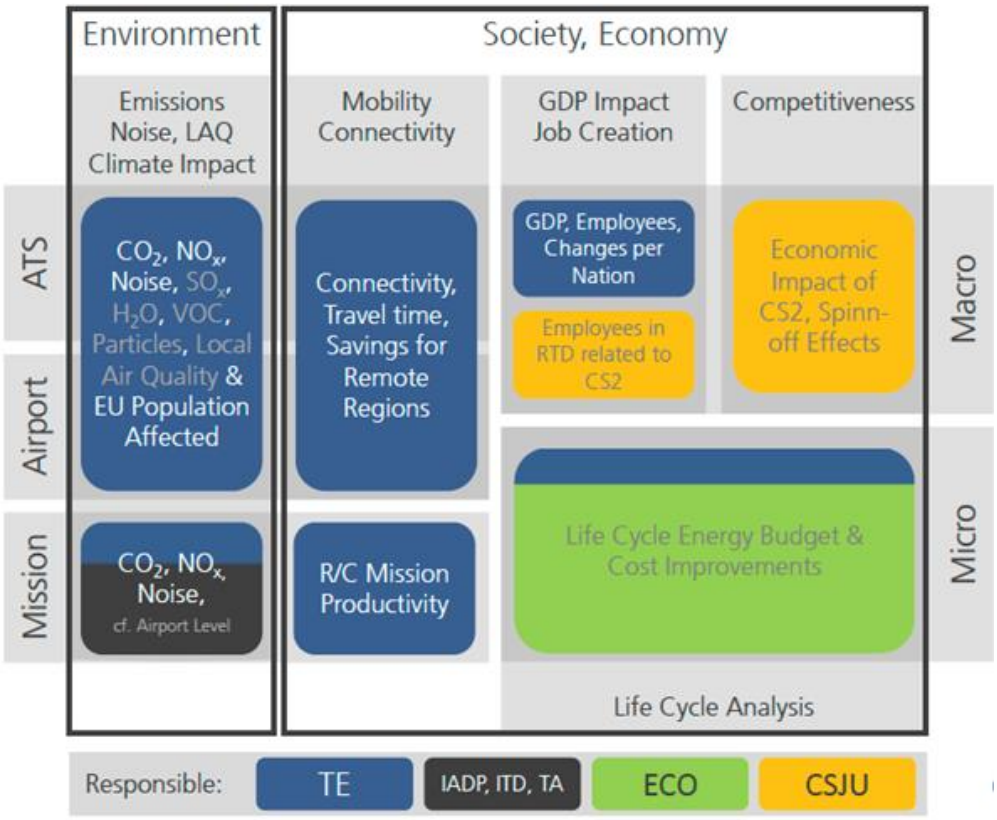


Figure H1: Integrated performance assessment framework by CS TE

The SESAR JU evaluates the potential benefit of deploying SESAR solutions against the policy objectives (also known as the Single European Sky High Level Goals) and a number of other related KPIs in a dashboard format. The expected benefits of deploying SESAR are reported in the European ATM Master Plan. The Macro-Economic Benefits (to GDP and Jobs) were established by an independent study. Actual performance in ATM is monitored by the EU's Performance Review Body (PRB), which uses related KPIs based on real world measurement. Both the SJU and PRB performance frameworks are consistent with each other and the overarching framework established by International Civil Aviation Organisation (ICAO) – the UN body for air transport. Feedback on actual performance and the latest traffic forecasts is used to drive updates to the European ATM Master Plan which in turn is used to define the work of the SJU.

The importance of providing accurate forecasts for performance improvements is key to ensuring exploitation of TJU results and achieving the underlying policy goals.

Overall it was also noted that the presentation of KPIs in the AARs was often difficult to understand. KPIs should be presented in dashboard style and limited to the **key** issues (e.g. 10 to 20 KPIs only). TJUs should ensure that when KPIs are reported they are done so against the target and indicating the evolution over time.

Recommendations:

- The European Commission should streamline the reporting requirements of micro-level KPIs and ensure that a single tool is available to efficiently automate the data gathering process as much as possible.
- The European Commission should commission a study of meso-level KPIs to measure the effectiveness the industries supported by the TJUs. The study should consider the data requirements and who should be responsible for the target setting and monitoring.
- In establishing future JU's the Commission should ensure that measurement of macro-KPIs is well defined within the core programme.
- All TJUs should ensure that when KPIs are reported they are done so against the target and indicating the evolution over time.

18.4. Longer-term risk assessment and scenario-planning of JU strategy outputs (e.g. master plans)

It is clearly crucial that the work of the TJUs is steered by evolving external factors including the long term forecasting. It is important that these assessments are not simply based on "longer term expansion logic" but also take account of potential down-turn scenarios and impacts from multi-modal transport – for example reduced demand for short haul air transport where the route is complemented by high-speed rail.

The TJUs have different approaches to establishing the strategic context for their work programme. For example, the Clean Sky work programme is driven externally by the ACARE Strategic Research and Innovation Agenda. SESAR JU work programme is driven by the European ATM Master Plan which is an internal process but driven by wide stakeholder consultation including links to the relevant EU bodies (Performance Review Body, Network Manager, European Aviation Safety Agency, European Defence Agency).

It is important that JUs closely monitor technological, economic, social and demographic evolutions and ensure that these are reflected in the work programme though discussion in the relevant governance arrangements. TJUs should ensure that the governance bodies contain representatives of the affected stakeholders beyond the Members to ensure that the wider perspective is taken on board. For example, the Airspace Users have a seat and 10% of voting rights in the SJU.

18.5. Dissemination activities

All TJUs have set up a variety of dissemination tools and activities, ranging from demonstrators, scientific publications, event organizations, newsletters and the use of social media. However, reporting on the amount of dissemination and the reach / impact of dissemination activities is not consistent across the TJUs (based on the information made available in AARs).

It is also noted that the dissemination activities are almost exclusively aimed at professionals within the industries concerned and not the general public. This means that society at large is not aware of the importance that the Commission is placing on solving transport issues to increase mobility and wealth.

Recommendations:

- The TJUs should share experiences of dissemination activities to ensure widespread use of best practice.
- The Commission should provide advice to the TJUs on requirements for public-facing dissemination of results to complement existing industry focussed dissemination.

18.6. Sharing Lessons Learnt

Whist all three TJUS have been evaluated as efficient, there are differences between them that could lead to improvements if lessons learnt were shared between the TJUs,

More formal meetings of the Executive Directors, and JU senior management at expert level, could help to formulate joint TJU positions on salient administrative issues (such as the current risk of mistrust of major partners in both SESAR and S2R due to the need to fully comply with the H2020 procedures, including the use of lower performing management / ICT tools).

Recommendations:

- The TJUs should define mechanisms to ensure that common approaches are followed where this would lead to greater efficiency.

18.7. Conclusions

The three evaluations support the relevance and achievements of the TJUs, and the need to continue their interventions towards a more sustainable, competitive, and resource-efficient air and rail transport system.

All **TJUs show significant matches with either strategic goals and/or initiatives of the underlying EU policies** and the Commission should consider JUs as an efficient means for pooling public and private resources to develop solutions for societal challenges.

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