



CONSOLIDATED ANNUAL ACTIVITY REPORT 2018





SESAR JU Consolidated Annual Activity Report for the year 2018

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Abstract

This Consolidated Annual Activity Report, established on the guidelines set forth in Communication from the Commission No. 2014/9641, provides comprehensive information on the implementation of the Joint Undertaking work programme, budget, staff policy plan, and management and internal control systems in 2018.



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Contents

Foreword	9
Administrative Board's analysis and assessment	11
Executive summary	13
1 Introduction.....	19
1.1 Background and objectives of the document	19
1.2 The SESAR JU: a key constituent of the EU Aviation Strategy.....	19
1.3 The SESAR JU membership.....	20
1.4 The role and missions of the SESAR JU.....	21
1.5 Factsheet: the SESAR JU in 2018.....	24
2 Part I. Achievements of the year.....	28
2.1 Strategic Area of Operation 1: Provide Strategic Steering to the SESAR Programme.....	35
2.2 Strategic Area of Operation 2: Deliver Exploratory Research (ER)	49
2.3 Strategic Area of Operation 3: Deliver Industrial Research & Validation (IR)	67
2.4 Strategic Area of Operation 4: Deliver Very Large-Scale Demonstration activities (VLD)	104
2.5 Strategic Area of Operation 5: Deliver SESAR Outreach.....	123
2.6 Strategic Area of Operation 6 (transversal activity): Deliver effective financial, administrative and corporate management.....	138
2.7 Overall conclusion on the SESAR JU achievement in 2018	153
3 Part IIa. Management Evaluation.....	154
3.1 Administrative Board.....	154
3.2 Major developments	155
3.3 Budgetary and financial management	155
3.4 Human Resources management	163
3.5 Assessment by Management	165
3.6 Budget implementation tasks entrusted to other services and entities.....	166
3.7 Assessment of audit results during the reporting year	166
3.8 Follow-up of recommendations and action plans for audits	168
3.9 Follow-up of observations from the discharge authority	169
3.10 Data protection	170
4 Part IIb. External Evaluations	171
5 Part III. Assessment of the effectiveness of the internal control systems.....	172
5.1 Risk Management.....	172

5.2	Effectiveness of the Internal Control Framework	175
5.3	Project Audits.....	176
6	<i>Part IV. Management assurance</i>	181
6.1	Review of the elements supporting assurance	181
6.2	Reservations.....	181
6.3	Overall conclusions on assurance	181
7	<i>Part V. Declaration of Assurance</i>	182
8	<i>Annexes.....</i>	183
8.1	Annex I. Core business statistics.....	183
8.2	Annex II. Statistics on financial management.....	204
8.3	Annex III. Organisation chart.....	205
8.4	Annex IV. Establishment plan.....	206
8.5	Annex V. Human and financial resources by activity	208
8.6	Annex VI. Specific annexes related to part II	209
8.7	Annex VII. Specific annexes related to part III	210
8.8	Annex VIII. Final Annual Accounts	224
8.9	Annex IX. Other annexes.....	226

List of Figures

Figure 1: SESAR JU membership from 2016 onwards	21
Figure 2: The SESAR Innovation Pipeline – from EU Aviation Strategy to SESAR Solutions	22
Figure 3: Number of projects per phase of the SESAR Innovation pipeline, per call (end 2018)	30
Figure 4: Evolution of SESAR 2020 calls-related commitments (forecasts beyond 2018 in dashed columns)	30
Figure 5: SESAR 2020 Programme portfolio of projects matching the research topics at the end of 2018 (projects in execution or closed)	31
Figure 6: All types of organisations are beneficiaries from SESAR 2020 funding	32
Figure 7: SESAR 2020 funding for EU Member States at the end of 2018	32
Figure 8: Number of SESAR Solutions delivered through Release 7, 8 and 9 (plan at the end of 2018)	33
Figure 9: Planned SESAR cumulated research and innovation contribution to the realisation of the ATM Master Plan KPAs	34
Figure 10: State of implementation of SESAR Solutions	40

Figure 11: Contribution of Wave 1 candidate SESAR Solutions to Key Performance Areas (first estimate)	41
Figure 12: Governance of the SESAR 2020 Programme	44
Figure 13: The ATM automation roadmap	66
Figure 14: Status of SESAR 2020 validation exercises at the end of 2018	68
Figure 15: Grant budget amendment process overview in 2018.....	83
Figure 16: Wave 2 preparation procedure	101
Figure 17: Detailed Definition phase consultation activities.....	102
Figure 18: U-space project execution approach	121
Figure 19: Key metrics on the SESAR JU website	135
Figure 20: Key metrics on the SESAR JU social media	136
Figure 21: Key metrics on the SESAR JU tweets	136
Figure 22: Target leverage and calculation method for the Programme and the SESAR JU	145
Figure 23: Cumulative leverage for the Programme and the SESAR JU	146
Figure 24: Breakdown of SESAR JU missions per Strategic Area of Operation (in percentage).....	148
Figure 25: The 2018 Budget allocation per Area of Operation (Commitments).....	163
Figure 26: The 2018 Budget allocation per Area of Operation (Commitments and Payments)	163
Figure 27: Human resources allocation per Area of Operation	164
Figure 28: Assessment by the SESAR JU management team against the Internal Control Framework at the end of 2018	175
Figure 29: Organisation chart of the SESAR JU as at 31 December 2018	205

List of Tables

Table 1: The SESAR Joint Undertaking in 2018 in brief	27
Table 2: Mapping of ATM Functionalities proposed for CP2 against the existing PCP AFs	37
Table 3: Updated maximum EU co-financing as a result of the grant budget amendment for IR and TA projects.....	85
Table 4: Outcome of the Release 7	90
Table 5: Planned outcome of the Release 8.....	98
Table 6: Solutions planned to be delivered through Release 9 and their target maturity level.....	100

Table 7: Updated maximum EU co-financing as a result of the grant budget amendment for Wave 1 VLD projects	110
Table 8: Very Large-Scale Demonstration activities selected as a result of the call H2020-SESAR-2016-2 in 2017 for which grant agreements were signed in 2018 and their max. co-financing value	111
Table 9: Budget implementation in relation with the Geo-fencing delegation agreement in 2018 ..	115
Table 10: Very Large-Scale Demonstration activities selected as a result of the call CEF-SESAR-2018-1 in 2018 with their location and their max. co-financing value.....	120
Table 11: Budget implementation in relation with the U-space delegation agreement in 2018	122
Table 12: Main publications by the SESAR JU in 2018	134
Table 13: Negotiated procedures under Article 134(1) RAP carried out in 2018	143
Table 14: Administrative Board decisions in 2018	154
Table 15: In-kind contributions from the SESAR JU Members other than the Union for the 1 st reporting period (Wave 1).....	159
Table 16: Benchmarking on Human Resources.....	164
Table 17: Recommendations of the Audit on Coordination with the CSC and implementation of CSC tools and services	166
Table 18: Recommendations stemming from previous audits from the IAS, ECA and EC, still open .	169
Table 19: SESAR JU Corporate risks and response plan summary on 31 December 2018	174
Table 20: Resources for project audits in 2018	178
Table 21: Scoreboard of Horizon 2020 common KPIs.....	186
Table 22: Indicators for monitoring cross-cutting issues	194
Table 23: KPIs specific to the SESAR JU – 2017 and 2018	196
Table 24: Single European Sky Performance Scheme as per the European ATM Master Plan.....	196
Table 25: Performance ambitions, Validation target starting point and SESAR 2020 Initial Performance assessment results (expectations)	198
Table 26: Main procurement activities launched and completed in 2018	203
Table 27: List of the 39 SESAR JU positions (31 December 2018).....	207
Table 28: Assessment of the SESAR JU's Internal Control Framework at the end of 2018	222
Table 29: List of acronyms and definitions.....	231
Table 30: Composition of the SESAR JU Administrative Board as at 31 December 2018	233

Foreword

Delivering the digital revolution in air traffic management



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

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

I am very proud of what the SESAR JU has delivered not just in 2018, but also since its establishment. It is a testament to how the public and private sector can work together. I look forward to seeing the work detailed in this report come to full fruition in the coming years.

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



The growth of traffic in 2018 and the outlook for the future have increased the sense of urgency not just within the aviation community, but also among decision-makers and policy-makers, to forge ahead with ATM modernisation efforts. The scale and complex nature of ATM means that no one stakeholder can do it alone. The job can only be done through effective collaboration which is at the core of the SESAR Joint Undertaking values. In 2018, the work performed on the European ATM Master Plan and on the Airspace Architecture aim to ensure that stakeholders are on the same page when it comes to the vision, research and innovation and where and when investments should be made. In doing so, the plan as well as the research and innovation efforts and priorities reflected in the SESAR 2020 new wave of projects, funded through the Horizon 2020 Programme, remain timely, relevant and are playing an important part in validating the way of getting to this vision, enabling all stakeholders to stay motivated and focussed on the way forward.

These latest developments come at a time of great debate and reflection. The much talked-about capacity crunch is setting new challenges in accelerating the time to market of the SESAR solutions. The SESAR large-scale demonstrations launched in 2018 constitute a clear answer and an opportunity to team-up all air transport stakeholders including airlines and regulators to accelerate the pace of change in air traffic management. Improved inter-operability, enhanced flexibility in resource allocation, ability to scale up, and to increase resilience are key to the SESAR projects being collaboratively undertaken by the SESAR JU partnership that continued their development in 2018 as well as to the ones to come in 2019.

The development of technology enablers to progressively increase automation in the system and make it more productive by coupling air and ground capabilities was one of the key highlights of the SESAR innovation days held in Vienna in 2018. It was a vivid demonstration that the innovation pipeline from Exploratory Research to industrial developments and demonstrations is active, effective and will continue to foster innovative solutions in traditional aviation but as well for the emerging drones market. The set-up of the U-space demonstrators funded through the Connecting Europe Facility Programme was another significant achievement of 2018 which holds important promises, bringing on board of SESAR many new entrants and will proudly contribute actively to the EU Network of Demonstrators.

The SESAR JU with its partnership continues, as the only effective means of, leading the way in delivering meaningful, widely supported and globally coordinated ATM modernisation in Europe. The SESAR JU also remains committed to delivering high performing aviation in Europe in a Digital European Sky.

Florian Guillermet, Executive Director, SESAR Joint Undertaking

Administrative Board's analysis and assessment

The Administrative Board has assessed the SESAR Joint Undertaking's Consolidated Annual Activity Report for 2018 (CAAR 2018) and, having reviewed the document, notes that:

- The SESAR JU met its key policy and operational objectives as outlined in the Single Programming Document for the period 2018-2020;
- The SESAR JU's key achievements in 2018 were the following:
 - The continuation of seventy-three Exploratory Research, Industrial Research and Validation and Very Large-Scale Demonstration projects funded through the Horizon 2020 Programme, and the supervision of the delivery of project results, including further matured (candidate) SESAR Solutions under Releases 7 and 8, and the preparation of the next phase of Solution delivery (Release 9 to be delivered in 2019),
 - The launch in execution of twelve new projects as an outcome to three calls for proposals, funded through three different legal frameworks (the Horizon 2020 Programme, the Connecting Europe Facility Programme and assigned revenue); this included the management of a new dedicated call for proposals on U-space funded through the Connecting Europe Facility (CEF) Programme, and the subsequent evaluation, award and grant agreement preparation phases,
 - The preparation of two new calls for proposals to be launched in 2019: the second restricted call for Industrial Research and Validation and Very Large-Scale Demonstration 'Wave 2', and the fourth open call for Exploratory Research,
 - The execution of the European ATM Master Plan update campaign, with a view to deliver the updated Master Plan in Q1 2019,
 - The realisation of a study on the future architecture of European airspace, under a specific mandate from the European Commission,
 - The amendment of grant agreements for Wave 1 Industrial Research and Validation and Very Large-Scale Demonstration projects with SESAR JU Members,
 - Payments in accordance with the financial circuit for the grant agreements,
 - Procurement activities in full compliance with the applicable regulation,
 - The fulfilment of all obligations related to planning and reporting,
 - Active cooperation with European and global stakeholders on matters relevant to the development of European Aviation,
 - Final financial and operational closure activities on the SESAR 1 Programme; The SESAR JU used its resources in line with the activities as described in the work plan;
- The SESAR JU used its resources in line with the activities, as described in the work plan;
- The performance indicators show that overall the targets were met;
- Internal control and management systems were in place and working adequately;
- The required building blocks of assurance (management assessment, exception register, audits etc.) have been in place all along the year 2018;
- The main risks for the delivery of the SESAR JU's key objectives were identified and the relevant mitigating measures taken, keeping overall risks under control and at an acceptable level of criticality.

Consequently, the Administrative Board concludes that the CAAR 2018 accurately and adequately describes the work performed by the SESAR JU in 2018.



Executive summary

In 2018, the SESAR JU's activities focussed on the effective delivery of projects covering the innovation pipeline of the SESAR 2020 Programme as well as new activities in support of the objectives of the Single European Sky and the EU Aviation Strategy.

This was achieved through extensive cooperation with European aviation stakeholders, including SESAR JU Members other than the Union and other industry partners, research centres and universities, operators of (new types of) aircraft, etc. This cooperation represented a geographic coverage spanning Europe, with organisations from 27 out of the 28 EU Member States participating in the SESAR 2020 Programme. The involvement of SMEs increased by 25 points, now representing 37,3% of the H2020 indicator related to innovations introduced on the market. The SESAR JU allocates 15% of the SESAR 2020 Programme budget to research centres and universities, while close to 30% of the overall budget is dedicated to activities not restricted to Members. 2018 saw ongoing commitment by all SESAR JU Members other than the Union to not only governance and programme management, but also to defining the future strategic vision of air traffic management and the European ATM Master Plan.

This wide cooperation was set up through ad-hoc mechanisms for the delivery of the specific mandates (Airspace Architecture Study and U-space demonstrations), in addition to the effective and outstanding support from the existing Advisory Bodies (Programme Committee, Master Planning Committee and Scientific Committee). As an EU body, the SESAR JU kept the necessary independence and strict management of conflict of interest to deliver the required research and innovation for the benefit of the Single European Sky and the achievement of the EU Aviation Strategy.

The SESAR JU progressed significantly with activities related to the SESAR 2020 Programme and its strategic objectives for the period 2014 to 2024: during 2018, 25 candidate Solutions were delivered by the pipeline while preparations got underway for a second wave of Industrial Research and Demonstration projects. The SESAR 2020 Programme is at cruise altitude and full speed with close to 60% of the budget committed through six calls for proposals, which represents 85 projects addressing the full SESAR Innovation Pipeline: Exploratory Research and Innovation, Industrial Research and Very Large-Scale Demonstration activities. So far, the Programme has delivered 259 prototypes (258 in 2018), and 344 feasibility activities (333 in 2018), as well as 40 new products, processes or methods ready for market uptake (32 in 2018).

The active role of the SESAR JU in the ATM community, supporting the Commission in setting the common vision for the future of aviation in Europe, and reinforced by the high-quality achievements and delivery in research and innovation, enabled the organisation to plan its future milestones in the Single Programming Document for the period 2019-2021 and beyond.

In 2018, the SESAR JU was not only operating at the European level but also a strong contributor to international cooperation, global interoperability and harmonisation. A key milestone in this regard was the thirteenth ICAO Air Navigation Conference (ANC/13) in October, in which the SESAR JU participated actively together with the European Commission and ECAC States. The outcome of this conference was aligned with Europe's objectives.

The SESAR JU ran its operations in full accordance with various frameworks: the Horizon 2020 Programme, the Connecting Europe Facility (CEF) Programme for drone U-space demonstration activities, as well as two specific frameworks for the Active Geo-fencing service (AGS) call and the study to develop a proposal for the future architecture of the European airspace. This was achieved without additional human resources. As in previous years, in 2018 the SESAR JU dedicated a vast majority (95%)

of its executed budget to operational expenditure related to the SESAR 2020 execution, keeping its staff and administrative expenditure within the limits fixed by its multi-annual budget.

The SESAR JU fulfilled all its goals as set in the Single Programming Document 2018–2020, which in 2018 focussed on delivering six core objectives:

- Provide strategic steering to the SESAR Programme,
- Deliver Exploratory Research,
- Deliver Industrial Research and Validation,
- Deliver Very Large-Scale Demonstrations,
- Deliver SESAR Outreach,
- Deliver effective financial, administrative and corporate management.

This section reflects the key achievements and main outcomes of the SESAR JU towards these objectives.

Provide strategic steering to the SESAR Programme

In 2018, the SESAR JU continued its active support of the Single European Sky initiative through successful delivery to the Commission of a proposal for a second Common Project, the execution of the first steps of the Master Plan Update Campaign (planned to conclude in the first part of 2019) and the execution of the Airspace Architecture Study. The latter demonstrated that the close coupling between the operational and technical dimensions of European ATM improvements (airspace, operations and technology, infrastructure, applications and data services) allows to increase performance, for instance to reduce the capacity issue in European ATM. It is the first time that such coupling was analysed in the context of Single European Sky.

The above-mentioned achievements were performed in close collaboration with the SESAR JU Members and with all relevant Master Plan stakeholders representing the whole European ATM community, including cooperation with the European ATM Standards Coordination Group (EASCG) to de-risk the transition towards implementation and market uptake. These achievements further contributed to the implementation of the Single European Sky policy and of the European Aviation Strategy through the development of a common vision of the future of aviation in Europe and roadmap towards its implementation, combining for the first time the technological and operational dimensions.

Furthermore, in 2018, Wave 1 Transversal Activities projects were successfully conducted with all expected delivery, committing to the coordination and monitoring of the SESAR 2020 delivery in terms of the Concept of Operations, Architecture activities and within the Performance framework.

Lastly, over the course of 2018, the SESAR JU continued its work on the SESAR 2020 Research and Innovation activities by preparing the IR-VLD Wave 2 and the fourth ER calls for proposal for launch in the first part of 2019, and setting the initial steps towards the VLD Open 2 call planned for launch in early 2020. The preparation included the overall coordination and strategy setting for the three calls, and the coordination and synchronisation the Airspace Architecture Study and the update of the European Master Plan to be delivered and approved in 2019. In order to ensure a strong coupling between the outcome of the Wave 1 and the demonstration activities, the SESAR JU decided to postpone the launch of the second open call for VLD to early 2020.

All activities of a strategic and transversal steering nature involved the consultation and active contribution of the three advisory bodies (Scientific Committee, Programme Committee and Master

Planning Committee). The SESAR JU also ensured regular reporting to and decision-making by the Administrative Board on the matters.

Deliver Exploratory Research (ER)

In order to feed the innovation pipeline of the research programme in line with the objectives set in the European Aviation Strategy, in 2018, the SESAR JU delivered scientific results in the areas of ATM Excellent Science & Outreach and ATM application-oriented research through a total of 45 projects resulting from three open calls for proposals with a total EU contribution of EUR 38,6 million:

- H2020-SESAR-2015-1 (ER1) on ATM Excellence Science & Outreach and ATM Application-Oriented Research,
- H2020-SESAR-2016-1 (ER2) on remotely-piloted aircraft systems,
- H2020-SESAR-2016-2 (ER3) on Transversal Exploratory Research and ATM Application-Oriented Research.

In 2018, all 28 ER1 projects completed their activities and delivered promising results on automation and science applied to ATM. The outcome of 11 projects have been incorporated into the specifications of the call for proposals for the next wave of Industrial Research and Validation projects (referred to as ‘Wave 2 call’), showing the effectiveness of the SESAR innovation pipeline. Additionally, nine projects from ER2 focussing on RPAS were in execution, and all eight projects from the ER3 call started their execution and delivered their first results. More broadly, the outcome of Exploratory Research projects, together with an internal study developed by the SESAR JU, led to the delivery of the first ever roadmap on ATM automation, which was then incorporated into the update of European Master Plan.

In total, all the Exploratory Research projects under SESAR 2020 Programme received contributions from 134 beneficiaries of which 46% are higher-education organisations or research centres from all over Europe.

Deliver Industrial Research and Validation (IR)

2018 was another year when the Industrial Research and Validation covered significant features of ATM Master Plan and progressed towards the delivery of candidate Solutions in pre-industrialisation maturity. This was carried out, under the supervision of the SESAR JU (supported by three projects related to transversal activities), through 17 IR projects resulting from the restricted call for proposals IR-VLD Wave 1. In this context, the SESAR JU finalised all validation exercises of Release 7 and executed the Release 8 first validation exercises. In December 2018, the Programme Committee approved the Release 9 plan. This is a major step towards completing the scope of Wave 1 as planned, which should end with the delivery of 25 SESAR Solutions at pre-industrial level of maturity (‘V3’) – of which two were already delivered through the Release 7 in 2018 – plus 44 candidate SESAR Solutions in earlier steps in the innovation pipeline.

This is expected to provide the following performance gains (current estimates, limited to those already identified candidate Solutions that have reached V3 at the end of the Programme): a minimum of +9% in airport capacity (MP 2015 target: +10%), +51% in en-route capacity (MP 2015 target: +49%), +47% in TMA capacity (aligned with MP 2015 target), 57% productivity gains (MP 2015: 52%), -22% technology costs (aligned with MP 2015 target), -414 fuel in kg/flight (MP 2015 target: -500 kg), +86% in predictability (MP 2015 target: +96%) and +7% in punctuality (aligned with MP 2015 target). The candidate Solutions delivery process defined by the SESAR JU also includes the participation of related

projects in standardisation activities, in particular meetings with EUROCAE and RTCA/EUROCAE to disseminate validation results and analysis.

In addition, the SESAR JU prepared the IR-VLD Wave 2 call for proposals, ready for launch in early 2019, which allowed to confirm the Solutions that require further development and to identify the next series of Solutions that will complement the performance gains provided by the SESAR 2020 Programme by the end of 2022. Projects resulting from this call will allow to further develop some of the 44 candidate solutions which have reached earlier levels of maturity at the end of Wave 1, and others which have been identified in the Wave 2 preparation process.

The SESAR Catalogue's third edition, which was in preparation in 2018, documents all the candidate Solutions the SESAR 2020 Programme aims to deliver. They include critical Solutions for the future ATM system such as IOP, Virtual Centres etc., which are key enablers to make the Single European Sky and the EU Aviation Strategy effective. This represents a step forward in securing the delivery of the research and innovation contribution to the objectives of the European Master Plan 2015 edition by the end of 2022.

With the preparation of IR-VLD Wave 2, the SESAR JU benefitted from the continuous and long-term support of its Members (the European Union, EUROCONTROL and the 19 other stakeholder Members), which renewed their commitment to the achievement of the objectives of the SESAR 2020 Programme. This commitment is expected to materialise in 2019 with the submission of Wave 2 proposals, which the SESAR JU expects to be of high relevance for the current and future aviation challenges. As such, the SESAR JU will continue to concentrate and rationalise ATM-related research and innovation effort from all over Europe.

In total, Industrial Research and Validation projects received contributions from 124 organisations (SESAR JU Members other than the Union and their linked third-parties) from all over Europe of which 7% are SMEs and 14% are from the academic and research area.

Deliver Very Large-Scale Demonstrations (VLD)

Very Large-Scale demonstrations enable the SESAR JU to get a broader view on the assessment of the project solutions.

In 2018, the five Wave 1 VLD projects were in full execution and delivered their expected results. Furthermore, the SESAR JU continued the VLD activities through the signature of five new grant agreements and the start of the execution of nine VLD Open 1 projects, which delivered their first results. An example of this is the delivery of the first ever aircrafts equipped with 4D-trajectory technology for demonstration activities which will take place in 2019.

In addition to this, the SESAR JU awarded seven new grants: one grant agreement was signed as a result from the Geo-fencing call, and the SESAR JU launched the new U-space call for proposals under the Connecting Europe Facility Programme, which resulted in the award of six projects and the signature of the related grant agreements. The six U-space projects aim to provide meaningful contribution to the U-space services that support the integration of drone operations in the European air traffic management. They bring on board new entrants together with the traditional actors and regulators, and will actively contribute to the EU Network of Demonstrators.

In total, the 20 Very Large-Scale Demonstration projects, representing a total EU contribution of EUR 58,5 million, receive contributions from 184 organisations of which 22% are SMEs from all over Europe.

Deliver SESAR Outreach

To maintain the engagement with the stakeholders from the ATM community, the SESAR JU participated in several major ATM-related events and activities such as the World ATM Congress 2018, the Singapore Air Show 2018, as well as the European Transport Arena and International Symposium for ATM in Civil Aviation. It also hosted several workshops on drones and in the context of the Airspace Architecture Study. Additionally, the SESAR JU held the annual SESAR Innovation Days (SIDs) event, now in its eighth year, providing an established networking platform for Europe's academic and scientific aviation community. In this context, the SESAR JU awarded the 2018 SESAR Young Scientist Award (YSA 2018), recognising young scientists with high potential contributing to the scientific research in the field of ATM and aviation. The SIDs also hosted the "Women in aviation research" panel.

2018 saw the release of several SESAR JU key publications, such as 'SESAR Innovation Pipeline - 2018 Highlights' on the European research and innovation programme, 'Exploring the boundaries of air traffic management' on the results of 28 completed Exploratory Research projects and the third edition of the 'NextGen – SESAR State of Harmonisation' on the current and planned collaboration efforts between the U.S. and the EU.

Worth mentioning is the fact that in line with previous years, the SESAR JU continued to support the strengthening of Europe's position in the evolution of the ICAO GANP/ASBUs and the Global Aviation Safety Plan.

Furthermore, the SESAR JU worked on strengthening links with the standard-making organisations: EUROCAE, EASCG and EUSCG.

Lastly, the SESAR JU's outreach can be reflected in more than 20 featured articles and interviews in a range of magazines and online media.

Deliver effective financial, administrative and corporate management

2018 was a continuation of the activities performed by the SESAR JU in the financial, corporate, legal and human resources management. The progress can be measured through the following major achievements: the execution of the grant budget amendment procedure for the IR-VLD Wave 1 projects, the development and adoption of the SPD 2019-2021, the submission of the CAAR 2017 to the Budgetary Authority, the implementation of the SESAR JU Procurement Plan and the signature of 48 contracts, the archiving of the SESAR 1 material.

Furthermore, the SESAR JU was able to cope with a significant increase in the level of complexity of its operations, which are now managed under four different legal frameworks. This was achieved through the implementation of efficiency measures and focus on highest priorities.

The SESAR JU also secured alignment with the EU DPR (in force since May 2018) and the Internal Data Protection Regulation (or IDPR, Regulation (EU) 2018/1725 in force since December 2018¹), the new

¹ Regulation (EU) 2018/1725 of the European Parliament and of the Council of 23 October 2018 on the protection of natural persons with regard to the processing of personal data by the Union institutions, bodies, offices and agencies and on the free movement of such data, and repealing Regulation (EC) No 45/2001 and Decision No 1247/2002/EC (OJ L 295, 21.11.2018, p. 39–98)

EU Financial Regulation (in force since July 2018)² and the new Internal Control Framework (approved by the Commission in 2017)³.

² Regulation (EU, Euratom) 2018/1046 of the European Parliament and of the Council of 18 July 2018 on the financial rules applicable to the general budget of the Union, amending Regulations (EU) No 1296/2013, (EU) No 1301/2013, (EU) No 1303/2013, (EU) No 1304/2013, (EU) No 1309/2013, (EU) No 1316/2013, (EU) No 223/2014, (EU) No 283/2014, and Decision No 541/2014/EU and repealing Regulation (EU, Euratom) No 966/2012 (OJ L 193, 30.7.2018, p. 1–222)

³ As per the Internal Control Framework published by the European Commission in 2017: Communication to the Commission from Commissioner Oettinger with reference C(2017) 2373 final on the revision of the Internal Control Framework

1 Introduction

1.1 Background and objectives of the document

The SESAR JU established this Consolidated Annual Activity Report (CAAR) in accordance with Article 74(9) of the EU Financial Regulation⁴ and Article 47 of the framework financial Regulation⁵, Article 16 of the Statutes of the SESAR JU⁶, and of Article 46 of the Financial Rules⁷ of the SESAR JU.

This Consolidated Annual Activity Report (CAAR) has several purposes: it provides evidence of progress towards achieving the SESAR JU's key objectives as defined in the Single Programming Document for the period 2018 to 2020 (hereafter referred to as 'SPD 2018-2020') implementing the SESAR 2020 Multi-Annual Work Programme (MAWP)⁸, taking into account resources used during the reporting period; it also outlines the management and oversight systems in place at the SESAR JU, including reference to the European Commission's Internal Control Framework; it includes a declaration of assurance in which the Executive Director, in his role as Authorising Officer, provides assurance regarding the true and fair view given by the report and pertaining to the legality and regularity and the sound financial management of all transactions under his responsibility.

The SESAR JU has developed this CAAR in accordance with the guidelines set forth in Communication from the Commission on the guidelines for programming document for decentralised agencies and the template for the CAAR for decentralised agencies⁹.

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

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

In December 2015, the publication of "An Aviation Strategy for Europe"¹⁰ by the European Commission provided additional focus and momentum towards completion of the Single European Sky (SES) to generate growth for European business, foster innovation and let passengers profit from safer, cleaner and cheaper flights, while offering more connections. The Strategy contributes directly to the Commission priorities of Jobs and Growth, Digital Single Market, Energy Union and the EU as a global

⁴ [Regulation \(EU, Euratom\) No 2018/1046](#) of the European Parliament and of the Council of 18 July 2018 on the financial rules applicable to the general budget of the Union, amending Regulations (EU) No 1296/2013, (EU) No 1301/2013, (EU) No 1303/2013, (EU) No 1304/2013, (EU) No 1309/2013, (EU) No 1316/2013, (EU) No 223/2014, (EU) No 283/2014, and Decision No 541/2014/EU and repealing Regulation (EU, Euratom) No 966/2012 (OJ L 193, 30.7.2018, p. 1)

⁵ [Commission Delegated Regulation \(EU\) No 1271/2013](#) of 30 September 2013 on the framework financial regulation for the bodies referred to in Article 208 of Regulation (EU, Euratom) No 966/2012 of the European Parliament and of the Council

⁶ Annex to Council Regulation (EC) No 219/2007 of 27 February 2007 on the establishment of a Joint Undertaking to develop the new generation European air traffic management system (SESAR)

⁷ Administrative Board decision ADB(D) 08-2015

⁸ The MAWP, which was approved by the Administrative Board in 2015, is updated through Single Programming Documents established each year; it can be consulted on the SESAR JU website: <http://www.sesarju.eu/newsroom/brochures-publications/sear-2020-multi-annual-work-programme>

⁹ Communication from the Commission (2014)9641 final on 'Guidelines for programming document for decentralised agencies and the template for the Consolidated Annual Activity Report for decentralised agencies'

¹⁰ <http://ec.europa.eu/transport/modes/air/aviation-strategy>

actor, and the SESAR project and the SESAR JU are key components enabling the implementation of the Strategy's objectives.

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

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

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

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

1.3 The SESAR JU membership

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

Founded by the European Union and EUROCONTROL, established in 2007 as a joint undertaking¹¹, the SESAR JU became a Union Body in 2009. It was augmented by 15 stakeholder Members and then in 2016 four further Members acceded to membership, all committing to achieving the mission of the Joint Undertaking by 2024.

¹¹ The SESAR Joint Undertaking (SESAR JU) was established under Council Regulation (EC) 219/2007 of 27 February 2007 (as modified by Council Regulation (EC) 1361 / 2008 (SESAR JU Regulation) and last amended by the Council Regulation (EU) 721/2014)



founding members



Figure 1: SESAR JU membership from 2016 onwards

Together with their partners and affiliates, the SESAR JU Members other than the Union represent over 120 organisations from across the ATM community, from civil and military air navigation service providers, to airports, civil and military airspace users, staff associations, academia and research centres. Through these partnerships and further collaboration with staff associations, regulators and the larger scientific community, the SESAR JU unites the skills of some 3,000+ experts to fast track and focus research leading to change in European ATM.

1.4 The role and missions of the SESAR JU

Responding to the objectives of the EU Aviation Strategy and the Single European Sky, the challenges for ATM are captured by the SESAR JU in the European ATM Master Plan (currently 2015 Edition), which is the main planning tool for ATM modernisation in Europe. The role of the SESAR JU in steering the SESAR research and innovation programme is to define and develop solutions that meet what is needed and build a more connected, greener, safer ATM system as well as ensuring this is standardised as needed and made globally interoperable. Much of this work has been undertaken since 2008 through the SESAR research and innovation programme (called SESAR 1 for the period covering 2008 to 2016, and SESAR 2020 starting in 2015 with a maximum period for award of grants ending in December 2020), coordinated by the SESAR JU and performed by the industry at large.

The SESAR 2020 activities are funded through four different funding instruments: the Horizon 2020 Framework Programme for Research and Innovation (H2020) for EUR 585 million, the Connecting Europe Facility (CEF) Programme for EUR 10 million for drone U-space demonstration activities, and

two initiatives funded through assigned revenues for a value of EUR 500.000 and EUR 800.000 respectively. This represents a total funding from the European Union of EUR 596,3 million. The SESAR JU maintains full compliance with these frameworks.

The SESAR JU transfers the result of its ATM research and innovation activities in the form of SESAR Solutions¹² that are made available for deployment, and therefore makes a positive contribution towards the achievement of the Single European Sky. This relationship between the EU Aviation Strategy, the SES objectives, the ATM Master Plan defining the medium and long-term planning of achievements, and the R&I activities delivering SESAR Solutions transferred to deployment, is structured in the SESAR Innovation Pipeline, which is depicted in the figure below:

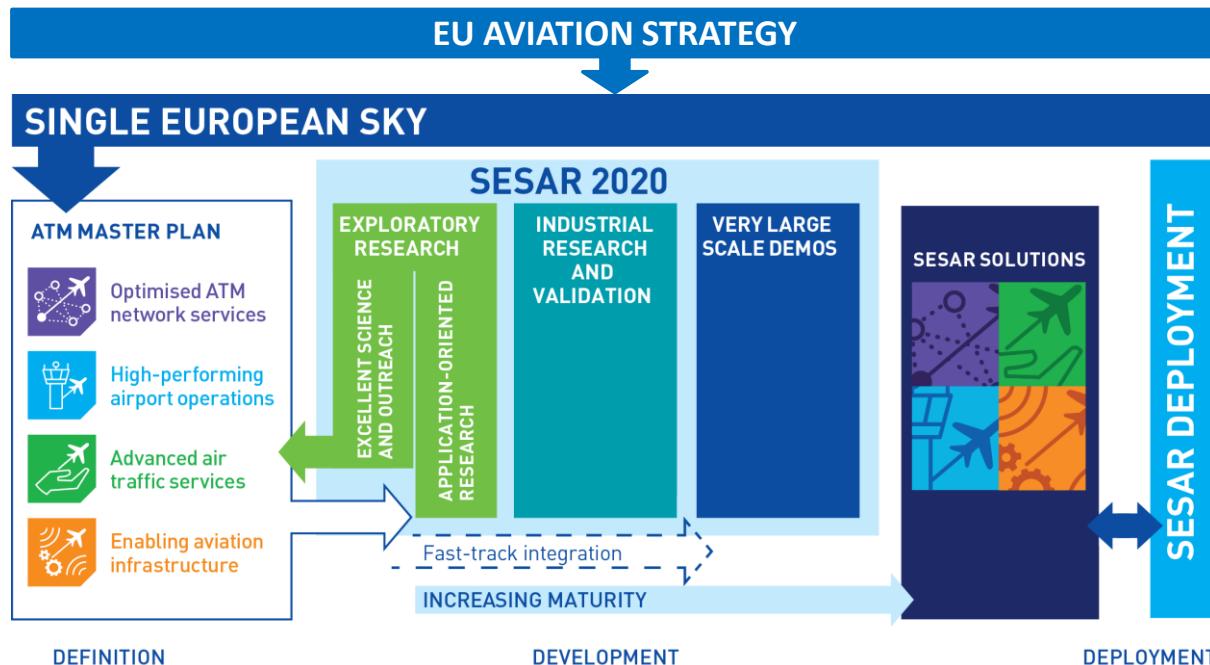


Figure 2: The SESAR Innovation Pipeline – from EU Aviation Strategy to SESAR Solutions

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

- The **Exploratory Research (ER)** addresses relevant fundamental scientific subjects representing transversal topics for future ATM evolution ('Excellent Science & Outreach') investigates the initial applications of such science for the ATM sector ('Application-oriented research'). Exploratory Research covers research activities up to TRL 2¹³. It also addresses the Knowledge Transfer Network aimed at facilitating the development of ATM research in

¹² SESAR Solutions are referred to as 'candidate SESAR Solutions' as long as they are under development in the Industrial Research phase of the SESAR innovation pipeline (see figure 2). Once validated at V3 level of maturity, they are packaged and referred to as 'SESAR Solutions'

¹³ As required by Horizon 2020, the maturity of research outcomes is assessed according to the Technology Readiness Level (TRL) model, combined with the European Operational Concept Validation Methodology (E-OCVM) model to allow for the assessment of technological and operational concept developments

Europe in support to the SESAR JU. This phase of research is wholly funded from EU funds and done in full compliance with H2020 and its rules for participation¹⁴. It is subject to open calls, allowing contributions from stakeholders beyond the membership including universities and research centres;

- Through the **Industrial Research and Validation (IR)**, which includes applied research, pre-industrial development and validation projects, SESAR Solutions are developed and, through validation exercises, their maturity and potential benefit is assessed in the context of yearly Releases (one per year). IR covers research activities up to TRL 6.
- The third phase deals with **Very Large-Scale Demonstration activities (VLDs)** which are designed as demonstrations of particular programme concepts elements and SESAR Solutions. These demonstration activities provide the bridge between the development and deployment phases of SESAR. They are funded through the H2020 Programme, or through the CEF Programme (for drone U-space demonstration activities) or through Assigned Revenue, through work undertaken by the SESAR JU Members other than the Union (through restricted calls), supplemented by open calls to ensure the widest possible stakeholder participation beyond the membership including small and medium enterprises (SMEs) and new entrants.

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

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

Besides the role of technology and innovation, the EU Aviation Strategy also recognises the need to secure Europe's leading role in international aviation. To this end, the SESAR JU also works closely with the European Commission, EUROCONTROL and EASA on building and executing a coordinated plan of action involving third countries and the ICAO.

¹⁴ Regulation (EU) No 1290/2013 of the European Parliament and of the Council of 11 December 2013 laying down the rules for participation and dissemination in "Horizon 2020 – the Framework Programme for Research and Innovation (2014-2020)" and repealing Regulation (EC) No 1906/2006 (OJ L 347, 20.12.2013, p. 81–103)

1.5 Factsheet: the SESAR JU in 2018

The table below provides an overview of key facts and figures related to the SESAR JU in 2018:

Name	SESAR Joint Undertaking (SESAR JU)
Objectives	The SESAR JU is responsible for coordinating, rationalising and concentrating all relevant ATM research and development efforts in the EU, aiming to contribute to the modernisation and harmonisation of ATM in Europe
Founding Legal Act	Established under Council Regulation (EC) 219/2007 of 27 February 2007 ¹⁵ Modified by Council Regulation (EC) 1361/2008 (SESAR JU Regulation) ¹⁶ Last amended by Council Regulation (EU) 721/2014 ¹⁷
Executive Director	Florian Guillermot (mandate running up to March 2022)
Administrative Board composition¹⁸	<p>Members with voting rights:</p> <p>A) SESAR JU Members</p> <ul style="list-style-type: none"> • European Union (Founding Member) • EUROCONTROL (Founding Member) • Airbus • AT-One consortium • B4-consortium • COOPANS Consortium • Dassault Aviation • DFS • DSNA • ENAIRE • ENAV • Leonardo • Frequentis Consortium • Honeywell • INDRA • NATMIG • NATS • SEAC 2020 • Skyslide • Thales LAS France SAS • Thales AVS France SAS <p>B) Representative at European level of civil users of airspace</p> <p>Members without voting rights:</p> <ul style="list-style-type: none"> • Military • Air Navigation Service Providers

¹⁵ 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)

¹⁶ 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)

¹⁷ 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

¹⁸ As on 31 December 2016. The list of participants to the Administrative Board is provided in annex IX. Before 2016, the SESAR JU membership was composed of the 2 Founding Members (EU and EUROCONTROL) and 15 additional Members

	<ul style="list-style-type: none"> • Equipment manufacturers • Airports • Staff in the ATM sector • Scientific community
Other Advisory Bodies	<p>The Programme Committee (PC) and its sub-committees: Delivery Management Sub-Committees (DMSC) and Operational & Technical Sub-Committee (OTSC)</p> <p>The Scientific Committee (SC)</p> <p>The Master Planning Committee (MPC)</p>
Human Resources¹⁹	<p>42 positions, of which 40 positions filled at the end of 2018:</p> <ul style="list-style-type: none"> • Temporary Agents: 37 positions • Seconded National Experts: 3 positions <p>45% men / 55% women</p>
Strategic Research Agenda	<p>SESAR 2020 Multi-Annual Work Programme (MAWP):</p> <p>http://www.sesarju.eu/newsroom/brochures-publications/sesar-2020-multi-annual-work-programme</p>
2018 Budget	<p>Budget revenue:</p> <ul style="list-style-type: none"> • Revenue entitlements (final commitments appropriations): EUR 153.437.961 <ul style="list-style-type: none"> ◦ EU contribution: EUR 122.563.000 (of which EUR 112.563.000 through H2020 and EUR 10.000.000 through CEF as assigned revenues) ◦ Other revenue: EUR 30.874.961 • Revenue (final payments appropriations): EUR 140.909.219 (of which EUR 119.913.926 for SESAR 2020 and EUR 20.995.293 for SESAR 1) <p>Budget expenditure:</p> <ul style="list-style-type: none"> • Commitment appropriations: EUR 153.437.961 <ul style="list-style-type: none"> ◦ Title I (staff expenditure): EUR 6.040.300 ◦ Title II (infrastructure and operating expenditure): EUR 3.476.234 ◦ Title III (operational expenditure): EUR 143.921.427 • Payment appropriations: EUR 166.465.285 <ul style="list-style-type: none"> ◦ Title I (staff expenditure): EUR 6.554.711 ◦ Title II (infrastructure and operating expenditure): EUR 5.853.099 ◦ Title III (operational expenditure): EUR 154.057.475

¹⁹ As on 31 December 2018. Details on the implementation of the Staff Establishment Plan are provided in section 2.4

2018 Budget implementation	<p>Implementation of budget revenue:</p> <ul style="list-style-type: none"> • Revenue entitlements: EUR 98.653.425 (64,3% of the approved budget): <ul style="list-style-type: none"> ◦ EU contribution: EUR 88.184.652 (SESAR 2020 budget only) ◦ EUROCONTROL contribution: EUR 5.189.144 (SESAR 2020 budget only) ◦ Other Members contribution: EUR 2.638.010 (SESAR 2020 budget only) ◦ Other revenue: EUR 2.641.620 • Revenues: EUR 97.887.180 (69,47% of the approved budget) <p>Implementation of budget expenditure:</p> <ul style="list-style-type: none"> • Actual commitment appropriations (commitments made on 2018 budget): EUR 146.323.724 <ul style="list-style-type: none"> ◦ Title I (staff expenditure): EUR 5.369.606 ◦ Title II (infrastructure and operating expenditure): EUR 3.263.224 ◦ Title III (operational expenditure): EUR 137.690.894 • Actual total payments made in 2018: EUR 78.625.670 <ul style="list-style-type: none"> ◦ Title I (staff expenditure): EUR 5.219.663 ◦ Title II (infrastructure and operating expenditure): EUR 4.219.945 (of which EUR 4.050.475 from SESAR 2020 budget and EUR 169.470 from SESAR 1 budget) ◦ Title III (operational expenditure): EUR 69.186.062 (of which EUR 67.515.373 from SESAR 2020 and EUR 1.670.690 from SESAR 1)
Call implementation	<p>A total of ten calls for proposals is planned to be launched over the period 2015-2020:</p> <ul style="list-style-type: none"> • Two calls (one open, one restricted to the SESAR JU Members other than the Union) launched in 2015 under the H2020 Programme, resulting in: <ul style="list-style-type: none"> ◦ 28 Exploratory Research projects with the corresponding grants signed with 88 beneficiaries and linked third-parties, for a total value of EUR 20,4 million, resulting from the open call H2020-SESAR-2015-1 (ER1) ◦ 20 Industrial Research & Validation projects with the corresponding grants signed with the 20 SESAR JU Members other than the Union (EUROCONTROL and 19 other SESAR JU stakeholder Members²⁰) and linked third-parties, for a total value of EUR 206,7 million, resulting from the restricted call H2020-SESAR-2015-2 (IR/VLD Wave 1) ◦ 4 Very-Large Scale Demonstration activities (1 was terminated in 2017) with the corresponding grants signed with the 20 SESAR JU Members other than the Union (EUROCONTROL and 19 other SESAR JU stakeholder Members²⁰) and linked third-parties, for a total value of EUR 31,7 million, resulting from the restricted call H2020-SESAR-2015-2 (IR/VLD Wave 1) • Two additional open calls launched in 2016 under the H2020 Programme, resulting in: <ul style="list-style-type: none"> ◦ Nine Exploratory Research projects focusing on RPAS with the corresponding grants signed with 43 beneficiaries and linked third-parties, for a total value of EUR 8,3 million, resulting from the open call H2020-SESAR-2016-1 (ER2-RPAS)

²⁰ As some SESAR JU Members are consortia, the 19 SESAR JU Members and EUROCONTROL represent in total 39 organisations. There are in addition 80 “linked third-party” organisations in this call for IR and 17 for VLD

	<ul style="list-style-type: none"> ○ Eight Exploratory Research projects with the corresponding grants signed with 29 beneficiaries and linked third-parties, for a total value of EUR 9,9 million, resulting from the open call H2020-SESAR-2016-2 ○ Nine Very Large-Scale Demonstration activities for a total grant value of EUR 16,9 million, plus one remaining to be signed resulting from the open call H2020-SESAR-2016-2 ● One additional open call for proposals launched in 2017 for Very Large-Scale Demonstration activities focusing on Active Geo-fencing Service, under assigned revenue from the European Commission (open call with reference SESAR-2017-1), resulting in one project for a grant value of EUR 0,5 million, ● One additional open call for proposals launched in 2018, managed under the Connecting Europe Facility (CEF) Programme, focusing on U-space demonstration activities (open call with reference CEF-SESAR-2018-1), resulting in six projects for a total value of EUR 9,4 million, ● Four additional calls, both open and restricted to the SESAR JU Members other than the Union, planned in the upcoming years: <ul style="list-style-type: none"> ○ Two calls for proposals in 2019 under the H2020 Programme, with award planned between the second part of 2019 and 2020, and corresponding projects taking place until the end of 2022: <ul style="list-style-type: none"> ■ Wave 2 call, restricted to the SESAR JU Members other than the Union, for Industrial Research & Validation and for Very Large-Scale Demonstration activities (restricted call with reference H2020-SESAR-2019-1) ■ ER4 call for Exploratory Research (open call with reference H2020-SESAR-2019-2) ○ Two calls for proposals in 2020 under the H2020 Programme, with award planned before the end of 2020, and corresponding projects taking place until the end of 2022: <ul style="list-style-type: none"> ■ An additional open call on Very Large-Scale Demonstration activities (open call with reference H2020-SESAR-2020-1), ■ A last Wave 3 call, restricted to the SESAR JU Members other than the Union, for Industrial Research & Validation activities (restricted call with reference H2020-SESAR-2020-1) <p>Additional calls for proposals may be organised as required</p>
Procurement management	<p>Overall value of procurement activities in 2018 amounts to EUR 18,6 million through:</p> <ul style="list-style-type: none"> ● 12 Framework Contract, Direct Services Contracts and secondment agreements ● 37 Specific Contracts ● 12 amendments

Table 1: The SESAR Joint Undertaking in 2018 in brief

2 Part I. Achievements of the year

This section highlights progress and presents the achievement of the SESAR JU's main objectives in 2018:

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

All the above-mentioned objectives have been achieved in 2018.

In 2018, the SESAR JU has conducted three major initiatives that have been key in setting the vision for the future of ATM in Europe: the Airspace Architecture Study, the update campaign of the European Master Plan and the delivery of a proposal for the second Common Project. The results of these achievements, recognised by the whole ATM community, have been transferred to the Commission that will take the next steps for their inclusion in the aviation legislative and policy framework.

The SESAR JU is at cruise altitude and full speed with 58% of the multi-annual budget committed, allowing a total of 85 projects in execution or completed, covering the three phases of the SESAR innovation pipeline. The 45 Exploratory Research projects (representing a total EU funding of EUR 38,6 million) deliver promising results in all topics expected to be addressed as per the SESAR 2020 multi-annual work programme, and 11 of them have delivered outputs which have been incorporated in the definition of the next wave of the Industrial Research and Validation projects. Industrial Research counts 20 projects (3 of which deal with transversal activities in support of the SESAR JU's steering) for a total EU funding of EUR 206,7 million. These projects are delivered by the SESAR JU Members other than the Union, developing candidate Solutions that contribute to the realisation of performance benefits measured against the six Key Performance Areas established in the ATM Master Plan, namely: Airport capacity, En-route capacity, TMA capacity, Fuel Efficiency, Productivity, Technology Cost, Punctuality and Predictability. Some of the candidate Solutions are also vital for the successful implementation of the Single European Sky – such as IOP, Virtual Centres etc. – and therefore are under specific monitoring by the SESAR JU. Industrial Research also encompasses a key contribution to the preparation of the future standards, which is a de-risking factor to mitigate the industrialisation gap risk. At the end of the SESAR innovation pipeline, 20 Very Large-Scale Demonstration projects (representing a total funding of EUR 58,5 million) allow to demonstrate the benefits of the developed Solutions in real-life environment across all Europe.

Overall, the 85 projects within the SESAR 2020 Programme receive contributions from all types of organisations targeted by the Horizon 2020 Programme, namely higher education and universities, research organisations, public organisations and private companies. Beneficiaries include the 20 SESAR JU Members other than the Union but are not limited to them, close to 30% of the overall funding being devoted to "open calls for proposals", i.e. calls open for other industry partners than the SESAR JU Members. Furthermore, with the SESAR Innovation Days and the Young Scientists Awards, the SESAR JU recognises and encourages innovation for ATM in the academic domain.

In addition to its results from the Exploratory Research projects, the SESAR JU has proven to be a key player in innovation for aviation through the integration of new entrants beyond the traditional actors

in ATM research and innovation. In U-space in particular, the innovation pipeline has been adapted to enable the fast integration of technology elements mature in other sectors into the ATM innovation.

The strong collaboration with other European organisations for aviation, such as the EASA or the Network Manager, has continued, especially in U-space demonstrations, in the Airspace Architecture study and in the Master Plan update. Beyond Europe, in 2018 the SESAR JU participated actively in the 13th ICAO Air Navigation Conference (ANC/13), securing the integration of Europe's view to the evolution of ICAO's Global Air Navigation Plan (GANP).

The SESAR JU, setting the vision of the future of ATM in Europe

The SESAR JU provides technical support to the Commission on the technological pillar of the Single European Sky; in that role, the SESAR JU

- delivered a new proposal to transit R&D results into implementation (CP2),
- developed a study on the future architecture of the European airspace (under a fourth regulatory framework), articulating with the other pillars of the SES such as the Network Manager and the performance scheme,
- led the update campaign of the European ATM Master Plan. Further information on these activities is available in section 2.1.

Furthermore, the SESAR JU is responsible for the cooperation with ATM stakeholders at the regional level and the international levels, and for communication and dissemination of ATM research-related information. Further information on these activities is available in section 2.5.

Two very innovative calls for proposals successfully organised

At the end of 2018, the SESAR 2020 Programme covers the full SESAR innovation pipeline through six calls for proposals under three different legal frameworks:

- Under the Horizon 2020 Programme:
 - The first Exploratory Research open call for proposals H2020-SESAR-2015-1 (ER1) resulting in twenty-eight projects for a total maximum EU funding of EUR 20,4 million;
 - The first call for proposals H2020-SESAR-2015-2 (IR-VLD Wave 1), restricted to the 20 SESAR JU Members other than the Union (EUROCONTROL and 19 other SESAR JU stakeholder Members) resulting in twenty Industrial Research and Validation projects (of which three dedicated to Transversal Steering Activities) for a total maximum EU funding of EUR 206,713 million, and in four (1 was terminated in 2017) Very Large-Scale Demonstration projects for a total maximum EU funding of EUR 31,7 million;
 - The second Exploratory Research open call for proposals H2020-SESAR-2016-1 (ER2-RPAS) resulting in nine projects for a total maximum EU funding of EUR 8,3 million,
 - The third Exploratory Research open call for proposals launched within the call with reference H2020-SESAR-2016-2 (ER3) resulting in 8 projects for a total maximum EU funding of EUR 9,9 million; this call was combined with the first Very Large-Scale Demonstration open call for proposals (VLD Open 1) resulting in nine projects for a total maximum EU funding of EUR 16,9 million, plus an additional project for which the grant agreement was still in the signature process at the end of 2018,
- Under assigned revenue from the European Commission: the second Very Large-Scale Demonstration open call for proposals SESAR-2017-1 for Very Large-Scale Demonstration

activities focusing on Active Geo-fencing Service, resulting in one project for a total maximum EU funding of EUR 497.403;

- Under the Connecting Europe Facility (CEF) Programme: the third Very Large-Scale Demonstration open call for proposals CEF-SESAR-2018-1, focusing on U-space demonstration activities and resulting in six projects for a total maximum EU funding of EUR 9,4 million.

These six calls for proposals have thus resulted, at the end of 2018, in a total of 85 projects (initially 86, but one project was terminated under the Wave 1 call) covering the full spectrum of the research topics defined in the SESAR 2020 Multi-Annual Work Programme:

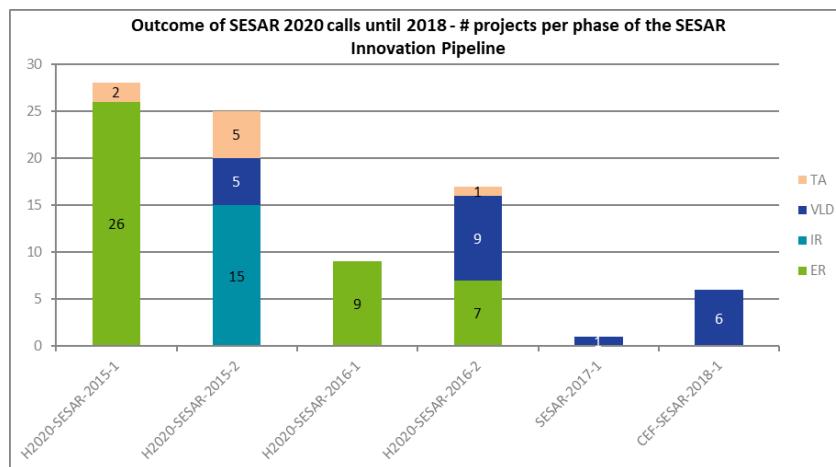


Figure 3: Number of projects per phase of the SESAR Innovation pipeline, per call (end 2018)

At the end of 2018, additional calls for proposals were planned and under preparation.

In total, up to 2018, the SESAR JU has successfully awarded grants for a total cumulated value of more than EUR 300 million, which represents 58% of the overall objective of funding of SESAR 2020. As initially planned in the SESAR 2020 Multi-Annual Work Programme, and with the inclusion of assigned revenues later on, the funding of activities through restricted and open calls for proposals will continue over the coming years with a forecasted cumulated amount of more than EUR 524,5 million by the end of 2020 (which means that the SESAR JU invests 90% of its EU contribution in research and innovation projects resulting from calls for proposals under H2020, CEF and other frameworks), as depicted in the graph below (dates refer to the grant award):

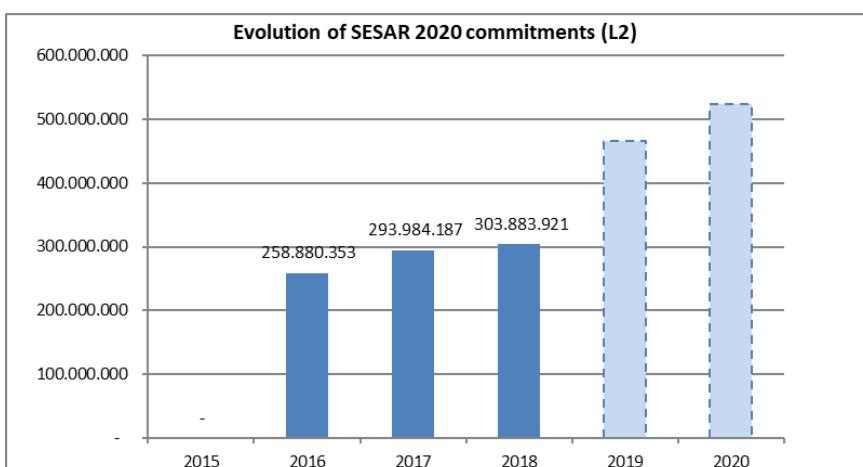


Figure 4: Evolution of SESAR 2020 calls-related commitments (forecasts beyond 2018 in dashed columns)

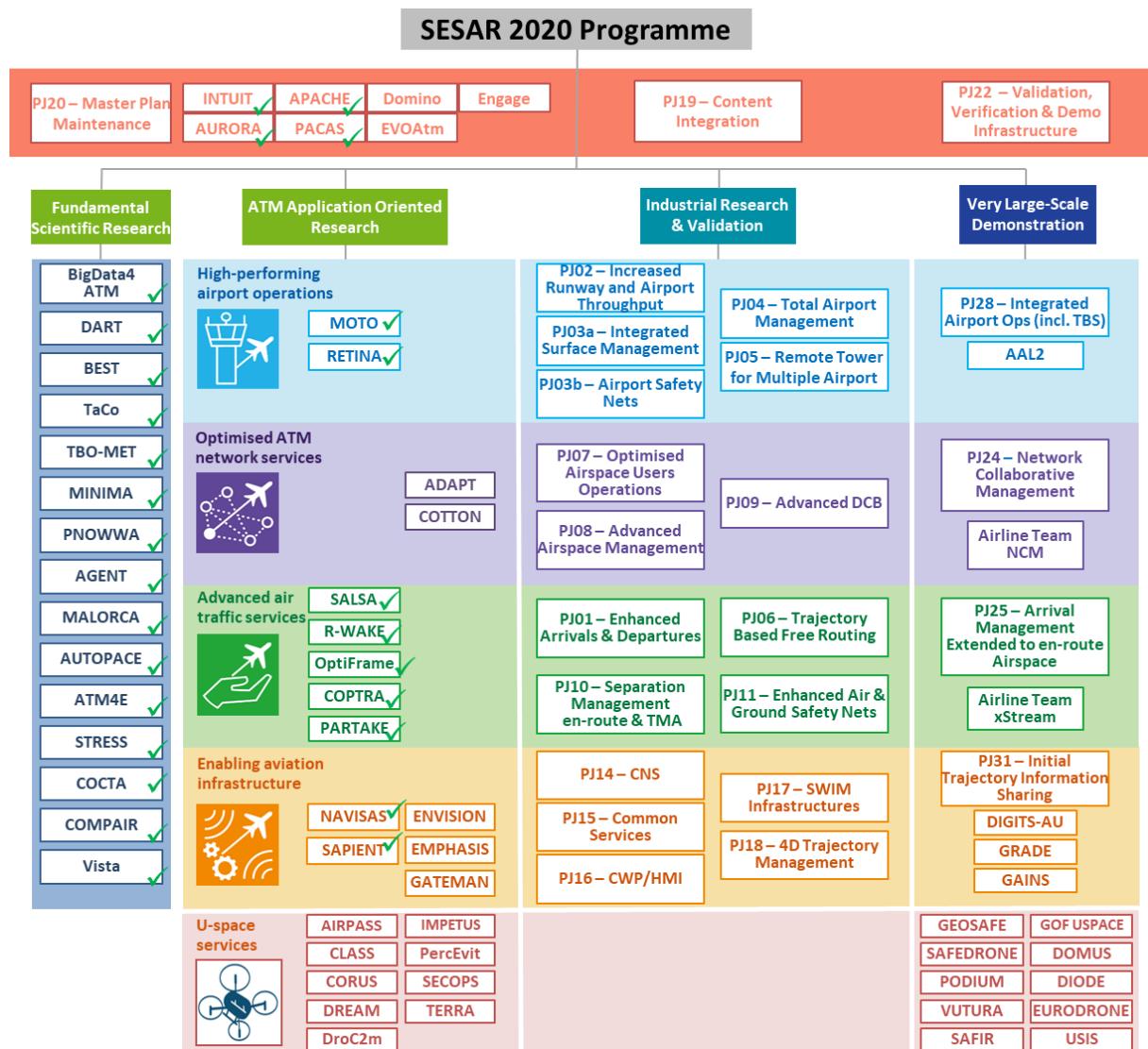


Figure 5: SESAR 2020 Programme portfolio of projects matching the research topics at the end of 2018 (projects in execution or closed)

The status of these calls for proposals and the related projects is presented in further detail in the following sections of this chapter.

Further information on the calls for proposals, their outcomes and the resulting projects is available in sections 2.1 to 2.4 below.

A programme benefitting to a broad range of stakeholders

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

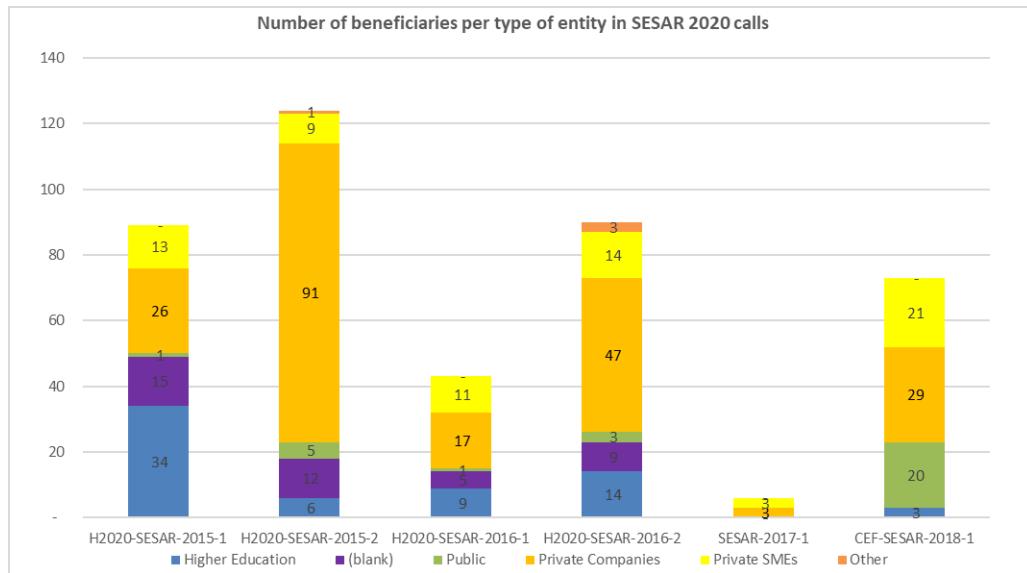


Figure 6: All types of organisations are beneficiaries from SESAR 2020 funding

This funding is distributed across 27 EU Member States:

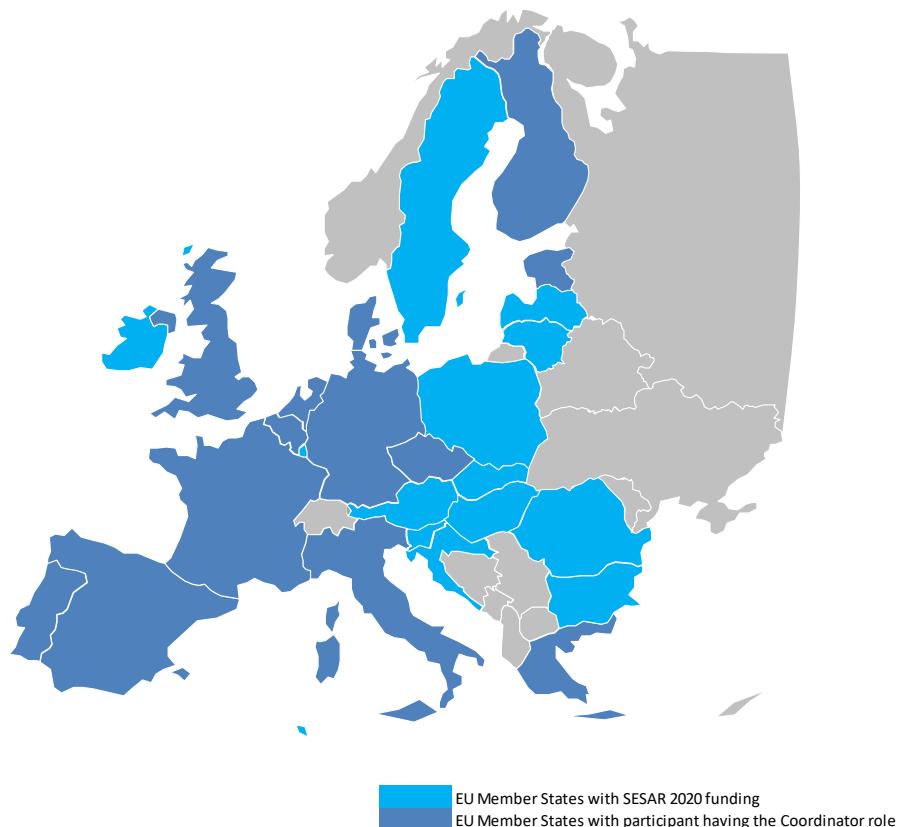


Figure 7: SESAR 2020 funding for EU Member States at the end of 2018

The delivery of candidate Solutions progressed significantly in 2018...

The funded IR projects are delivering results in the form of candidate SESAR Solutions which, through the Release process, are validated at a certain maturity level (V1 or TRL2, V2 or TRL-4, V3 or TRL-6, the latter corresponding to readiness for deployment). Releases are delivered every year. The following figure shows the number of (candidate) SESAR Solutions delivered through the Releases in action in 2018, namely Release 7 (concluding in April 2018), Release 8 (delivering in 2018 and planned to conclude in April 2019), and Release 9 (the plan of which was approved in December 2018):

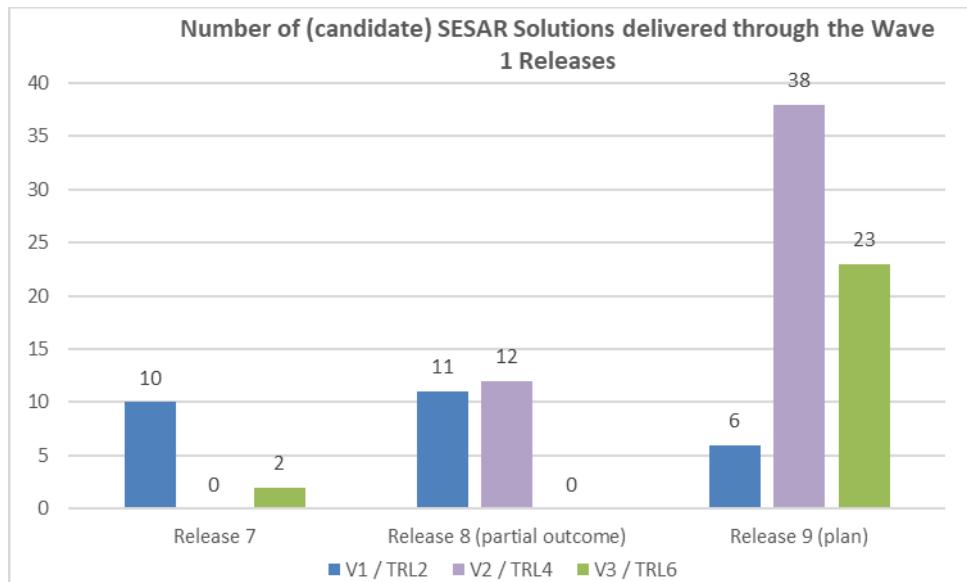


Figure 8: Number of SESAR Solutions delivered through Release 7, 8 and 9 (plan at the end of 2018)

The figure above shows that the delivery of SESAR Solutions is effective. This is expected to continue in the upcoming years, with for instance some Solutions in V2 or TRL-4 level of maturity being further developed and delivered through the subsequent Releases up to 2022 under Wave 2 and Wave 3.

... allowing to secure the contribution to Master Plan performance targets

Therefore, the SESAR 2020 Programme has already delivered effective contribution to the performance targets as set in the 2015 edition of the European ATM Master Plan. The following figure provides a view, at the end of 2018, of the already achieved and expected further contribution of candidate SESAR Solutions to the six ATM Key Performance Areas (KPAs) of the SESAR Performance Framework, which represent the part of the SES performance ambitions that the SESAR Programme is expected to achieve. The figures in the figure below only consider the validation targets assigned to these SESAR Solutions that reach the V3 level of maturity, not counting V2 Solutions which add to forecasted performance benefits. Furthermore, new Solutions developed in Wave 2 and further delivery waves of the SESAR 2020 Programme, are not included in the forecasted overall contribution yet. Hence, it may be expected that the forecasted SESAR contribution to the KPAs may increase.

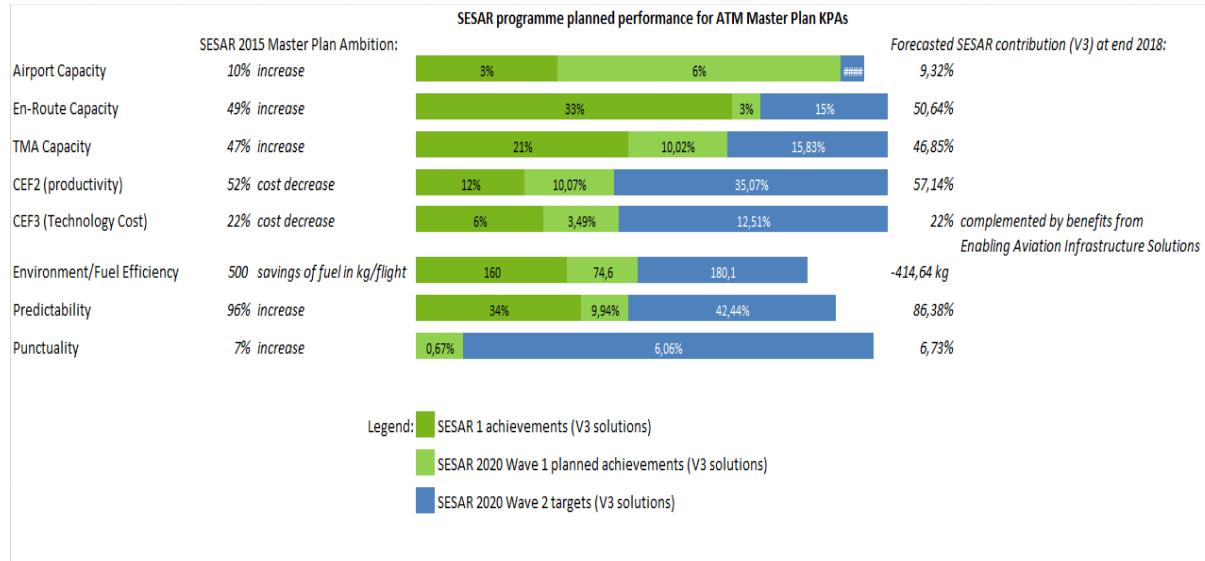


Figure 9: Planned SESAR cumulated research and innovation contribution to the realisation of the ATM Master Plan KPs

Complementing the figure above, section 2.1.4 below provides examples of first estimates of performance results stemming from the first realised V1 validation activities of some candidate SESAR Solutions. These results are, in most cases, beyond the expected performance targets above.

With the progress already achieved up to 2018, with the ongoing delivery of candidate SESAR Solutions and based on the result of estimated performance results stemming from actual V1 activities, the SESAR JU is confident that the SESAR 2020 Programme will provide the required research and innovation contribution to achieve the targeted improvement of the European ATM system.

2.1 Strategic Area of Operation 1: Provide Strategic Steering to the SESAR Programme

The SESAR JU met all its objectives related to Strategic Steering of the SESAR programme in 2018. This includes the following achievements and results:

- *Call reference H2020-SESAR-2015-2 (IR –VLD Wave 1 Call) - Wave 1 Transversal Activities projects delivery of results: projects PJ.19, PJ.20 and PJ.22 were in execution and delivered their expected contributions on Performance, Architecture and Master Plan update*
- *Call reference H2020-SESAR-2015-2 (IR –VLD Wave 1 Call) - conduct Wave 1 Transversal Activities grant budget amendments campaign: the three grant agreements of projects PJ.19, PJ.20 and PJ.22 were amended successfully*
- *Execute the Master Plan Update Campaign: the Master Plan campaign was executed according to plan and the final delivery is expected in Q1 2019; the initial plan was revised to fully incorporate the results of the Airspace Architecture Study*
- *Strengthen coordination with relevant Master Plan stakeholders: Master Plan stakeholders provided support to the SESAR JU in some of its key activities in 2018, especially the Common Project 2 proposal (delivered in March 2018), the Airspace Architecture study (final report completed at the end of 2018) and the Master Plan update campaign (final delivery planned in Q1 2019)*
- *Prepare ER4, Wave 2 and VLD Open 2 Calls for proposal for launch in 2019 - overall coordination and strategy setting: the calls for proposals to be launched in 2019 were prepared and the required coordination took place both within the SESAR JU and in consultation with advisory bodies. The SESAR JU decided to postpone the launch of the VLD Open 2 call to cover the orientations of the Airspace Architecture study and the update of the European Master Plan to be delivered and approved in 2019)*
- *Call reference H2020-SESAR-2019-1 (IR/VLD Wave 2 Call) - preparation of content and call material for Transversal Steering activities: the Transversal Steering activities related topics have been prepared in the call conditions and call material*
- *Provide support to EC on other areas linked to the technological pillar of the SES: Common Project 2 proposal delivered in March 2018, Airspace Architecture study (final report completed at the end of 2018) and Master Plan update campaign (final delivery planned in Q1 2019); the SESAR JU provided further support in the integration of these results in the Commission activities related to the SES*
- *Ensure effective and efficient SESAR 2020 programme governance meetings: the SESAR JU held three meetings with the Scientific Committee, five meetings with the Programme Committee and five meetings with the Master Planning Committee*

In 2018, in line with the plan set in the SPD 2018-2020, Programme steering activities included the following:

- The delivery of a proposal for the second Common Project,
- The organisation, launch and delivery of the Airspace Architecture study,
- The launch and execution of the ATM Master Plan update campaign,
- The continued transversal steering of SESAR 2020 Programme activities supported by projects PJ.19, PJ.20 and PJ.22,
- The continued collaboration of the ATM community through the SESAR JU advisory bodies.

The following paragraphs provide detailed information of the achievements in these various fields of activities.

2.1.1 Delivery of a proposal for the second Common Project

In order to increase the transition rate of mature SESAR Solutions (delivered in SESAR 1) to deployment, the SESAR JU received a mandate for developing a recommendation on the content of a Common Project – CP2, the SESAR JU delivered its proposal in February 2018. This proposal was developed in line with the guidelines contained in the mandate and the Work Plan that was agreed on 11 May 2017.

This CP2 recommendation combines, in a coherent manner, technological and procedural improvements actions. Overall, it aims to achieve significant performance improvements in the short to medium term, assuming that deployment (or decommissioning) is carried out in an optimal way. It is expected to:

1. Enhance air navigation services provision in all flight segments (en route, approach/terminal and airport levels), building on the PCP functionalities;
2. Improve safety by addressing in particular the issue of runway incursions / runway collisions, which are flagged by EASA as a key safety risk area²¹;
3. Make significant progress towards the implementation of a lean and efficient use of ANS infrastructure.

The recommendation was developed with the involvement of all relevant operational stakeholders, as well as the Network Manager, the SESAR Deployment Manager, EASA and the European Defence Agency. It complements or supplements the PCP and has been coordinated with the PCP review carried out in parallel by the SESAR Deployment Manager (SDM). It focuses on mature SESAR Solutions for which a coordinated and synchronised implementation among the key investors was considered to be necessary or would provide increased performance compared to a purely local deployment.

The result is composed of a balanced and coherent set of six “ATM Functionalities” (AFs), as per the Commission’s implementing Regulation on common projects²², consisting in logical groupings of essential operational/technical changes identified in the European ATM Master Plan. Five of these functionalities build on the existing PCP AFs, while the sixth one is new (CNS rationalisation). The six AFs were proposed as a package, achieving maximum benefits within the set period as described in the cost benefit analysis (CBA), and should ensure a well-reasoned transition from the changes already included in the PCP as well as future common projects in consistency with the SESAR Vision outlined in the European ATM Master Plan. The AFs proposed for CP2 and their mapping against the existing PCP AFs is as follows:

²¹ EASA Annual safety Review 2017 <https://www.easa.europa.eu/newsroom-and-events/news/2017-easa-annual-safety-review-published>

²² Commission IR (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” <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32013R0409>

CP2	PCP
AF # 1E: Enhanced AMAN/DMAN integration and Optimised low-level routes for rotorcraft	AF # 1: Extended AMAN and PBN in high density TMAs
AF # 2E : Enhanced airport situational awareness and AOP	AF # 2: Airport Integration and Throughput Functionalities
AF # 3E: Improved ATS using enhanced short-term conflict alert (STCA)	AF # 3: Flexible Airspace Management and Free Route
AF # 4E: Network Collaborative Management and data exchanges	AF # 4: Network Collaborative Management (Flow & NOP)
AF # 5E: Digital aeronautical data	AF # 5: iSWIM: Ground-ground integration and aeronautical data management and sharing
No CP2 proposal	AF # 6: Initial Trajectory Information Sharing: air-ground integration
AF # 7: CNS rationalisation and evolution	New

Table 2: Mapping of ATM Functionalities proposed for CP2 against the existing PCP AFs

In November 2018, the SESAR JU was informed that the Commission had decided to mandate the SESAR Deployment Manager to explore the possibility to integrate the SESAR Solutions proposed for CP2 into the PCP review and later develop a full CBA on the final configuration of the reviewed PCP. Consequently, the SESAR JU will organise a hand-over session of the CP2 proposal to the SESAR Deployment Manager which took place in Q1 2019.

2.1.2 Delivery of the Airspace Architecture study

On 13 December 2017, the SESAR JU signed a Delegation Agreement with the European Commission to develop a proposal for the future architecture of the European Airspace²³.

The Commission request was inspired by the concept of “Trans-European Motorways of the sky” of the European Parliament, embracing a new era of innovation and digital technologies in consistency with the Single European Sky initiative, the European Aviation Strategy and the European ATM Master Plan. The study aimed to efficiently support growing traffic flows, promote an optimised provision of air navigation services, and stimulate the rationalisation of ATM/CNS infrastructure. It required to fully respond to the needs of the airspace users and support the concept of European Upper Information Region (EUIR).

This activity had to be fully coordinated with the Master Plan update carried out in parallel. Both activities were closely coordinated and both documents are consistent, containing appropriate cross-references and aligned milestones, timelines and key contents.

Work was carried out in close cooperation with the Network Manager, and its outcome now sets the vision on how the European airspace architecture should look like in the medium to long term (2035),

²³ Delegation Agreement EC/SESAR JU with reference MOVE/E3/DA/2017-477/SI2.766828 to conduct a study on the future architecture of European Airspace

describing the intended airspace organisation, design and operations and the steps to be taken to achieve that architecture.

Recent developments in ATM have shown the potential of new operational concepts to reduce the fragmentation of the European airspace. The European ATM Master Plan, which update is conducted in 2018-2019, contains the building blocks enabling the implementation of the findings of the Study, such as free-route airspace, advanced flexible use of the airspace, dynamic and cross-border sectorisation, dynamic air traffic flow and capacity management and virtual centres. This technology, deployed in good synchronisation with the related operational, infrastructure and service provision optimisations, will optimise the use of airspace and facilitate the choice of preferred trajectories by airspace users.

The focus of the study and its main specificity is the link it builds between the operational and technical dimensions: airspace, operations and technology, infrastructure, applications and data services. The intent is to propose measures and a phased and coordinated implementation that will ensure that airspace is optimised according to operational needs, without being dimensioned by flight information region or national boundaries. It is the first time that such a close coupling between all these different dimensions has been undertaken in the context of SES.

The study comes complete with a description of the conditions for its success:

- The setting up of a “capacity-on-demand” service and more generally the extension of cross-FIR ATS provision;
- The creation of the ATM Data Service Provision (ADSP) function;
- The setting up of incentives that will reward early movers.

The activities were kicked off on 9 March 2018 with the approval of the work plan designed by the SESAR JU and approved by the Steering Committee (set up to oversee the execution of the study and composed of the SESAR JU, the Commission and the Network Manager). The core tasks were executed in close cooperation with the Network Manager and in three phases. The delivery of the Master Plan was postponed from 2018 to 2019 so as to take full account of the outcome of this work:

- **Phase 1** (from March to July 2018) where the core analysis was performed together with a first round of bilateral meetings with key stakeholders. This phase covered all objectives of the study and preliminary directions and principles were shared in all transparency through an open workshop organised on 6 and 7 July 2018. It resulted in the delivery of an interim report.
- **Phase 2** (September to October 2018) overall refinement of the analysis together with a second round of bilateral meetings with key stakeholders. It resulted in the delivery of a draft final report.
- **Phase 3** (November to December 2018) overall consolidation at SESAR JU level and delivery of a final report and all the necessary material for the organisation of a workshop to present the final results conducted on 20 and 21 November 2018. It resulted in the hand-over to the EC of the proposed final report in December 2018.

2.1.3 Towards a major update of the European ATM Master Plan

Since the 2015 edition of the Master Plan, several significant developments have taken place in the European air traffic. These are in particular: an unprecedented increase in demand for flying, generating a serious and increasing capacity challenge; the emergence of new air vehicles with in particular a rapidly growing drone traffic that needs to be efficiently integrated into all categories of airspace; and the need to enable the European ATM network to react efficiently to unexpected events, be they punctual (system breakdown, meteorological event) or structural (economic or political crises).



The ATM modernisation therefore needs to address these challenges through a digital transformation of aviation, while sustaining or even improving the levels of safety and security. For these reasons and to fully incorporate the results of the Airspace Architecture Study together with the document "Roadmap for the safe integration of drones into all classes of airspace" endorsed by the Administrative Board of the SESAR JU in March 2018, the SESAR JU initiated in 2018 an update campaign of the European ATM Master Plan. This campaign is expected to result in the delivery of a major update proposal in 2019 to reflect the joint industry declaration "towards a digital European sky" of November 2017. The draft Master Plan has been handed over to the SESAR JU Administrative Board for its consideration.

The preparatory activities conducted in 2018 included a general review of the state of implementation of the SESAR project (both in terms of development and deployment activities) which was also a requirement from the European Court of Auditors (in its Performance audit of the SES). This analysis concluded that SESAR 1 and SESAR 2020 taken together are expected to deliver the solutions framed in the Master Plan 2015 but that further research and innovation will be needed to respond to emerging challenges related in particular to drones and more generally higher levels of autonomy in the skies.

Taken together, the solutions framed in the ATM Master Plan fall into three categories:

1. **Delivered**²⁴: Solutions successfully rolled out from R&D with demonstrated benefits and transferred to deployment. These mainly cover phases A and B of the vision for the time being;
2. **In development**²⁵: Solutions that are currently under development within the SESAR Programme and are expected to reach readiness for industrialisation within the lifetime of the current SESAR 2020 Programme. These will cover the remaining elements of phase B and allow delivering the ATM Master Plan Vision up to phase C. These solutions will be transferred to deployment phase once maturity is reached;
3. **Estimated future R&D**²⁶: Solutions that are needed to achieve the digital European sky (phase D) and that are currently being further explored.

²⁴ Source: third edition of the SESAR Solution Catalogue (2019)

²⁵ Source: SESAR JU Single Programming Document 2019-2021

²⁶ Based on research needs identified in section 4.3 "Delivering the digital European sky (phase D)"

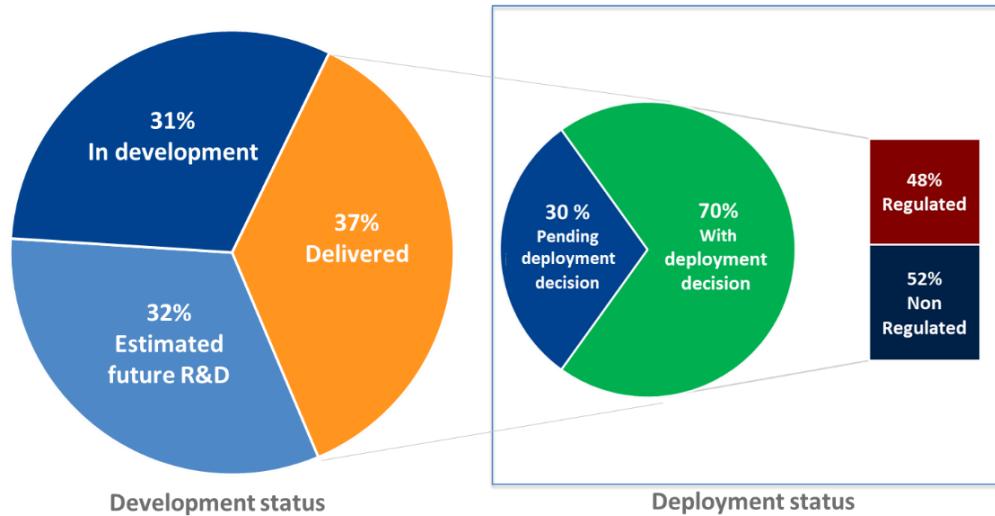


Figure 10: State of implementation of SESAR Solutions

The deployment status²⁷ of delivered SESAR Solutions is to be interpreted as follows:

- The adoption of an implementation objective in the Master Plan level 3 yearly plan implies that a deployment decision has been taken.
- In the absence of an implementation objective in the Master Plan level 3, it is assumed that no deployment decision has been taken yet and, therefore, the deployment of the associated solution is described as “pending deployment decision.”

Finally, for the subset of SESAR Solutions for which a deployment decision has been taken, the figure also presents the share of the ones that are regulated (through the pilot common project) against the ones that are non regulated.

For solutions that have been delivered or are in development, there is a strong emphasis on de-risking related standardisation activities. For this reason, this update campaign closely associated the main actors engaged through the European ATM Standards Coordination Group (EASC). This group is a joint coordination and advisory group with the European Commission, EASA, EUROCAE, CEN/CENELEC, ETSI, the SESAR JU and EUROCONTROL as members. It ensures a coherent approach to standardisation of new SESAR solutions stemming from the European ATM Master Plan.

2.1.4 Contributions from the transversal steering projects

Three projects delivered results related to the transversal steering of the SESAR 2020 Programme: PJ.19 ‘Content Integration’, PJ.20 ‘Master Plan Maintenance’ and PJ.22 ‘Validation, Verification and Demonstration infrastructure’. The following paragraphs outline their achievements in 2018.

PJ.19 CI ‘Content Integration’: the objective of the project PJ.19 is to support on a continuous basis all SESAR 2020 IR projects as well as the SESAR JU itself in activities related to governance, decision-making, and this by integrating content and ensure coherency in the domains of SESAR Functional, Information and Services Architecture. This is done to ensure alignment with the expectations as outlined in the European ATM Master Plan with regards to performance and transition to deployment; and to ensure alignment of SESAR with other SES-related dependent activities and related research,

²⁷ Source: Draft Master Plan Level 3 edition 2019

including Cyber Security, RPAS, and Air Vehicle System developments in Clean Sky. In 2018, PJ.19 supported the content integration needs by interacting with solution projects, by running on a repeated basis the content meta information change process, by providing and maintaining the ATM architectural framework as well as the SESAR performance framework, by supporting project PJ.20 in updating the Master Plan, and by supporting the SESAR JU in preparing the candidate Solution maturity gates. In addition, there were some additional and domain-specific activities by:

- WP 19.2: developed and delivered a high level and up-to-date concept of operations as well as a validation strategy for the overall Programme;
- WP 19.3: supported the SESAR JU in rolling out a newly developed cyber security methodology;
- WP 19.4: provided dedicated training and coaching to solution projects related to several transversal methodologies like safety, security, CBA development, etc. and delivered reports related to ATM solution (forecasted and captured) performance results and maturity;
- WP 19.5: provided dedicated training and coaching to solution project related to architectural monitoring; reported and monitored the architectural maturity of those solutions.

In addition to the main deliverables such as the updated Concept of Operations and the cyber security methodology, PJ.19 has captured the first performance results stemming from the first V1 validations activities of some candidate SESAR Solutions. As examples, the pictures hereafter show a first estimate of the contribution of the candidate SESAR Solutions of Wave 1 (beyond the ones expected to be in V3 maturity at the end of Wave 1) to some Key Performance Areas:

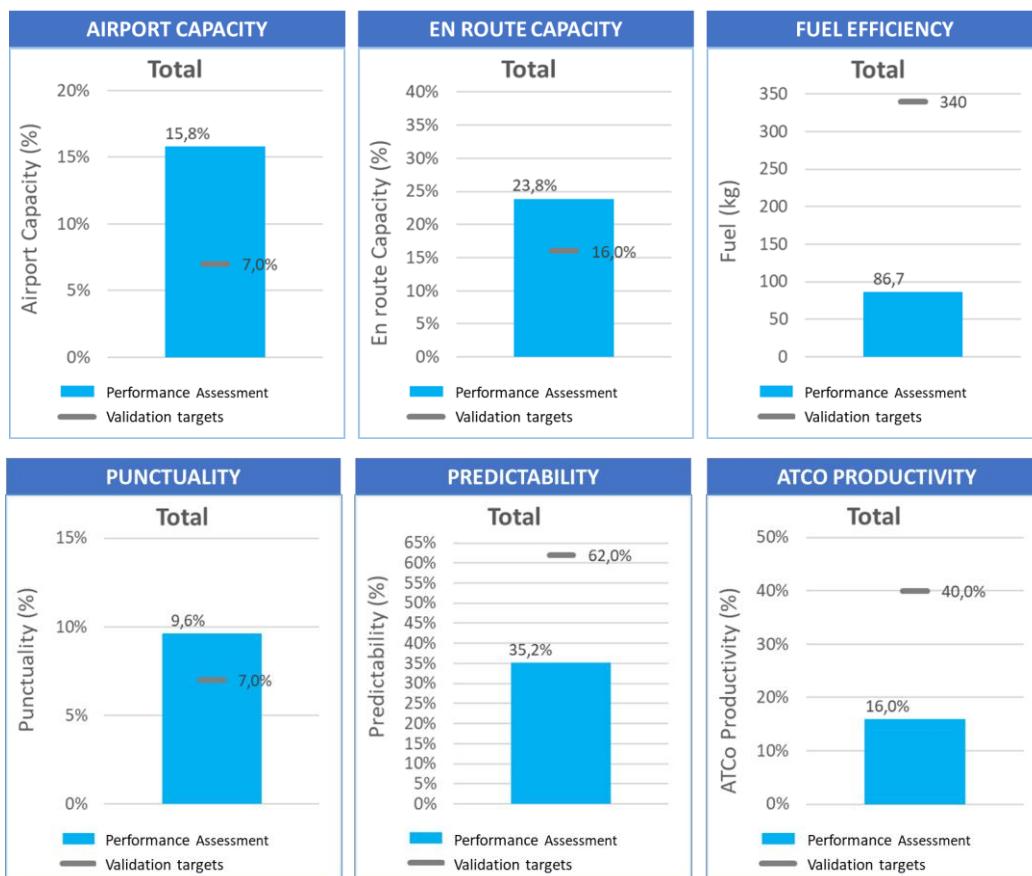


Figure 11: Contribution of Wave 1 candidate SESAR Solutions to Key Performance Areas (first estimate)

The validation targets have been allocated to the SESAR Solutions that expect to address the related KPAs. In some cases, the current estimation of the achieved performance show results above the expectations (validation targets) while for other KPA such as the Fuel efficiency, ATCO productivity or predictability the current estimation remains below the target.

Such results might be explained by the nature of the Wave 1 Solutions which is more technology (enabler) driven. The currently planned W2 SESAR Solutions (as defined in the W2 call material) are more operational activities driven and therefore should better address the KPAs not reaching yet the targets.

These estimated performance contributions will be refined on a yearly basis according to the more quantitative values that will be delivered as output from the validation activities.

PJ.20 AMPLE ‘Master Plan Maintenance’: the overall objective of the project PJ.20 is to support the SESAR JU in its Master Planning activities. Essentially, it consists in maintaining, updating and publishing as and when necessary the ATM Master Plan, for its three levels (Executive, Planning and Implementation views). In 2018, a key task was also to manage the Master Plan update campaign through a transparent and collaborative process involving all stakeholder categories and the key institutions of European ATM (European Commission, EUROCONTROL, the European Aviation Safety Agency - EASA, the Network Manager - NM, the SESAR Deployment Manager - SDM, the European Defence Agency - EDA, and EUROCAE).

PJ.20 is composed of a consortium of 21 active partners, thus ensuring a wide and genuine collaborative process. It is split in three Work Packages: WP1 deals with the overall management of the project; WP3 deals with the Ethics requirements; WP2, the Master Plan maintenance package, is the core part of PJ.20 work and, in 2018, was split into eight Sub-Work Packages.

In 2018, work of PJ.20 was ongoing, mainly supporting the Master Plan update campaign started in December 2017 and continuing over the first half of 2019, and contributing to the finalisation and delivery in February 2018 of a proposal on the content of a second common project. Work can be summarised as follows:

- WP2.1: Built the MP Level 2 data in the form of Data Sets in close cooperation with SESAR projects (specifically PJ.19), connecting to, synchronising with, and supporting the Master Plan update campaign. Maintained the public Master Plan Portal, providing a drill-down from electronic Level 1 contents to Level 2 and Level 3 data/information.
- WP2.2: Ensured inclusion of performance ambitions and future Operational Environments' (OEs) capability requirements definition in SESAR2020 Performance Framework (developed by PJ.19). Supported the definition of the performance ambitions in the Master Plan update campaign. Defined OEs capability requirements at ATM MP Level 2 to support PJ.19 Performance Assessment assumptions and guided WP2.4 on Deployment Scenarios development for the Master Plan update.
- WP2.3: Identified from the SESAR projects the standardisation and regulatory needs and, on this basis and in collaboration with EUROCAE and EASA, developed the standardisation and regulatory roadmaps for the Master Plan update. WP2.3 also ensured consistency and connection with EASA's EPAS (European Plan for Aviation Safety).
- WP2.4: As part of the Master Plan update campaign, provided Deployment Scenarios for SESAR (SESAR 1) Solutions expected to reach V3 maturity one year after Wave 1 closure, including Business Case (BC) and Impact Assessment (IA).
- WP2.5: Delivered as planned by end June 2018 the Master Plan Level 3 Implementation Plan 2018 and the Level 3 Report 2018 (covering the period from January to December 2017). In

addition, contributed (in coordination with the SESAR Deployment Manager) to the drafting of the “State of SESAR implementation” section of the Master Plan Level 1, as part of the Master Plan update campaign. This latter work continues over 2019 to ensure providing up-to-date information at the time of Master Plan approval.

- WP2.6: Within the overall Master Plan update campaign, delivered the business cases for the Essential Operational Changes and the holistic Business View (in collaboration with an external consultant contracted by the SESAR JU). For Level 3 “implementation plan” of the Master Plan, delivered the business cases for the “candidates” for new Implementation Objectives.
- WP2.7: This sub-work package aimed at operating the campaign processes and ensuring the delivery to the SESAR JU of a draft Master Plan Executive View (Level 1), having ensured stakeholders’ and key ATM players’ involvement and buy-in. This was materialised mainly by the setting up of the Master Planning Group and related thematic Key Focus Teams and Completion Teams, working under Master Planning Committee’s guidance.
- WP2.8: In 2018, this sub-work package was active only in January and February to help the SESAR JU finalise its recommendation on the content of a common project.

A WP2.9 had been constituted in 2017 to support the SESAR JU in the preparation of the “*Roadmap for the safe integration of drones into all classes of airspace*”, which was to become a key input to the Master Plan update. However, even though the document was approved by the SESAR JU’s Administrative Board in March 2018, WP2.9 had ceased its activities in December 2017 and the finalisation of the roadmap was carried out by the SESAR JU only.

PJ.22 SEabird ‘Validation, Verification and Demonstration infrastructure’: the project PJ.22 aims to address validation and demonstration engineering aspects related to the solutions under development within SESAR 2020 Programme. The project develops, maintains and provides a system engineering data management framework (SE-DMF) to support the coherent development and delivery of SESAR Solutions. This framework allows implementing, at Programme level, an efficient requirement management approach based on a data-centric, data-driven rather than document-based paradigm. The project is also in charge of the maintenance and evolution of the V&VP, V&VI and Demonstration Platform Development Methodology and the identification of potential strategic validation tools and interoperability solutions to improve the SESAR 2020 validation process.

In 2018, the project PJ.22 work was on-going and can be summarised, per work-package, as follows:

- WP 22.2: developed, verified and deployed the final SE-DMF version for supporting full operations at Programme level regarding requirements management. This version incorporated the recommendations proposed by solution projects during the training activities, the updates of the SESAR templates and solves the interaction with EATMA. The project has organised an intense coaching campaign to increase the level of adoption of SE-DMF at Programme level and support the SESAR JU during the maturity gate processes e.g. traceability matrix between requirements and validation objectives. The project has successfully implemented the platform catalogue in the SE-DMF;
- WP 22.3: further updated the V&VP, V&VI and Demonstration Platform Development Methodology and the training material. The project has started the training activities on the methodology for the solution projects;
- WP 22.4: identified an initial list of potential interoperability solutions and delivered an initial set of technical specifications. The project has actively participated in the standardisation activities of WG 81.

The activities conducted by PJ.22 support the execution of the Release process with a focus on maintaining the traceability of the operational requirements. In particular, PJ.22 produces traceability matrices and coverage analysis as an input to the maturity gate process. Through these reports, the maturity review can address the coverage of the system versus operational requirements and the validation objectives and results against requirements. The aim is to confirm that the candidate SESAR Solutions has correctly addressed the requirements.

2.1.5 Contributions from the SESAR JU governance and advisory bodies in steering the SESAR 2020 Programme

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

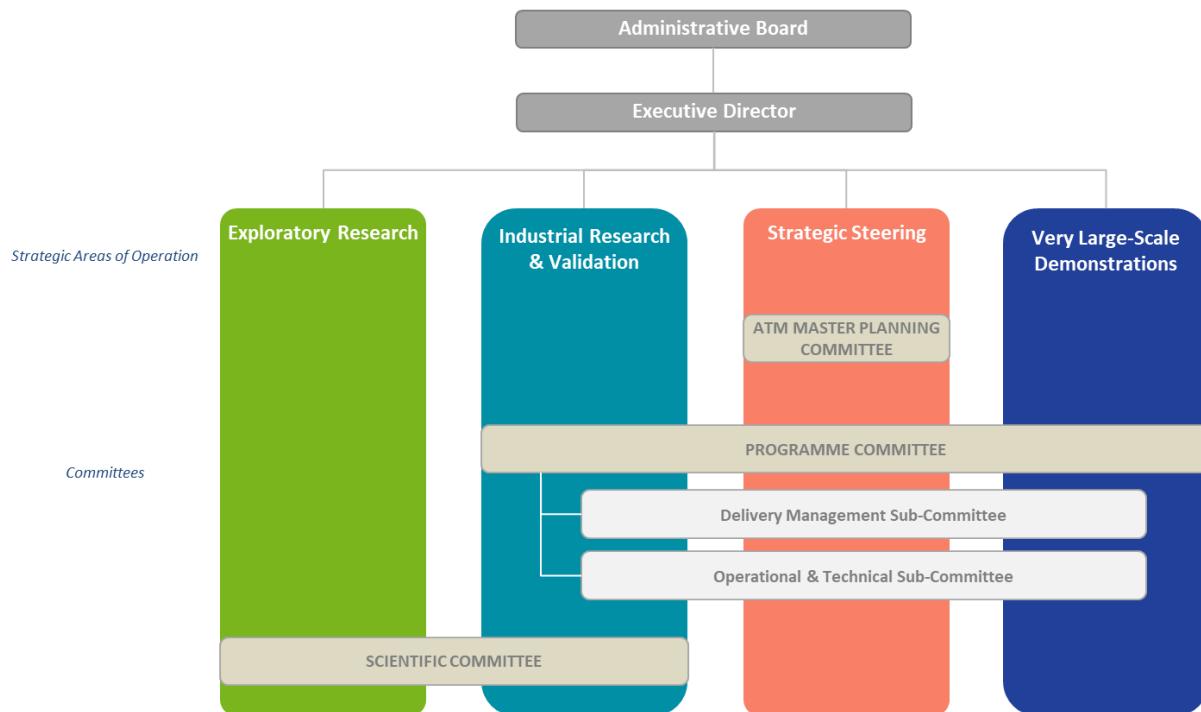


Figure 12: Governance of the SESAR 2020 Programme

The following paragraphs summarise the contribution of the Administrative Board (SESAR JU governance) and of the advisory bodies (Scientific Committee, Programme Committee, ATM Master Planning Committee) to the SESAR JU activities in 2018.

2.1.5.1 Activities of the Administrative Board in 2018

Activities of the Administrative Board in 2018 are addressed in Part IIa. Section 3.1.

2.1.5.2 Contributions from the Scientific Committee in 2018

The most important achievements and conclusions of the Scientific Committee for the year 2018 are summarised hereafter.

The Scientific Committee provides scientific advice and recommendations to the SESAR Joint Undertaking in looking beyond SESAR's current horizon and formulating the vision for future ATM research. It has a particular focus on exploratory research, long-term planning activities and on the transfer of knowledge and outcomes to industrial research activities. As such, the Scientific Committee is an important platform to ensure that the SESAR research programme and results are technically and

scientifically sound. For this purpose, while providing oversight of the SESAR research programme's scientific and technical relevant, the Scientific Committee has also organised itself in Task Forces focusing on certain activities or topics.

Regarding the *Scientific Research Agenda*, the Task Force defined a process for identifying potential gaps in research and education in ATM. This process allows a matching exercise and gap identification between the Strategic Research and Innovation Agenda (SRIA) challenges (at large) and research and education activities at the Programme level (e.g. in SESAR ER calls or the SESAR Academy). It was further developed and adopted for SRIA Challenge 5 ("Prioritizing research, testing capabilities and education"). The SRIA is also an instrument for integrating the view of different stakeholders in research and education, ranging from industry through the main European advisory bodies to the representatives of research.

Regarding the *Innovation Pipeline*, the Task Force focused on the other end of the innovation pipeline – the gap between the development (SESAR JU) and market uptake by individual stakeholders), and formulated the recommendations based on the findings. The plan for the next year is to continue the work on smoothing the flow in the innovation pipeline and the speed of transition to implementation. The Task Force noted the positive developments regarding some of the last year's recommendations on "feeding the pipeline" as they were taken on board, either directly (inclusion in PJ.19.04 work) or indirectly, through the inclusion of the results from 11 ER projects into the IR Wave 2 call.

Regarding *Performance Measurement*, the Task Force continues to identify ways to improve performance measurement in ATM, especially regarding missing indicator development for the future system, coordinating with IR activities such as PJ.19.04 and with ATM Master Plan stakeholders, through the production of detailed recommendation papers, plus participation in and coordination of stakeholder workshops addressing both short- and longer-term assessment needs.

Regarding *Automation*, the Task Force focused on the projection of current trends into the long term (2035+). Three main axes of discussion (technical, users/organisations, and society) have been identified and preliminary alternative long-term automation targets/scenarios, analysed. In addition, the Task Force led a critical analysis of the new proposal of the Levels of Automation introduced by the SESAR JU staff and specifically of the document "Automation levels of ATC Systems: SESAR Model and Roadmap". The recommendations from the Scientific Committee were subsequently used to update the automation roadmap used for the Master Plan update.

Regarding *Complex System*, the Task Force assessed that in literature the topics Emergent behaviour and Resilience involve a wide scope of ATM relevant research. Therefore, the recommendation is to perform an in depth analysis/audit of the simulation means and procedures used by the SESAR Programme to "validate" its developments regarding the way they are using methodologies to identify emergent behaviour and to incorporate resilience aspects. Subsequently additional specific research actions may be recommended related to the analysis of this kind of techniques to help design/optimize/assess complete ATM systems, capable to deal with different alternative ConOps, automation levels, airspace and operations designs.

Overall, during the second year of its mandate, the Scientific Committee has built on the experience achieved and the activities carried out during the first year, according to the work breakdown and tasks performed by the different Task Forces.

It has also to be noted that, on top of the work performed by the several Task Forces, the Scientific Committee carried out a number of transversal activities. In the first semester, the members actively contributed to support the SESAR JU in the identification, review and refinement of the list of topics for the upcoming ER4 call for proposals to be launched in 2019, together with a set of best practices, lessons learned and recommendations for future Exploratory Research calls for proposals (see also

paragraph 2.2.4 related to the preparation activities of the ER4 call). This set focused mainly on how to achieve a more effective and streamlined exploratory research life cycle and on the provision of a longer communication, dissemination and exploitation phase for which more time and effort have been recommended. Also in 2018, as in the previous year, the Committee supported activities related to the SESAR Programme, such as the evaluation of the applications for the Young Scientist Award, the evaluation of the papers for the annual SESAR Innovation Days event that took place in Salzburg, Austria in December, and the review of some key SESAR documents like the Master Plan, the Automation Model and the Performance Framework.

The constant engagement with the SESAR JU communication media (e-news, LinkedIn, Twitter) and the attendance to the Scientific Committee meetings of external observers have contributed to boost the visibility of the Scientific Committee to all levels inside and outside the organisation and created a higher awareness of its scope and ongoing work.

The active contribution of the members of the Scientific Committee to the organisation of thematic workshops and fora falling within the SESAR JU initiatives has also contributed to keep the Scientific Committee work under the spotlight of the SESAR JU communication media. One example is represented by the attendance of two members of the Scientific Committee and the PC external observer to the “Women in aviation research” panel organised in the framework of the SESAR Innovation Days in December 2018.

2.1.5.3 Contributions from the Programme Committee in 2018

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

Five meetings were held in 2018 with the aim of addressing the following key topics:

- As specified in the Multi Annual Work Programme (MAWP), the end of the Wave 1 projects is scheduled by the end of 2019. In order to complete SESAR 2020 Programme research and innovation objectives, the SESAR JU planned to launch in early 2019 a Wave 2 call restricted to the SESAR JU Members other than the Union covering industrial research activities and very large scale demonstrations. To prepare the Wave 2 call, SESAR JU had to define a clear and coordinated procedure enabling consultation process with the Programme Committee. In compliance with that process defined in the SPD 2018-2020, discussions were launched with the Programme Committee with the aim of identifying key solutions that would be changing and improving the ATM in a disruptive way for the next coming 10 years. Based on a first list of innovative solutions included in the draft SPD 2019-2021, the consultation of the Programme Committee did allow identifying a shorter list of Wave 2 SESAR Solutions. This list was baselined at the dedicated Programme Committee session held on 13 July. As defined in the consultation process (documented in the SPD 2018-2020 section III paragraph 2.1.2), that date was identified as the cut-off date meaning the close out of the consultation phase. Subsequently, the SESAR JU started the “SESAR JU Finalisation of call material” phase that was conducted in total isolation with the aim to consolidate the technical specifications into the call material for further publication. The final Wave 2 call conditions were documented in the Single Programming Document 2019-2021 (adopted by the Administrative Board in its 45th meeting on 12 December 2018) and served for the financing decision authorising the launch of the call for proposals and the use of the dedicated budget. The Wave 2 call was formally published in the H2020 Funding and Tenders Portal on 10 January 2019.

- The specific budget amendment process defined in the SESAR JU's Annual Work Programme for 2016 was launched in early January. In a first phase, this process required a preparation of the amendment to be done based on SESAR JU Members' reports on their achievements and justifying the need for additional budget for covering the following projects activities. These reports were reviewed by the SESAR JU in a collaborative way with the different projects building on the formal H2020 Project Review process. The outcomes of the review together with the projects proposed amendments were shared with the Programme Committee early September for approval. As a follow up, the Programme Committee agreed to launch the formal budget amendment. This formal process was completed in early December.
- The SESAR 2020 Programme delivery approach is based on the Release process that identifies on a yearly basis the Solutions that will be delivered at a specific maturity level together with the planned demonstration activities from the VLDs. The Programme Committee supported the SESAR JU in the context of three Releases. The Release 7 (in execution in 2017 until April 2018) delivered its outcomes that were shared with the Programme Committee through the Release 7 report (more information on the Release 7 outcomes can be found below in paragraph 2.3.2.1). The Release 8 Plan was defined in December 2017 based on the validation activities information extracted from the projects schedules. The Programme Committee approved the Release 8 Plan in its 06 March 2018 session, launching it into execution until April 2019. Similarly, the Release 9 was defined at the end of 2018 with the approval of the Programme Committee at its session on 9 December 2018. The Release 9 will be the final Release of the Wave 1.
- Considering that the IOP solution (Interoperability between ATM Ground Systems) is critical to enable the European aviation infrastructure to evolve towards higher level of interoperability and automation, the Programme Committee closely monitored the progress made in its development. Further information on the IOP solution can be found in the paragraph on IR project PJ.18 4DTM '4D Trajectory Management' (paragraph 2.3.1.1 below). In particular, PC members together with Commission DG MOVE representatives were invited to an IOP showcase event, which took place on 26 April 2018. The showcase demonstrated concrete benefits of exchanging flight profile data between the two IOP families (i.e. Coflight and iTEC) - three interconnected platforms located in Toulouse, Langen and Rome. In addition, the IOP decision team (made of PC members contributing to the IOP development) discussed and agreed on the criteria to be applied at the Go/No-go meeting scheduled in May 2019. That Go/No-go meeting was identified as part of the mitigation action for monitoring the IOP development. The aim will be to consider the outcomes of the IOP validation exercise 01 (scheduled in April 2019) in the light of the criteria in order to decide about the continuation of the IOP development.

2.1.5.4 Contributions from the ATM Master Planning Committee in 2018

The Master Planning Committee (MPC) was created as a governance body within the SESAR 2020 set-up, to "provide expert advice and recommendations to the SESAR JU Executive Director on the maintenance, execution and update of the European ATM Master Plan and will contribute to maintaining a strong connection between the SESAR development and deployment activities".

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

Three face-to-face meetings were held in 2018 (20 March, 30 May and 19 June), plus two web conferences (13 February and 28 November), with the aim of addressing the following key topics (also addressed in paragraphs 2.1.1, 2.1.2 and 2.1.3 above):

- Finalisation by the SESAR JU recommendation of the content of a Common Project: a number of decisions had to be taken on the scope, content and cost-benefit analysis of the document referred to as “CP2 proposal” to secure robustness of the proposal and maintain stakeholders’ buy-in.
- Airspace Architecture Study: the MPC was involved in the scoping of work, the finalisation of its findings, and ensured that a close connection is maintained between the Master Plan and the Airspace Architecture Study, so that both streams of work reinforce each other and the results are visibly and fully coordinated.
- Master Plan update campaign: steering and monitoring the evolution of the Master Plan update campaign was central to the MPC activities in 2018 in its three face to face meetings, and triggered the need for a dedicated web conference meeting on 28 November 2018. The steering of the MPC consisted mainly in:
 - Requesting an ambitious SESAR Vision, building on the needed digital transformation of aviation and incorporating the drones and U-space concepts in the Master Plan document;
 - Securing the performance ambitions at least the level of the 2015 Edition of the Master Plan, taking due account of the fact that the deterioration of the situation of delays at European level required strengthening of the efforts;
 - Stimulating an ambitious approach where the “Essential Operational Changes”(EOCs) of the Master Plan now are the main conceptual game-changers required to deliver the SESAR Vision;
 - Ensuring a strong connection with EASA’s European Plan for Aviation Safety
 - Providing a critical path for the rationalisation of infrastructure and the rollout of SESAR technology, synchronised with the key milestones of the Airspace Architecture Study and the avionics roadmap.

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

The SESAR JU met all its objectives related to Exploratory Research in 2018. This includes the following achievements and results:

- *Call reference H2020-SESAR-2015-1 (ER1 Call) projects execution - delivery of results: all 28 ER1 projects delivered their final results and grants were closed in 2018*
- *Call reference H2020-SESAR-2016-1 (ER2 – RPAS Call) projects execution - delivery of results: the nine ER2 RPAS projects were in execution and delivered their results according to plan*
- *Call reference H2020-SESAR-2016-2 (ER 3 Call) projects execution - delivery of initial results: the eight ER3 projects started their execution and delivered their first results*
- *Call reference H2020-SESAR-2019-2 (ER 4 Call) - preparation of content and call material: call conditions were approved in the SPD and the call material, including technical specifications, were ready at 80% in line with plan, including the consultation process documented in the SPD 2018-2020*
- *Ensure effective and efficient governance meetings related to Exploratory Research: three meetings took place with the Scientific Committee*

The SESAR JU delivers Exploratory Research results (both fundamental research and ATM Application-oriented research) through 45 projects resulting from the following calls for proposals under the H2020 framework:

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

In addition, Exploratory Research encompasses other activities: the SESAR innovation Days, the participation to relevant research events or fora and mechanisms set up by the Knowledge Transfer Network (e.g. PhDs), on top of workshops and open days from the individual ER projects.

The following paragraphs outline the status and delivery of these 45 projects in 2018.

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

The first open Exploratory Research call, H2020-SESAR-2015-1²⁸, was closed on 25 June 2015²⁹. The procedure resulted in the award of 28 projects with a total value of EUR 20,4 million, under two work areas: **Work Area 1 – ATM Excellent Science & Outreach research** (15 projects) and **Work Area 2** (13 projects) – **ATM application-oriented research** (the latter covering the 4 Key Features of the ATM Master Plan). The main outcome of these projects is summarised in the paragraphs below. In 2018, 144 deliverables were received from these 28 projects, then assessed and approved by the SESAR JU. While the ‘SAPIENT’ project was closed in 2017 (final payment executed in early 2018), 25 ER1 projects have been closed and paid in the course of 2018. The remaining two ER1 projects (COCTA and SALSA)

²⁸ Call documentation is available on the [Funding and Tenders Portal](#)

²⁹ Call provisions are summarised in the SESAR JU’s Annual Activity Report for 2015: [SESAR JU Annual Activity Report for 2015](#)

have concluded their activities in 2018 and the approval of their final technical and financial reports is under finalisation in the beginning of 2019.

Communication, dissemination and exploitation were also key enablers for success. Experience from ER1 shows that not all projects managed, in the given 24-month timeframe, to achieve a successful and effective level of dissemination of their results. This aspect was also addressed by the Scientific Committee in a set of recommendations, which the SESAR JU took on board for the upcoming ER4 call for proposals (see above in paragraph 2.1.5.2).

As said above, the ER1 projects achieved different levels of results. It is important to recall that, especially for the Fundamental Research, (partial) failure is an acceptable option. An important aspect of research is not to just feed the main Programme, but to improve the understanding of new technological threats and opportunities. If a particular innovation effort does not succeed, the use of appropriate scientific and engineering methods helps anyway to gain important insights from that failure.

The early involvement of stakeholders and end-users was a key determinant of success. It helped to ensure buy-in and to guide basic researcher to answer real problems rather than issues that projects believe to be of significance in operational contexts. It can be very hard to feed the products of research into the main Programme once these projects are over, if buy-in is not sought early on.

The following paragraphs summarise the achievements of the ER1 projects under **ATM Excellent Science and Outreach** in 2018.

The **AUTOPACE** (Facilitating the Automation Pace) project completed its work in Q1 2018. The project performed fundamental research on psychological modelling to predict how future automation would impact on Air Traffic Controller (ATCo) performance and to identify competences and the training needs to cope with the effects of automation on humans. It performed analytical studies to estimate cognitive demanded resources in a 2050 environment based on the multiple resource theory. Psychologists, ATM Experts, Controllers and Training experts set the hypothesis to build a Psychological Model of the ATCo cognitive resources based on the attentional theories. Finally, the project looked at the future use of this Psychological Model to support the identification of future competences and training strategies.

The **TACO** (Take Control) project completed its work in Q3 2018. TACO delivered a framework for designing, developing, verifying and implementing in the future the required automated tools for the Tower Controllers by involving the end-users from the beginning (end-users programming of airport surface movements management). The delivered framework gives the Tower Controller the possibility of instructing automation with the rules, procedures and working methods that actually support his everyday work. This was achieved by means of an interactive platform enabling the definition of rules, procedures and working methods related to the management of surface movements in complex airports. The proposed approach gives to the Tower Controllers the opportunity to program and test automation based on their operational needs and using a simple visual language.

The **AGENT** (Adaptive Self-Governed Aerial Ecosystem by Negotiated Traffic) project completed its work in Q1 2018. AGENT focused on enhancing the overall performance of the air transport system, mainly targeting the separation management layer of air traffic and its connections with Trajectory Management and Collision Avoidance. AGENT researched and developed a framework, proposing trajectory manoeuvres that take into account interdependencies between human behaviour,

automation and aircraft performance. The framework provides air traffic controllers and pilots with the means to deal with situations of conflict between planes by allowing them to choose the best solution when changing trajectories according to specific characteristics of each conflict.

The **STRESS** (Human Performance Neuro-metrics Toolbox for Highly Automated Systems Design) project completed its work in Q3 2018. STRESS examined the Human Performance issues, benefits and impacts of the shift towards increased automation. This refers to a new generation of air traffic control systems, expected to (partially) autonomously manage decision-making and implementation tasks, currently carried out by air traffic controllers. The latter will still be responsible for running the system safely, but their role would be shifted from that of an active controller to one more like that of a monitor.

The **MINIMA** (Mitigating Negative Impacts of Monitoring High Level of Automation) project completed its work in Q2 2018. MINIMA focused on improving the comprehension of the Out-of-the-loop (OOTL) performance problem in the context of future Air Traffic Management scenarios. MINIMA also addressed the detection of the negative impact of OOTL and the way for mitigating it. The MINIMA project developed a vigilance and attention controller (VAC) tool using electroencephalography, which can measure in real-time controller vigilance and triggers adaptive automation functionalities when vigilance is warning. The tool was tested by fifteen controllers. The VAC proved to successfully identify episodes of decreasing controller vigilance, and re-increase it through its adaptive automation system. The tool helped to introduce a level of interaction between the controllers and the system, making tasks more stimulating for the controllers.

The **BIGData4ATM** project completed its work in Q2 2018. BIGData4ATM focused on better considering the impact of the travellers' behaviour on the ATM operations. To do so, the project did capture behavioural data such as Twitter data (to reconstruct international passenger flows at a more aggregated level), mobile phone records, (to reconstruct in a more detailed manner the airport access/egress legs in those countries where mobile phone data were available). These data were 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. BIGData4ATM project delivered methodologies and application results to some case studies such as Passenger-centric door-to-door travel times (Results from this case study show that reliable estimations of airport catchment areas and travel times can be obtained) or Airports influence areas (Show the importance of access/egress in the competition between high speed rail and air transport).

The **DART** (Data Driven Aircraft Trajectory Prediction Research) project completed its work in Q3 2018. DART explored the potential of machine learning methods using historical data to increase the predictability for individual trajectories, and multi-agent collaborative reinforcement learning methods to resolve Demand-Capacity Balancing (DCB) problems, supporting the incorporation of stakeholders' preferences into the planning process. Results suggest that data-driven methods, compared to model-based approaches, can enhance trajectory prediction capabilities by exploiting patterns derived from historical data.

The **MALORCA** (Machine learning of speech recognition models for controller assistance) project completed its work in Q2 2018. Significant progress was made in recent years in artificial intelligence (AI) and in particular in machine learning applications like automatic speech recognition (ASR). MALORCA developed Assistance Based Speech Recognition (ABSR) systems for ATC, to facilitate the transition from laboratory to the real world. The performance of the trained ABSR system delivered by the project was successfully evaluated on proof-of-concept trials by nine controllers in Vienna and Prague in January 2018. MALORCA proved for Prague and Vienna approach area centers that unsupervised learning is able to significantly improve command recognition rate and that automatic learning from radar data and voice recordings can reduce costs of data, speed up development and reduce manual adaptation effort.

The **BEST** (Achieving the benefits of SWIM by making smart use of semantic technologies) project completed its work in Q3 2018. BEST project focused on determining how semantic technologies could be used effectively to maximise the benefits of adopting SWIM. Based on several use cases, the project produced guidelines about how to use ontologies in flexible ways to describe meta-data, and how these can be used in innovative yet scalable ways. The project also demonstrated how the ATM information reference model (AIRM) and various data exchange models can be transformed into web ontology language (OWL) representations, allowing these models to be processed by semantic technologies. The project produced tools to automate the transformation process, as well as compliance validation tools to automate consistency checking between different models.

The **TBO-MET** (Meteorological Uncertainty Management for Trajectory-Based Operations) project completed its work in Q3 2018. A better understanding of the factors that lead to uncertainty in air traffic is key when planning, executing, monitoring and synchronising trajectories between ground systems and aircraft. To this end, the TBO-Met project focused on three research topics: trajectory planning, storm avoidance, and sector demand analysis, considering meteorological forecast uncertainties. To address mid-term trajectory planning, the project developed a stochastic optimisation approach to plan the most efficient trajectories with low levels of uncertainty. The methodology is capable of trading-off predictability and cost efficiency (flight time or fuel consumption). To address storm avoidance, the project developed a probabilistic trajectory predictor, which proactively proposes possible deviations in order to avoid stormy conditions. As for addressing sector demand, the project defined a methodology to provide a probabilistic sector demand based on the uncertainty of the individual trajectories. The approach is able to quantify the impact of improved trajectory planning considering weather forecast uncertainty on sector demand.

The **ATM4E** (Air Traffic Management for Environment) project completed its work in Q3 2018. The ATM4E project developed a methodology to expand climate optimisation of aircraft trajectories (CO₂ and non-CO₂ emissions), by introducing air quality and noise impact as additional criteria or dimensions. The project also developed algorithms to determine environmental impacts based on meteorological information available through the system-wide information management (SWIM). Results showed that depending on the prevailing weather situation, high resolution environmental information provided as part of the MET service could enable the optimisation of aircraft trajectories with the potential to reduce the climate impact by around 20% for specific routes.

The **PNOWWA** (Probabilistic Nowcasting of Winter Weather for Airports) project completed its work in Q3 2018. It extrapolated weather movements based on radar echoes and predictability of changes

in snowfall intensity caused by underlying terrain (such as mountains and seas) and developed a method for probabilistic 0-3h forecasts (nowcasts) of snowfall and freezing rain at airport, in steps of 15 minutes . Within these nowcasts the projects provided information on the probability of a wide range of events, such as runways freezing over or decreased visibility. The project demonstrated its model in Austria and Finland, allowing to gather airport feedback on the applicability of the model and its scalability to other airports. These results enable the quantification of the uncertainties related to delays in ground operations due to winter weather situations.

The **COCTA** (Coordinated Capacity Ordering and Trajectory Pricing for Better Performing ATM) project completed its work in Q4 2018, following a 5-month extension. The COCTA project developed a conceptual framework to improve efficiency of air navigation service provision in Europe by a better coordination of capacity and demand management. On the capacity side, the Network Manager orders capacities from Air Navigation Service Providers at several instances, i.e. at long-term, medium and short term to adjust orders to meet air traffic demand in the cost-efficient manner. On the demand side, the Network Manager defines different trajectory products to meet Airspace Users' needs, but also to improve overall network performance. Results from a large-scale case study on a European level (Central and Western European airspace, with more than 11,000 flights) indicated that the COCTA concept would improve overall cost-efficiency, when compared to a baseline (which resembles the current system to the extent possible).

The **VISTA** (Market Forces Trade-offs Impacting European ATM Performance) project completed its work in Q3 2018. The Vista project examined the effects of market forces (e.g. fuel prices, economic development), technologies and regulatory factors on European performance in ATM, through the evaluation of stakeholder and environmental indicators. The delivered model is holistic since it covers the three phases of ATM (strategic, pre-tactical and tactical). It captures a typical, busy day of operations. The model is able to estimate the impact of the above-mentioned factors on these different ATM phases independently and/or as a coupled system, providing an assessment of how indicators change in different scenarios and phases.

The **COMPAIR** (Competition for Air Traffic Management) project completed its work in Q1 2018. The project looked at a number of options that could increase competition, including performance regulation with variations in ownership and governance models, tender of licenses for en-route air traffic services, and flight centric, sector-less operations. The project also analysed the effects of unbundling the terminal control in Sweden, UK, Spain and Germany (at mostly regional airports). Furthermore, the project developed a game theoretic modelling approach to analyse the ATM market existing in 2014 and ask what-if questions as to how the market may change were an auctioning system to be introduced. The models applied suggest that introducing competition in the market via outsourcing service provision may lead to a reduction in charges by up to half the current levels.

Under **ATM application-oriented research**, the nine ER1 projects' main delivery in 2018 included:



High-performing airport operations

The **MOTO** (the embodied reMOte Tower) project, completed its work in Q2 2018. The MOTO project identified an initial concept for multimodal multiple remote tower operations. The project also developed a virtual reality multimodal tower simulation platform and an augmented multimodal remote tower prototype. Both could support further exploratory research activities. The project also developed neuro-physiological classifiers to monitor human performance in (remote) tower operations. Finally, MOTO project identified key multimodal stimuli in the current control tower operations and defined user requirements for a multimodal remote tower, to reconstruct multimodal perception in a remote tower simulation platform and enhance the air traffic controllers' sense of presence

The **RETINA** (Resilient Synthetic Vision for Advanced Control Tower Air Navigation) project, completed its work in Q1 2018. The RETINA project proved that introducing synthetic vision and virtual / augmented reality (V/AR) in the ATC tower can bring benefits to airport ATM in terms of safety (i.e. increase in ATCO's head-up time and situational awareness mainly) and resilience (i.e. limiting or even cancelling the impact of low visibility conditions on airport capacity by providing equivalent level of information and situational awareness to the ATO to nominal conditions). RETINA developed a set of V/AR goggles through which the controllers can see synthetic information overlaid on the actual "out-of-the-window" view. With these goggles, the controller can have a heads-up view of the airport traffic, call sign and aircraft type, supplemented by additional information, such as wind velocity and direction, airport layout and runway status, even during low-visibility conditions.



Advanced air traffic services

The **SALSA** (Satellite-based ADS-B for lower separation minima application) project completed its work in Q1 2018. The SALSA project evaluated the performance and value of Space ADS-B in the context of enhanced surveillance and revision to separation standards in the non-radar airspace. By bringing Space based ADS-B along with other sources of surveillance based on ground, air and oceanic relays, SALSA conceived a system-of systems approach for enhanced and continuous surveillance, particularly in the non-radar airspace, thereby enabling revisions to the separation standards, benefits to the prevailing procedural separation operations and the considerations for nurturing the concept for operational realization. Through theoretical analysis/models, SALSA validated the revised separation standard and airspace capacity for the non-radar airspace and at high-level, the operational impacts and benefits.

The **R-WAKE** (Wake vortex simulation and analysis to enhance en-route separation management in Europe) project completed its work in Q1 2018. R-WAKE addressed the risk and safety study of the wake vortex encounter (WVE) hazards in en-route airspace, and the identification of potential enhancements to the current separation schemes, aiming to enable traffic and trajectory management improvements. The project mainly delivered an ATM traffic simulator that includes high-fidelity WVE dynamic risk models; a WVE hazard severity baseline defined as a matrix of upset parameters

thresholds per severity; and a proposed concept, which consists of six new separation schemes designed to increase safety against WVE hazards and airspace capacity.

The **OptiFrame** (An optimisation framework for trajectory based operations) project completed its work in Q2 2018. The OptiFrame project developed an optimisation framework for trajectory based operations (TBO), which assigns 4D trajectories to flights based on stakeholders' preferences and priorities. These preferences were modelled by means of a multi-objective optimisation mathematical model that provides the capability of identifying the trade-offs between flight departure delays, flight efficiency, and flight route charges. In addition to visualising the listed trade-offs, the proposed approach offers the capability to analyse solutions at a microscopic level. Indeed, the project also looked in detail at alternative solutions, such as attributing values to the identified key performance indicators (KPI) for each airspace user and/or visualising the 4D trajectory as well as the values of the identified KPIs for each flight.

The **COPTRA** (Improving trajectory prediction through understanding uncertainty) project completed its work in Q2 2018 and focused on developing an efficient methodology to estimate air traffic demand probabilistically by using flight trajectory predictions within a Trajectory Based Operations (TBO) environment. The COPTRA project developed trajectory prediction uncertainties that describes the individual trajectory predictions through stochastic definitions. Probabilistic occupancy counts and their time-based behaviours were obtained through a stochastic queuing network model and a graph model at the network level. The results were used for the identification of critical flights and balancing demand and capacity in a probabilistic way.

The **PARTAKE** (Cooperative departures for competitive ATM network service) project completed its work in Q2 2018. The PARTAKE project has developed a decision support system to prioritise the departure of aircraft, taking into account information from the airport (on taxiways and runways status), as well as from the airspace users on their preferences and the aircraft, including its trajectory. With this data, the system can identify areas of airspace where the demand is higher than capacity. In doing so, action can be taken to delay departures or expand the separation between aircraft in congested traffic areas.



Enabling aviation infrastructure

The **SAPIENT** project was closed in 2017 and did not have any activity in 2018.

The **NAVISAS** (Navigation of airborne vehicle with integrated space and atomic signals) project completed its work in Q1 2018. The NAVISAS project developed a concept for small aircraft to obtain alternative positioning, navigation and timing (A-PNT) information when satellite navigation fails while keeping performance and efficiency consistent with the airspace requirements. NAVISAS investigated the possibility of combining navigation data from multiple constellations (e.g. GALILEO and GPS) with an advanced inertial measurement unit (IMU) based on atomic gyroscopes implemented using microelectromechanical systems (MEMS) technology. The project scope was extended and included

an assessment of vision-based navigation in flight, which was confirmed as a viable option for small aircraft.

Furthermore, under **ATM application-oriented research**, four ER1 projects focused on *Innovative ATM Architecture, Performance & Validation*. Their main delivery is outlined in the following paragraphs.

The **INTUIT** (Interactive toolset for understanding trade-offs in ATM performance) project completed the work in Q2 of 2018. The INTUIT project addressed the need for suitable performance modelling techniques and explored the potential of visual analytics and machine learning to improve our understanding of the trade-offs between KPAs and identify cause-effect relationships between indicators at different scales. Based on a systematic characterisation of available ATM performance datasets and following a consultation process with ATM stakeholders, three use cases were selected to demonstrate the potential of the investigated techniques. In the first case study, airline route choices were analysed and a model was developed to estimate the impact of changes in route charges on the overall ATM performance. The second case study showed how flight inefficiencies within a particular area control centre are correlated with flight properties derived from both the flight plan and the ideal route, such as heading, altitude and airspace crossed. The third case study demonstrated how ATM performance can be measured at a finer spatial and temporal level and investigated the relationship between sector configurations and air traffic flow management (ATFM) regulations.

The **AURORA** (Advanced user-centric efficiency metrics for air traffic performance analytics) project completed its work in Q2 of 2018. The AURORA project explored new efficiency indicators that encapsulate fuel consumption, schedule adherence, route charges and overall cost efficiency of flights. A key difference between these new efficiency indicators and today's indicator is that their calculation requires the generation of user-preferred trajectories, i.e. fuel and cost-optimal trajectories, considering the impact of weather conditions and without the need of confidential information from airlines. AURORA demonstrated that flight inefficiency in terms of costs is not necessarily aligned with inefficiency in terms of horizontal difference, and that the new indicators can better capture these cost-based inefficiencies. The new indicators were validated by a group of airlines in terms of representativeness, transparency and usability.

The **APACHE** (Assessment of performance in current ATM operations and of new concepts of operations for its holistic enhancement) project completed the work in Q2 of 2018. The APACHE project explored the potential of advanced simulation and optimisation tools to improve ATM performance assessment across a wide range of KPAs. To do this, the project developed of a novel ATM simulation system, a service-oriented software that enables proactive and predictive analysis of the current and future ATM system, as a first step towards Performance Based Operations. The project has proven the usefulness of advanced simulation and optimisation tools to improve or define new performance indicators overcoming some of the current limitations in performance assessment and allowing the assessment of interdependencies between different KPA and/or SESAR solutions.

The **PACAS** (Participatory Architectural Change Management in ATM Systems) project completed the work in Q1 of 2018. The PACAS project developed an innovative participatory change management process wherein heterogeneous stakeholders could actively participate in the architectural evolution of the ATM system. The project constructed a web platform that facilitates understanding, modelling and analysis of changes in the ATM system at different layers of abstraction. The process relies on the

provision of multiple views (to accommodate the expertise of the various domain stakeholders), as well as the representation and analysis of multiple objectives, namely those related to economical, organisational, security, and safety concerns. The overall product was successfully demonstrated during a specific validation workshop.

Given the wide spectrum of topics and solutions proposed, it is clear that the achievements have to be assessed at different levels, depending on different factors such as (for example) the level of technological innovation introduced, but overall the results have been positive and, in some cases, extremely positive.

Out of 28 projects granted from the ER1 call for proposals, 11 are referred to, at various levels, in the text of the IR-VLD Wave 2 call for proposals (see below in paragraph 2.3.3). The following paragraph give two examples of success stories demonstrating the effectiveness of the SESAR Innovation Pipeline:

Success story #1: the RETINA project results transfer to Industrial Research and Innovation

The RETINA project investigated synthetic vision for advanced control tower air navigation provision. By using synthetic vision and augmented reality technologies, the project developed a set of goggles through which ATCOs can see synthetic information overlaid on the actual “out-of-the-window” view.

The inputs coming from the project are recommended for inclusion in the Wave 2 solution “PJ.05-W2-97 HMI Interaction modes for Airport Tower” and solution “PJ.10-W2-96 HMI Interaction modes for ATC centre”. The involvement in the RETINA Project of two ANSPs has certainly contributed to the final achievements of the Project, which successfully passed, with minor reservations, the V1 (TRL2) Gate. RETINA built upon SESAR technologies such as Remote Towers, SWIM, and Safety Nets.

Success story #2: the MALORCA project results transfer to Industrial Research and Innovation

Differently from RETINA, MALORCA was granted as a project under the ATM Excellent Science & Outreach topic (i.e. Fundamental research) initially targeting TRL1 maturity level. MALORCA is about the usage of machine learning techniques like automatic speech recognition for controller assistance, and managed to demonstrate a significant reduction of command recognition error-rate in two main centres such as Prague and Vienna Approaches.

During the project lifecycle, the project participants and the SESAR JU recognised the potential benefit arising from the proposed solution, and elements of the solution have been included in the Wave 2 Call solution “PJ.10-W2-96 HMI Interaction modes for ATC centre”.

MALORCA, like RETINA, benefitted from the presence of ANSPs as members of the consortium, additional evidence of the effectiveness of having an early engagement of the SESAR Programme participants in the exploratory research.

Such success stories show how the pipeline bridging Exploratory Research with Industrial Research and Validation works effectively. To ensure lessons learnt and continuous improvement, the SESAR JU has set up an ad-hoc Task Force of the Scientific Committee to raise a number of recommendations to improve this Innovation Pipeline mechanisms. The number of projects granted, their variety in terms of topics and academic members, along with the early involvement, in some cases, of ANSPs and Industry participants to the SESAR Programme, show how innovation is a key enabler for addressing the several challenges that ATM and aviation are facing. Furthermore, the appetite to look beyond the

horizon is critical for aviation when it comes to the need for coping with increase of traffic demand, increase of air vehicles, increase of automation, etc.

As mentioned above, 11 projects are referenced, at various levels, in the definition of the new wave of Industrial Research (ref. IR-VLD Wave 2 call specifications). Other than RETINA and MALORCA, these are:

- COCTA (ER-1 Fundamental Research Project) – Flexible and efficient ATM service provision in Europe – as part of Solution “PJ.09-W2-49 Collaborative Network Performance Management”;
- DART (ER-1 Fundamental Research Project) – Data driven Trajectory Prediction Research – as part of Solution “PJ.09-W2-45 Enhanced Network Traffic Prediction and shared complexity representation”;
- PNOWWA (ER-1 Fundamental Research Project) - Probabilistic now-casting of winter weather for airports – as part of Solution “PJ.04-W2-28 Enhanced Collaborative Airport Performance Planning and Monitoring”;
- TBO-MET (ER-1 Fundamental Research Project) - Meteorological uncertainty management for trajectory-based operations – as part of Solution “PJ.18-W2-53 Improved Ground Trajectory Predictions enabling future automation tools”;
- COPTRA (ER-1 Applied Research) – Combining probable trajectories – as part of Solution “PJ.09-W2-45 Enhanced Network Traffic Prediction and shared complexity representation”(same as DART);
- NAVISAS (ER-1 Applied Research) – Navigation of airborne vehicle with integrated space and atomic signals – as part of Solution “PJ.14-W2-81 Long-term alternative Position, Navigation and Timing (A-PNT)”;
- INTUIT (ER-1 Applied Research) – Interactive Toolset for understanding trade-offs in ATM performance – as part of Solution “PJ.09-W2-49 Collaborative Network Performance Management”;
- AURORA (ER-1 Applied Research) – Advanced User-centric efficiency metrics for air traffic performance analytics – same solution as for INTUIT;
- APACHE (ER-1 Applied Research) – assessment of performance in current ATM operations and of new concepts of operations for its holistic enhancement – same solution as for INTUIT.

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

The second Exploratory Research open call for proposals, H2020-SESAR-2016-1³⁰, was open on 14 July 2016 and closed on 15 November 2016 and aimed to address the domain of Remotely Piloted Aircraft Systems (RPAS) and unmanned vehicles (UAS).

- The **UAS/RPAS integration operational issues** project will deliver the U-space Concept Definition addressing the operational concept to enable the operation of drones of all capabilities in the very low-level (VLL) environment, including urban drone operations, the role of autonomy and operational mitigations to command and control failure/corruptions. The required interface with air traffic control (ATC) and the role of incursion protection against protected areas will be addressed. The U-space concept definition will address operational needs and provide a functional breakdown of the U-space;

³⁰ Call conditions were set in SESAR JU Annual Work Programme 2016. Call documentation is available on the [Funding and Tenders Portal](#)

- The **RPAS integration technical issues** projects will deliver emerging technology options to support drone operations and integration in the VLL and VFR domains. Emerging technologies and applications for U-space from advanced fields such as IT, telecoms, intelligent systems or robotics will be fast-tracked into providing solutions to specific problems that are core to the near-term development of the EU drone industry. It should also help bridge SESAR U-space research with the wider scientific community and will provide the science necessary to support the safe integration of VLL drones, considering higher levels of automation, security and cyber-resilience.

The evaluation of the proposals received in response to the call for proposals was completed in January 2017 with the award of nine projects with a total value of EUR 8,3 million, followed by the grant agreement preparation phase completed in 2017. The projects have started to deliver their results in 2018. In 2018, 51 deliverables were received from these nine ER projects and 43 were assessed and approved, eight deliverables being still under review at the end of 2018. The table below provides an overview of the projects currently in execution phase, and further detail on the initial activities of each in 2018 can be found in the following paragraphs.

Within the **CORUS (Concept of Operation for EuRopean UTM Systems)** project, the Initial concept of operations was presented to the stakeholders' community during the CORUS Definition Workshop (Jun 2018 - around 70 participants). The inputs of the stakeholders' community have been further collected and will constitute the basis for the preparation of the Intermediate ConOps to be released in March 2019. This work has laid the foundations for the description of U-space services and capabilities, includes descriptions of new airspace classification and considers the societal impact of large-scale drone usage in Europe. The project has progressed with the definition of an initial U-space architecture from a business and operational viewpoints in EATMA (the European Air Traffic Management Architecture portal), leading the way to a unified technical architecture description.

The **AIRPASS (Advanced Integrated RPAS Avionics Safety Suite)** project reviewed existing CNS infrastructures and technologies as well as existing on-board technologies for unmanned aircraft that could support very low-level flights, dense airspace and possible U-space integration. From this, the project has matched every U-space services to the main avionics components of a drone (communication, navigation, automated flight control, and database). The project has then compiled 68 basic requirements for an on-board system concept for drones in a U-space environment

The **CLASS (Ground based technologies for a real-time unmanned aerial system traffic management system (UTMS))** project has developed a set of scenarios and KPIs to cover different situations where cooperative, non-cooperative surveillance and identification can provide useful services for drone operations. CLASS then defined a surveillance system comprising of the Drone-IT (Drone Identifier and Tracker) on-board cooperative sensor system, UAS variant of Aveillant's Holographic Radar called Gamekeeper, integrated with data fusion (with support from NTNU) into a the real time situation display provided by Unifly. Using the defined system KPIs and scenarios, CLASS performed a series of live trials in October 2018. This trial has already shown the feasibility of the technologies providing an integrated surveillance and tracking system.

The **TERRA (Technological European Research for RPAS in ATM)** project has identified functional service requirements for U-space Ground Systems based on the collection of operational needs and

analysis of CONOPS. Specific targets have been set for the performance of communications, navigation and surveillance services. Non-functional requirements have been defined for the Drone traffic management system (design, security, monitoring and interfaces). TERRA performed an analysis of existing technologies with analysis ongoing on the identification potential new technologies.

The **DREAMS** (Drone European AIM Study) project has performed an analysis of current data and services employed by traditional aviation users and existing information services used by drone operators/users that are of interest to U-space services. This was done with operator/user input as extensive survey. The project performed a gap analysis where seven key information gaps were identified. It was also found that the majority of existing information services cannot be applied for future unmanned flight. It was highlighted that current U-space services only support low densities of traffic and that for traffic management and separation guidance information services will be critical for achieving safe high-density drone operation in VLL urban airspace.

The **IMPETUS** (Information Management Portal to Enable the inTegration of Unmanned Systems) project will research on the application of the ‘micro-services’ paradigm as a flexible and cost efficient solution for lifecycle support of the expected high variety of drones and missions. So far, the project has collected a lot of useful information from their surveys and meetings with U-space stakeholders. As an example, they have analysed the existing information from the manned aviation to see whether they cover the needs from the drone. The results of this work will be translated into requirements for the related information management services and then better define the U-space services.

The **Droc2Om** (Drone Critical Communications) project has performed a first real-life measurement campaign in the city of Aalborg Denmark. The aim is to assess whether U-space services can use the existing commercial cellular system (3G) or not. Do we need a specific infrastructure for U-space? The 1st answer is YES considering this will require requirements on drones (e.g. quality of the receivers, number of antenna) the project has started to develop.

The **PercEvite** (Sense and avoid technology for small drones) project has developed a multi-communication package with Wi-Fi, LTE, and ADSB-in. This package allows drones to communicate information on their own position to other air users, communicate with other drones, and receive messages from manned aircraft (ADSB-in). Communication will be an important way to ensure sufficient clearance between different air users. For the Wi-Fi, a novel scheme has been developed, which allows much quicker exchange of information between drones – by using the SSID to store position and velocity. The project has implemented a solution for obstacle detection and avoidance, which uses the two cameras and processing of the Parrot SLAM dunk. In particular, the method uses both stereo vision (to see distances) and optical flow (to estimate the velocity of the drone). This allows the drone to fly both indoors, where the GPS signal is bad or absent, and outdoors. The drone can fly autonomously and stop if it detects obstacles. The project has developed software to see distances in a single image. This way of seeing distances is complementary to using stereo vision (triangulation with two cameras), and has the potential to improve distance estimation.

The **SECOPS** (An Integrated Security Concept for Drone Operations) project performed a first risk evaluation based on the U-space concept, threat scenarios and likelihood indications. This consisted of security objectives, information flow diagram, overview of primary assets, overview of supporting

assets, threat scenarios and evaluation of risks. This fed into a gap analysis to gain knowledge of the U-space concept security objectives and to determine all supporting assets that are not compliant with the security objectives. 89 unique gaps were identified with ongoing analysis.

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

The third open Exploratory Research call for proposals, within the call with reference H2020-SESAR-2016-2³¹ also covering Very Large-Scale Demonstrations (VLD Open 1), was open on 15 December 2016 and closed on 11 May 2017. The H2020-SESAR-2016-2 call for proposals consisted of two different Work Areas: ‘Exploratory Research’ covering six topics and ‘Very Large Scale Demonstrations’ covering a further ten topics. The total budget of the call was EUR 28.000.000, of which EUR 10.000.000 for Exploratory Research (the EUR 18.000.000 other for VLD, see chapter 2.4). The evaluation of the proposals was completed in September 2017 for the ‘Exploratory Research’ Work Area with the award of eight projects and the subsequent grant signature process, for a total value of EUR 9,9 million (in December 2017). The grants awarded in that context will deliver their results in the period from 2018 through to 2020. In 2018, 37 deliverables were received from these eight ER projects and 25 were assessed and approved, 12 deliverables being still under review at the end of 2018. The following paragraphs outline the outcomes of the projects in 2018.

The **DOMINO** (Novel tools to evaluate ATM systems coupling under future deployment scenarios) project developed a toolbox containing a set of metrics and analyses, with the aim of providing the basis of a future, more exhaustive decision-making tool offering both flight and passenger perspectives. Domino aims to produce improved insights into, and knowledge of, the current state of the system, and its behaviour under the implementation of three mechanisms: dynamic cost indexing, User Driven Prioritisation Process and Extended Arrival Manager.

The **EvoATM** (Evolutionary ATM - A modelling framework to assess the impact of ATM evolutions) project focused on building a framework to better understand and model how architectural and design choices influence the ATM system and its behaviours, and vice versa how the expected ATM overall performances drive the design choices. The EvoATM project will model a specific part of ATM system combining the agent based paradigms with evolutionary computing.

The **ENVISION** (Enhanced Situational Awareness through Video Integration with ADS-B Surveillance Infrastructure on Airports) project focused on making use of technical progress in closed circuit television (CCTV) cameras, light detection and ranging (LIDAR) technology and image processing techniques, and at taking advantage of reduced equipment costs, to provide regional and local airports safe and affordable surface movements surveillance capabilities in support of advanced surface movement guidance and control system (A-SMGCS) and airport collaborative decision making (A-CDM) services.

The **ADAPT** (Advanced prediction models for flexible trajectory-based operations) project focused on proposing strategic models to predict the volume, flexibility and complexity of traffic demand taking

³¹ Call conditions were set in SESAR JU Annual Work Programme 2016. Call documentation is available on the [Funding and Tenders Portal](#)

into account both individual flights and network infrastructure (i.e. sectors and airports). The aim is to enable early flight information sharing in order to identify potential network bottlenecks and the degree of flexibility of all flights. At the tactical level, the extent to which strategically assessed pre-departure and en-route flight flexibility mitigates actual network congestion, will be evaluated.

The **COTTON** (Capacity Optimisation in TrajecTory-based OperatioNs) project focused on maximising the effectiveness of capacity management processes in trajectory-based operations taking full advantage of available trajectory information. Specifically, the project explores the integration of demand and capacity and flight centric solutions.

The **EMPHASIS** (EMPowering Heterogeneous Aviation through cellular SInalS) project focused on increasing safety, reliability and interoperability of general aviation/rotorcraft (GA/R) operations both with commercial aviation and with emerging drones operations. These aspects are foreseen as critical elements to secure and improve airspace access for GA/R users in future airspace environment and improve operational safety of their operations.

The **GATEMAN** (GNSS Navigation Threats Management) project focused on researching multiple measures that could be deployed on most aircraft to manage GNSS threats, either on their own or in a collaborative fashion with other aircraft. Indeed, Global Navigation Satellite System (GNSS), such as the Galileo constellation, will become the primary means of aircraft navigation in the mid and long term. However, GNSS signals are vulnerable to threats, especially to jamming and spoofing, which may cause the total loss of navigation.

The **Engage** project was launched in January 2018 in the context of the ER3 Call to perform the role of SESAR 2020 Knowledge Transfer Network (KTN) in support to the SESAR JU and is managed by a consortium of Academia and industry. Its focus is two-fold: inspiring new researchers and helping to align SESAR Exploratory and Industrial Research, through a wide range of activities and financial support actions. The Network aims in particular to stimulate the transfer of Fundamental Research results towards ATM Application-Oriented Research, and from Application Oriented Research to Industrial Research.

In 2018, the project organised three thematic challenges workshops and launched a call for funding PhDs and post graduate research. The three thematic challenges workshops covered the topics of data-driven trajectory prediction, efficient provision and use of meteorological information in ATM, and novel and more effective allocation markets in ATM.

The project also supported the SESAR JU in the organization of the eighth SESAR Innovation Days (SIDs, see also in paragraphs 2.2.5.1 and 2.5.3.1) held at the Salzburg Congress Centre in December 2018. The event put air traffic management (ATM) exploratory research in the spotlight through a series of workshops, presentations, poster exhibitions and networking events. More than 300 guest, mainly from European R&D Centres and Universities, but also involving international guest (FAA, NASA, Japan and Singapore CAAs, etc.) and Programme Committee members, attended the event.

2.2.4 Exploratory Research 4 call preparation

In 2018, the SESAR JU prepared the fourth Exploratory Research call for proposals (call ER4 with reference H2020-SESAR-2019-2), in accordance with the consultation and definition process defined in the SPD 2018-2020 (paragraph 2.1.2 in Section III) and approved in December 2017 by the Administrative Board.

As defined in the SPD 2018-2020, the definition of the ER4 call for proposals was performed in consultation with the Scientific Committee. The High level Definition Phase took place in 2017 with an SESAR JU internal seminar, the result of which was submitted to the review of the Scientific Committee in December 2017. Considering the discussions held in the Scientific Committee, the SESAR JU refined the initially set list of topics list and introduced them into the draft SPD 2019-2021 for ADB review and approval.

Further to the completion of that phase, in 2018, the SESAR JU ran the second phase of definition of the ER4, the ‘Detailed Definition phase’, as follows:

- From January to 5 February 2018: the SESAR JU addressed the comments received from the Scientific Committee members and prepared a new release of the list of topics of ER4;
- 6 February 2018: fifth meeting of the Scientific Committee;
- From 7 February to 29 May 2018: the SESAR JU addressed the comments received from the Scientific Committee members on the revised list of topics established in January 2018, and prepared a third release of the list of topics of ER4;
- 30 May 2018: sixth meeting of the Scientific Committee;
- 8 June 2018 : cut-off date, defined in the SPD 2018-2020 as the date at which the SESAR JU stops the consultation of its Advisory Bodies;
- From 31 May to 31 August 2018: the SESAR JU addressed the comments received from the Scientific Committee members on the second revised list of topics established in May 2018, and prepared the final list of topics of ER4.

Based on the outcome of the Detailed Definition phase, the SESAR JU proceeded in Q3 and Q4 2018 with the further drafting of the call conditions in the SPD 2019-2021 (adopted by the Administrative Board in December 2018) and the preparation of the call documentation including the technical specifications. The finalisation of the call documentation was the result of a strong collaboration across the SESAR JU teams, under the principles set in the adopted SPD 2019-2021.

2.2.5 Other activities related to Exploratory Research

2.2.5.1 SESAR Innovation Days (SIDs)

The eighth edition of the SESAR Innovation Days (SIDs) took place between 3 and 7 December 2018 in Salzburg, Austria at the Salzburg Congress Centre. The SESAR JU organised the event while the SESAR KTN ‘Engage’ project took responsibility of the programmatic, i.e. scientific content of the conference. Engage provided a detailed report³² while the main aspects are summarized in the following paragraphs.

The SIDs are the main vehicle for the SESAR JU to share progress and disseminate results of its exploratory research Programme. More specifically, the objectives of the event are to:

- Pool together Europe’s academic and scientific ATM research community and provide them a platform to show their achievements and disseminate their results,
- In particular, give visibility to the research results from the first SESAR 2020 exploratory research call (ER1),
- Showcase how new thinking and ideas that come out of SESAR’s exploratory research projects can feed ATM industrial research,
- Provide a backdrop for the SESAR Young Scientist Award.

³² Engage - D2.8 SESAR Innovation Days 2018 Report

In December 2018, three workshops took place that were not part of the official programme but co-located seeking synergies with the main conference. The conference started with the inauguration of a poster exhibition on Monday evening. The poster remained available during the conference. The official opening of the SIDs took place on Tuesday 4 December. The conference programme included several plenary talks, discussion panels and a number of technical session. These sessions were running in two parallel tracks. The closing session on Thursday afternoon included the Young Scientist Award ceremony and the announcement of the SIDs 2019. On Friday, three technical tours to Austrian aerospace stakeholders organised by the SESAR JU and Salzburg University were offered.

Researchers could select between two types of submissions: full paper submissions (up to eight pages) and poster abstracts (up to two pages). Selected papers were presented during the technical sessions. A total of 57 full papers and 33 posters were submitted and reviewed by the Programme Committee (including reviewers from the Scientific Committee). Each paper was reviewed by three reviewers. A total of 34 papers and 28 posters were accepted; this corresponds to an acceptance rate of 60% for full papers which is satisfactory and in line with previous SIDs. Out of 34 papers, eight included results from exploratory research 1 projects. Overall, presentations and poster were of a high standard and many different areas of ATM research were covered. A high number of presentations included applications of machine learning in ATM.

All relevant information including Call for papers, submission instructions, logistical information and, at a later stage, programme and conference registration were available via the SIDs website. All papers are available for download from the website together with the presentations. A dedicated smart phone application was also available which included relevant information and allowed users to comment and engage in dialogue.

2.2.5.2 Young Scientist Award (YSA 2018)

The annual edition of the Young Scientist Award contest was publicly launched on 7 May 2018. The initial deadline for the submission of the applications, 31 July 2018, was extended by the SESAR JU until 5 September 2018 in order to allow more students to apply.

Following some recommendations raised by the Scientific Committee on how to attract young generation of students from a broader geographical range of countries, the Call targeted any young scientist who has contributed to scientific achievements within the area of Air Traffic Management and Aviation within their

- Bachelor thesis defended not more than 18 months before the date of publication of the Call, or
- Master thesis defended not more than 18 months before the date of publication of the Call, or
- PhD thesis defended not more than 18 months before the date of publication of the Call; or
- on-going PhD,

and being a citizen or a resident in an EU Member State or an Associated Country to the Horizon 2020 Research and Innovation Framework Programme (H2020) as defined in Article 7 of the Horizon 2020 Regulation.

Approximately twenty applications were received; first they were checked by the SESAR JU Legal Unit against the eligibility criteria described in the YSA2018 Contest Rules published together with the Call. Successful applications were sent to the Evaluation Panel for the award phase. The Evaluation Panel was composed of three members of the Scientific Committee. At the end of October 2018 the Panel sent the Evaluation Report to the SESAR JU, according to which the following winner and runner ups were proposed:

- First place: Gianluca Di Flumeri for his work on electroencephalography-based measurements of mental workload for the development of passive Brain-Computer Interfaces to be used in operational environments;
- Second place: Riccardo Patriarca for his work on methods for improving traditional risk analyses for complex socio-technical systems;
- Third place: Goran Pavlovic for his work on the innovative idea of airport pair route charging system.

The SESAR JU Executive Director endorsed the recommendation from the independent panel and signed the decision off.

The three short-listed scientists were awarded during the SESAR Innovation Days that took place in Salzburg, Austria the first week of December.

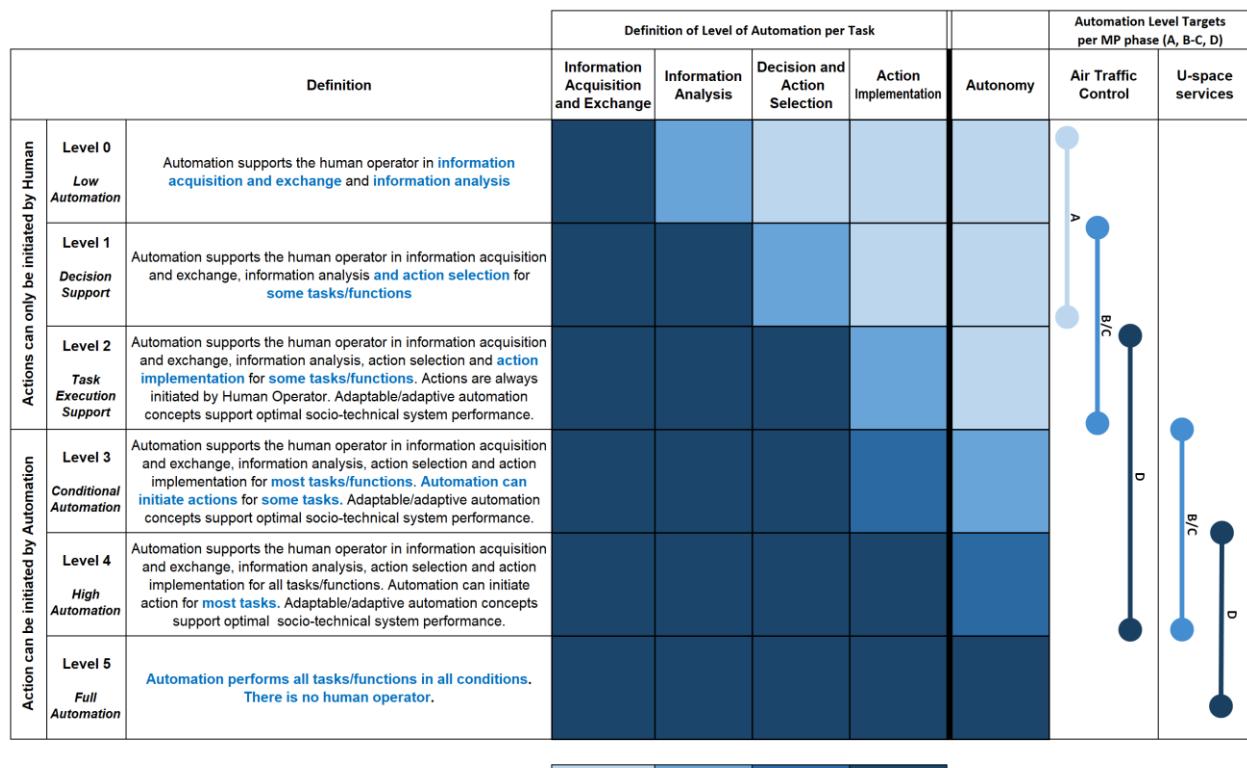
2.2.5.3 Internal study on ATM Automation roadmap

Digital transformation is the means to accelerate the roll-out of the SESAR vision as set out in the ATM Master Plan (see section 2.1.3 above). A “digitally transformed aviation” will use targeted data and information through automated and connected solutions to improve the overall performance of the system from a safety, efficiency and cost perspective. Aviation will take full advantage of advanced digital technologies to generate new services, optimise current ones while delivering a better experience and benefits to all stakeholders.

The strategy for digitalising European ATM responds to the need expressed in the EU Aviation Strategy to digitalise Europe’s aviation infrastructure and responds to Europe’s Digital Single Market Strategy³³. The Digital Single Market strategy defines a Digital Economy and Society Index (DESI)³⁴. It is a composite index that summarises relevant indicators on Europe’s digital performance and tracks the evolution of EU Member States in digital competitiveness. The DESI indicator is a broad societal index that, so far, does not detail specific branches of industry. Consequently, leveraging the results of Exploratory Research projects and in the context of the Master Plan update campaign, the SESAR JU carried out an internal study to demonstrate alignment between the SESAR project and Digital Single Market goals. This study resulted in the first ever ATM automation roadmap which is depicted in the following figure:

³³ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: “A Digital Single Market Strategy for Europe”, COM/2015/0192 final

³⁴ <https://ec.europa.eu/digital-single-market/en/desi>

**Figure 13: The ATM automation roadmap**

The figure above introduces an automation model for ATC based on the classic levels of automation taxonomy (LOAT) model used by human performance and safety experts in the SESAR Programme. It mirrors the five-level model from the Society of Automotive Engineers (SAE) (ranging from level 0 “no automation” to level 5: “full automation”)³⁵. It presents a simplified view of the overall level of automation in each of the ATM master plan phases (A to D) targeted in two different areas: ATC and U-space. It highlights the steps envisioned towards the profound digital transformation outlined in this vision.

³⁵ SAE standard J3016 Levels of Automated Driving

2.3 Strategic Area of Operation 3: Deliver Industrial Research & Validation (IR)

The SESAR JU met all its objectives related to Industrial Research and Validation in 2018. This includes the following achievements and results:

- *Finalise validation exercises of Release 7 and draft final report: all validation exercises of Release 7 were completed and the Release Report was delivered and approved by the Programme Committee in April 2018*
- *Execute validation exercises of Release 8: the first Release 8 validation exercises were executed according to the plan approved by the Programme Committee in March 2018*
- *Prepare Release 9: the Release 9 plan was approved by the Programme Committee in December 2018*
- *Call reference H2020-SESAR-2015-2 (IR –VLD Wave 1 Call) - Wave 1 projects delivery of results: IR projects were in execution and delivered their expected result*
- *Call reference H2020-SESAR-2015-2 (IR –VLD Wave 1 Call) - conduct Wave 1 IR grant budget amendments campaign: the 17 grant agreements related to IR projects were amended by the end of 2018*
- *Call reference H2020-SESAR-2019-1 (IR Wave 2 Call) - preparation of content and call material: call conditions were approved in the SPD and call material, including technical specifications, were ready at the end of year, through the consultation process as documented in the SPD 2018-2020*

In the beginning of 2018, the seventeen IR projects and three transversal steering activities projects (see above paragraph 2.1.1) resulting from the IR/VLD Wave 1 call for proposal launched in 2015 (call with reference H2020-SESAR-2015-1) were in full execution. This represents a total EU co-financing amount of EUR 208,8 million.

With the aim to assess the maturity of SESAR Solutions developed in the 17 IR projects, the SESAR JU and its Members finalised the Release 7 and conducted the Release 8 in 2018. Additionally, the SESAR JU started the planning phase of the Release 9, expected to be completed in the beginning of 2019.

During the year 2018, SESAR JU and its Members got support from the SDSS (SESAR Development Support Services) in the implementation and execution of the processes and procedures required guaranteeing consistency in the Programme lifecycle. SDSS contributed to the definition of the Release 8 Plan in identifying the different Solutions to be validated and delivered according to the Release process. Activities related to the maturity assessment of the Solutions have also been supported by SDSS through the delivery and maintenance of the maturity assessment tool together with the organisation of the maturity gates and the preparation of the required material as input and as outcomes of the gates.

This chapter presents the status of the projects resulting from the Wave 1 call for proposals and their main achievements in 2018, then the results and achievements of the Release7, the execution status of the Release 8 and the planning of the Release 9. The last paragraph presents the developments in relation with the Wave 2 preparation.

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

2.3.1.1 Project activities and results in 2018

The first call on Industrial Research and Validation, which was restricted to SESAR JU Members other than the Union, within the call with reference H2020-SESAR-2015-2³⁶ also covering VLD, closed in 2016, followed by the award of 17 projects. The main outcome of these projects is summarised in the paragraphs below.

In 2018, 113 deliverables were received from the 17 IR projects and 105 were assessed and approved, eight deliverables being still under review at the end of 2018. Furthermore, IR projects contributed to validation exercises which are presented in the paragraph 2.3.2.2 which summarises the Release 8 execution and temporary results (as per the Release Plan, Release 8 will finish in Q1 2019). It is expected that all IR projects will continue over 2019 and will complete their delivery in late 2019, with the exception of four that will deliver their final results in early 2020 in accordance with the Programme Committee recommendation.

According to the Releases 7, 8 and 9 Plans, the SESAR JU expects to deliver, through the SESAR 2020 Programme, 27 candidate SESAR Solutions in V1/TRL2 maturity, 50 in V2/TRL4 maturity and 25 in V3/TRL6 maturity. The following figure shows the progress made per maturity level at the end of 2018, considering that only validation results from Release 7 and some from the Release 8 were completed and known in December 2018 (Release 8 will be completed in April 2019 and the Release 8 close out report consolidating all R8 results will be published in June 2019).

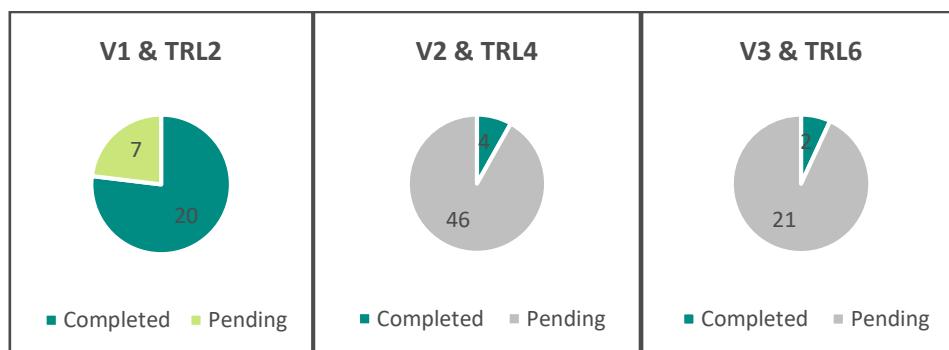


Figure 14: Status of SESAR 2020 validation exercises at the end of 2018



Under the ‘High Performing Airport Operations’ Key Feature, IR projects delivered the following:

The project **PJ.02 EARTH** ‘Increased Runway and Airport Throughput’ focuses on developing, validating and delivering separation and procedures to improve runway and airport throughput considering wake vortex, weather, the environment and noise while taking account of different levels of traffic demand, future aircraft capabilities and airport configurations. The solutions in the project scope are:

- PJ.02-01 ‘Wake turbulence separation optimization’. The solution aims to achieve a V3 maturity level by Q1 2020;

³⁶ Call documentation is available on the [Funding and Tenders Portal](#)

- PJ.02-02 ‘Enhanced arrival procedures’ The solution aims to achieve a V3 maturity level by Q1 2020;
- PJ.02-03 ‘Minimum-Pair separations based on RSP’. The solution aims to achieve a V3 maturity level by Q4 2019;
- PJ.02-05 ‘Independent Rotorcraft operations at the Airport’. The solution aims to achieve a V3 maturity level by Q4 2019;
- PJ.02-06 ‘Improved access into secondary airports in low visibility conditions’. The solution aims to achieve a V2 maturity level by Q4 2019;
- PJ.02-08 ‘Traffic optimisation on single and multiple runway airports’. The solution aims to achieve a V3 maturity level by Q4 2019;
- PJ.02-11 ‘Enhanced Terminal Area for efficient curved operation’. The solution aims to achieve a V1 maturity level by Q4 2019.

Good progress was made in all the solutions in 2018. For each solution, the project team refined the concept description and related technical specifications, continued to plan validation activities and develop the corresponding validation platforms and prototypes. In each solution, validation reporting started with the analysis of the results collected in the validations completed in 2018.

PJ.02-08 V2 maturity gate took place in November 2018. The result was ‘completed conditional’ with actions to be completed by the project in order to bridge the maturity gaps identified during the gate.

The project **PJ.03a SUMO** ‘Integrated Surface Management’ aims at:

- Optimising the allocation of airport resources for smoother and more predictable airport operations in all weather conditions;
- Developing resilient airport systems especially when low visibility procedures are in place;
- Improving accessibility to airports operating in low visibility conditions by:
 - Providing flight crews with an enhanced vision aid to perform approach, landing and taxi operations with an increased safety level;
 - Providing accurate and available navigation information with higher integrity provided by aircraft systems;
- Considering the integration of remotely piloted aircraft systems (RPAS) in the surface operations when allocating airport resources.

The solutions in the project scope are:

- PJ.03a-01 ‘Enhanced Guidance Assistance to Aircraft and Vehicles on the Airport Surface Combined with Routing’. The solution aims to achieve a V2 maturity level by Q3 2019;
- PJ.03a-03 ‘Enhanced navigation and accuracy in low visibility conditions (LVC) on the airport surface’. The solution aims to achieve a TRL4 maturity level by Q4 2019;
- PJ.03a-04 ‘Enhanced Visual Operations’. The solution aims to achieve a V3 maturity level by Q4 2019;
- PJ.03a-09 ‘Surface operations by RPAS’. The solution aims to achieve a V2 maturity level by Q4 2019.

Good progress was made on all the solutions in 2018. For each solution, the project team refined the concept description (ATM solutions) and related technical specifications (ATM and technological solutions), continued to plan validation activities and develop the corresponding validation platforms and prototypes.

In PJ.03a-01, validation reporting started with the analysis of the results collected after all the planned validations were completed. In PJ.03a-03, data collection feeding the technical analysis was started.

PJ.03a-09 V1 maturity gate took place in December 2018. The result was ‘completed conditional’ with actions to be completed by the project in order to bridge the maturity gaps identified during the gate.

The project **PJ.03b SAFE** ‘Airport Safety Nets’ aims at defining, consolidating and validating additional safety barriers to mitigate the risks of runway incursion, runway excursion and more generally the risk of incidents and accidents involving aircraft at the airport. In order to achieve this goal the project is developing four solutions:

- PJ.03b-01 ‘Enhanced Airport Safety Nets for Controllers’. The solution aims to achieve a V2 maturity level by Q4 2019;
- PJ.03b-03 ‘Conformance monitoring safety net for Pilots’. The solution aims to achieve a V2 maturity level by Q4 2019;
- PJ.03b-05 ‘Traffic alerts for pilots for airport operations’. The solution aims to achieve a V3 maturity level by Q4 2019;
- PJ.03b-06 ‘Safety support tools for avoiding runway excursions’. The solution aims to achieve a V2 maturity level by Q4 2019.
 - Good progress was made in all the solutions. For each solution, the project team refined the concept description and related technical specifications, continued to plan validation activities and develop the corresponding validation platforms and prototypes.
 - Six out of seven planned PJ.03b-01 validations were completed and the solution team started to analyse and consolidate the results.
 - Both planned PJ.03b-03 validations were completed.
 - One planned PJ.03b-05 validation was completed. All the planned PJ.03b-06 validations were completed.

The project **PJ.04 TAM** ‘Total Airport Management’ takes a ‘holistic’ view of airport operations, including the three key processes (aircraft, passengers, baggage) and more importantly, the interaction between them, as it is the degree of coordination between these different processes which constitutes a significant contributory factor to punctual and predictable operations and ultimately therefore passenger satisfaction. The entire scope of the PJ.04 TAM project is covered by two SESAR Solutions:

- PJ.04-01 ‘Enhanced Collaborative Airport Performance Planning and Monitoring’. The solution aims to achieve a V2 maturity level by Q1 2019. Initial V3 R&D activities are planned until the end of 2019;
- PJ.04-02 ‘Enhanced Collaborative Airport Performance Management’. The solution aims to achieve a V2 maturity level by Q4 2019.
 - Good progress was made in both solutions.
 - All PJ.04-01 planned V2 validations were performed, leading to the submission of the validation report and updated concept description, technical specifications and cost benefit analysis as well as the validation roadmap for V3 for the SESAR JU quality check. The PJ.04-01 V2 maturity gate is planned in Q1 2019.
 - PJ.04-02 V1 maturity gate took place in January 2018. The result was ‘completed – acceptable risks’. Since then, the solution team worked on the update of the concept description, the technical specifications and the V2 validation plan and associated

platform and prototype developments, addressing the risks identified in the V1 maturity gate.

The project **PJ.05 Remote Tower** ‘Remote Tower for Multiple Airports’ aims at further developing the multiple remote tower concept compared to SESAR 1 by investigating the feasibility of increasing the traffic volumes, complexity and/or number of aerodromes controlled from one remote tower module and in a remote tower centre. PJ.05 also aims at developing a technological solution for automated remote weather observations. This work is split into three solutions:

- PJ.05-02 ‘Multiple Remote Tower Module’. The solution aims to achieve a V3 maturity level by Q4 2019;
- PJ.05-03 ‘Remote Tower Centre with Flexible Allocation of Aerodromes to Multiple Remote Tower Modules’. The solution aims to achieve a V2 maturity level by Q4 2019;
- PJ.05-05 ‘Advanced Automated MET System for Remote Airport’. The solution aims to achieve a TRL4 maturity level by Q3 2019.

Good progress was made in all three solutions.

- All PJ.05-02 planned V2 validations were performed, leading to the submission of the validation report and updated concept description, technical specifications and cost benefit analysis as well as the validation roadmap for V3 for the SESAR JU quality check. The PJ.05-02 V2 maturity gate is planned in Q1 2019.
- The PJ.05-03 team refined the concept description and related technical specifications, continued to plan validation activities and develop the corresponding validation platforms and prototypes. One V2 validation was completed in 2018.
- As a technological solution, PJ.05-05 refined the technical specifications and finalised the preparation of the technical validations and completed the only planned TRL4 exercise, allowing the team to initiate the work on the technical validation report.



Advanced air traffic services

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

The project **PJ.01 EAD** ‘Enhanced Arrival and Departure’ focuses on operational improvements to the flow of arriving and departing traffic within the E-TMA that aim to increase airspace capacity and cost efficiency, improve safety and predictability and provide greater fuel efficiency and environmental sustainability. It addresses the development of concepts, tools and procedures to increase the capacity of extended TMAs (E-TMAs) to meet forecast traffic growth in a safe, cost-effective and environmentally sustainable manner. This will be achieved by taking advantage of the latest technological developments from both an airborne and a ground-system perspective and through secure sharing of data in seven solutions:

- PJ.01-01 (Extended Arrival Management with overlapping AMAN operations and interaction with DCB and CTA) that aims to investigate the use of queue management techniques that are extended further from the arrival airport, more integrated with airport and network-wide demand and capacity balancing and make use of more accurate and predictable arrival timings. It is assessing the impact on the en-route sectors of multiple arrival management systems operating out to extended range and it is considering how to balance the needs of

those involved. The methods for sharing data between systems and reconciling the constraints of different systems is also addressed.

In 2018, 4 out of 7 planned validation exercises were performed in preparation for the target V2 Maturity gate in 2019.

- PJ.01-02 (Use of Arrival and Departure Management Information for Traffic Optimisation within the TMA) that analyses TMA traffic managed in near real time, taking advantage of predicted demand information provided by arrival and departure management systems from one to 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.

In 2018, 3 out of 5 planned validation exercises were performed in preparation for the V2 Maturity gate in 2019.

- PJ.01-03a (Improved Parallel Operations) that analyses improvement through the application of RNP navigation specifications and the development of enhanced ATC procedures.

In 2018, 4 out of 6 planned validation exercises were performed in preparation for the V2 Maturity gate in 2019.

- PJ.01-03b (Dynamic E-TMA for Advanced Continuous Climb and Descent Operations) that analyses how dynamically attributed use of routes 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. The solution includes: dynamically attributed departure/arrival routes (based on fixed, published, SID/STARs and transitions to final approach) and the development of enhanced ATC procedures.

In 2018, 1 out of 2 planned validation exercises were performed in preparation for the V2 Maturity gate in 2019.

- PJ.01-05 (Airborne Spacing Flight Deck Interval Management) 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.

In 2018, 4 out of 6 planned validation exercises were performed in preparation for the V2 Maturity gate in 2019.

- PJ.01-06 (Enhanced Rotorcraft operations in the TMA) 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.

In 2018, 2 out of 3 planned validation exercises were performed in preparation for the V3 Maturity gate in 2019.

- PJ.01-07 (Approach Improvement through Assisted Visual Separation) 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.

In 2018, the two planned validation exercises were performed in preparation for the V2 Maturity gate in 2019.

The project submitted 13 deliverables to support the planning and the realisation of the various validation exercises; all deliverables were accepted.

The project **PJ.06 ToBeFREE** ‘Trajectory-Based Free Routing’ addresses the Free Routing concept, which enables Airspace Users to fly as close as possible to their preferred trajectory, without being

constrained by fixed airspace structures or fixed route networks. Free Routing (FR) implementation represents a step towards a less fragmented European airspace foreseen by Single European Sky and provides the AUs with the possibility to fly their user preferred routes in accordance with their business needs or mission requirements. FR will result in a seamless airspace enabling more efficient flight, a reduction in AU costs and will promote cheaper travel, increasing personal mobility and trade.

- PJ.06-01 Solution; Optimized traffic management to enable Free Routing in high complexity environments
- In 2018 after the successful delivery of the Validation plan, the focus of PJ.06-01 has moved to platform development. Validation exercises were prepared and implemented. Project team started to work on the delivery of Initial TS/IRS and Cost Benefit Analysis report.
 - Exercise PJ.06-01-E01; (real time simulation using 2 platforms addressing cross border Free Routing operations (2 ANSPs/2 adjacent FRAs, and 2 ANSPs/1 FRA) in very high complexity environment) is started to be executed in the last quarter of 2018.
 - Exercise PJ.06-01-E02; (Real time simulation operating two distinct FDPs (compliant with cross border FRA operations), feeding two independent iTEC platforms. The objective is to validate the processes and procedures to be applied by ATCOs to support Free Routing operations in high complexity cross-border environment; cross-border military activity is emulated. Airspace considered is a single FRA across two ACCs) is executed in the last quarter of 2018.
- PJ.06-02 Solution: V1 maturity gate was successfully executed and the solution passed to the next stage. Project has finalised and delivered the Initial version of OSED/SPR/INTEROP document. In parallel, work on other V2 tasks; such as production of the VALP V2, test platforms development and integration (B4 IBP, EEC) and CBA continued. Exercise PJ.06-02-V2-E03 (RTS using EUROCONTROL ESCAPE simulator) objectives are to determine the conditions under which FRA can be extended below FL 310 safely, efficiently and at acceptable controller workload. Exercise assess the impact of extending FRA operations below FL 310 with reference to the key performance areas of safety and environment (flight efficiency) and the impact of RPAS in FRA within civil airspace in nominal and non-nominal situations) is executed at the end of the 2018.

The project **PJ.10 PROSA** ‘Separation Management & en-route & TMA’ aims at providing the air traffic controller with more automated tools, thus freeing capacity for situations where human intervention is crucial. This provides even safer service for an increasing amount of traffic and with lower costs, as required by airspace users. The Project concerns the implementation and validation of a series solution:

- Solution PJ.10-01a: High Productivity Controller Team Organisation
- Solution PJ.10-01b: Flight Centric ATC
- Solution PJ.10-01c: Collaborative Control
- Solution PJ.10-02a: Improved performance in the provision of separation
- Solution PJ.10-02b: Advanced Separation Management
- Solution PJ.10-05: IFR RPAS Integration
- Solution PJ.10-06: Generic' (non-geographical) Controller Validations

In 2018, all solutions are ongoing and validations are executed as planned. The Solutions PJ.10.01b and PJ.10-05 reached TRL level 2 maturity, the validations exercises are demonstrating promising results. Both solution continues to develop and validate solutions with the aim to complete TRL 4 in 2019. The

Solution PJ.10.02a encountered some concerns with the Aircraft Derived Data concept, this will lead in 2019 to a split of the solution and partial re-scoping of the activities.

The project **PJ.11 CAPITO** ‘Enhanced Air & Ground Safety Nets’ addresses Current Airborne Collision Avoidance System (ACAS) performance requirements, which 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. The Project concerns the implementation and validation of a series solution:

- Solution PJ.11-G1: Enhanced Ground-based Safety Nets adapted to future operations,
- Solution PJ.11-A1: Enhanced Airborne Collision Avoidance for Commercial Air Transport normal operations – ACAS Xa,
- Solution PJ.11-A2: Airborne Collision Avoidance for Remotely Piloted Aircraft Systems – ACAS Xu,
- Solution PJ.11-A3: ACAS for Commercial Air Transport specific operations – ACAS Xo,
- Solution (PJ.11-A4): Airborne Collision Avoidance for General Aviation and Rotorcraft – ACAS Xp.

In 2018, the project PJ.11 CAPITO continued to participate in standardisation activities, in particular EUROCAE and RTCA/EUROCAE meetings to disseminate validation results and analysis. The Solutions PJ.11.A4, PJ.11.A2 and PJ.11-G1 reached TRL 2 maturity level, those three Solutions continue to develop and validate with the aim to complete TRL 4 in 2019. It is to be noted that the project covers a large spectrum of Airspace Users including the Remotely Piloted Aircraft Systems (RPAS), General Aviation (GA), rotorcrafts (R) and military operations (MIL).



Optimised ATM network services

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

The project **PJ.07 OAUO** ‘Optimised Airspace Users Operations’ focuses on flight planning supported by improved trajectory information sharing with ATM as defined in ICAO/FF-ICE and on flight prioritisation processes in capacity constraint situations–UDPP-, and on a step-wise integration of Military operations into civil ATM collaborative processes.

OAUO validates improved Airspace Users Flight/Wings Operations Centres’ processes and tools for Trajectory Definition, Fleet Prioritisation and Preferences, and Mission Trajectory. Objectives include new performance indicators reflecting AUs’ business needs in the ATM performance scheme; technology that drastically reduces the need for Airspace Users to perform labour intensive coordination; and integration of ICAO/ FF-ICE concept in the Trajectory Definition and UDPP processes.

- Solution 07.01 Airspace Users’ Processes for Trajectory Definition is about developing requirements and validating procedures and workflows for Flight Operations Centres, enabling them to interact better with other ATM stakeholders, especially with the Network Manager, with regard to (medium and short term) trajectory definition and Airspace User preference provision. This will also ensure continuity in the CDM process throughout the trajectory lifecycle. For this solution, all V1 documents are produced and approved.
 - 07.01-01 Exercise Run (Expert group V1); (V1 Expert group on Airspace Users Preferences to be included by the AU in the future FPL to support DCB decisions to modify FPLs/Trajectories) is completed in the first quarter of 2018. For V2 maturity,

- intermediate VALP and the second intermediate TS and OSED were delivered. Preparation of iteration 2 and validation platform is done successfully.
- 07.01-02 Iteration 1 Execution; (FF-ICE planning service & Enriched DCB information for AUs: Submission of a preliminary FPL prior to FPL filing Integration of flight planning and flow management information exchanges Standardised DCB/ATM trajectory changes proposal to airspace users Enriched DCB information to AUs on the planned trajectory (hotspots, congestion indicators) Advanced what-if Exercise on NMVP with AU's connected (B2B) is completed.
 - Solution 07.01-02 Iteration 2 a (FF-ICE planning service & Enriched DCB information for AUs: Submission of a preliminary FPL prior to FPL filing Integration of flight planning and flow management information exchanges Standardised DCB/ATM trajectory changes proposal to airspace users Enriched DCB information to AUs on the planned trajectory (hotspots, congestion indicators), Advanced what-if Exercise on NMVP with AU's connected (B2B) is executed.
 - The Solution 07.02 Airspace Users' Fleet Prioritisation and Preferences (UDPP) is designed to smoothly integrate the priorities and preferences of airspace users via collaborative processes at airports and in Network DCB processes, allowing those processes to perform multi-criteria optimisation tasks involving many stakeholders. This solution will also address how airspace users who are not regular users at a given airport can use UDPP. Intermediate documents were delivered in 2018. ECTRL Network V2 Platform (INNOVE) integrated with UDPP server and with ECTL APOC Platform is finalized. A first operational acceptance of the validation platform by the AUs and Airport participants resulted in a NO-GO for the exercise. Improvements to the software components had to be developed and a new version of the platform was installed. At the second Ops acceptance on 4 and 5 December 2018, the green light was finally given by the users AUs and airports for starting the operational validations, there will be 3 validation sessions in 2019.
 - The Solution 07.03 Mission Trajectory Driven Processes develops requirements and validate procedures and workflows for Wing Operations Centres, enabling them to interact better with other ATM stakeholders, especially with the Network Manager regarding the Mission Trajectory. In a first phase the focus will be on harmonising military flight plans and integrating military traffic intentions into the overall European ATM network. Solution 07.03 and Solution 18.01 are working together as one single project: the operational deliverables and the validation are managed by solution 07.03 and the technical and systems aspects are managed by Solution 18.01.
 - VP-07-03-01 Exercise;(Overall the V2 is about the Mission Trajectory Life-Cycle from Planning to Execution which focus on iOAT Flight Plan, integration in NM and sending to ATC centres and the processes between WOC and ATC) is executed at the beginning of the year successfully.
 - Solution 07.03 successfully completed the V2 data pack, passed the maturity gate, and started to work in the V3 phase in 2018. On 15-Nov, the V2-gate of Solution 07.03 took place and the result was a positive outcome. PJ.07.03 is now at level V2 of maturity and will start with preparing V3 exercises the level initial V3. V3 exercise scope definition has been done with NM and partners. NM developments will be included in NM release 23.0. OSED and VALP definition are started and the exercise will take place in May 2019.

The project **PJ.08 AAM** ‘Advanced Airspace Management’ focuses on Dynamic Airspace Configurations (DAC) and Dynamic Mobile Areas (DMA). Compared to today’s airspace scenarios, which by their nature are static, DAC/DMA enable flexible solutions that can be dynamically adapted to traffic demand to respond to different regional/local performance objectives, which may vary in time and place. AAM Partners elaborate the definition of DAC/DMA, the associated data models and operational processes, validate the operational feasibility and assess the performance impact. The readiness for integration of the DAC operational process in the DCB process is also addressed. Automated tools to generate optimum sector design and configurations, as well as DMA optimal location and volume to meet performance targets are developed. AAM supports the SESAR Deployment regulation and addresses European concerns on economic (more efficient use of ATM Network resources) and environmental sustainability (reduced fuel burn and emissions) of Air Transport system.

- Solution 08.01 – Management of Dynamic Airspace Configurations: Key tasks such as Initial OSED, VALP and Initial TS were prepared and delivered according to the Project Schedule. OSED INAPS Requirements (describing the INAP process) DAC Levels redefinition were completed.
 - Exercise PJ.08-01 VP-08-01.04 (DMA type 2 performance assessments in FRA airspace through a gaming experiment using R-NEST and Alrtop simulators) is completed.
 - Exercise PJ.08-01 VP-08-01.05 Execution (Operational feasibility of the DAC concept for FMP till INAP time horizon, with human in the loop, by expert judgement- Operational acceptance and relevance of DAC services to support sectors configuration optimization process.- Technical feasibility and operational assessment of airspace design generated using a flow centric approach)
 - Exercise PJ.08-01 VP-08-01.06 Execution (TAT Session + OAT Training + RTS) (evaluation of DAC concept from the ATCOs perspective) is completed.
- Solution 08.02 – Dynamic Airspace Configurations supporting Moving Areas: the only task of the Solution is to develop Moving Hazard Zones’ scope assessment study that evaluates the MET Gate data content to be used to determine the initial implementation of the moving hazard zones concept. The assessment also focus on the state of the DAC framework providing necessary recommendations for Wave 2 is started in the last quarter of 2018. Initial Study Report is completed and delivered. Evaluation of tool to be used almost completed for use (validation) in Q1/2019.

The project **PJ.09 DCB** ‘Advanced DCB’ evolves the existing DCB process to a powerful distributed network management function, which takes full advantage from the SESAR Layered Collaborative Planning, Trajectory Management principles and SWIM Technology to improve the effectiveness of ATM resource planning and the network performance of the ATM system in Europe.

- Solution 09-01 – Network Prediction and Performance develops shared situation awareness with respect to demand, capacity and performance impacts. Traffic and demand forecast have improved reliability based on complexity assessment and the computation of confidence indexes. Network Operations will be continuously monitored through Network Performance KPA/KPI. Network impact assessment will analyse trade-offs and facilitate collaborative decision making processes. The key deliverables, such the Interim OSED, second iteration of the VALP and Initial TS have been delivered. The validation exercises and their supporting activities (ACT-09.01-01, EXE-09.01-02, EXE-09.01-03 and ACT-09.01-04) were progressing well for all three concept elements: demand prediction, complexity assessment and network performance management. In June 2018, the team successfully conducted first

major human-in-the-loop exercise EXE-09.01-02 with FMPs from ENAIRE, DSNA and NATS. The main objective was to validate the new probabilistic demand prediction algorithm, assess different ways of visualising the demand uncertainty & complexity to FMPs. In September 2018, the Solution 1 team has also kicked-off the preparation for the final human-in-the-loop (HIL) exercise, EXE-09.01-05. The prototyping and NM system developments are started. The following exercises are completed;

- VAL912 Exercise Execution: Demand and Imbalance Prediction
- VAL913 Exercise Execution: Traffic Complexity Prediction
- VAL915 Exercise Execution: Network Performance Measurement and Supervision is under preparation.
- Solution 09.02: Integrated Local DCB Process forms the core functionality of the INAP process (everything which can and should be decided locally. Solution PJ.09-02 is the logical follow-up of the SESAR1 Local DCB toolset. It includes: INAP management, ASM integrated into DCB, reconciliation of DCB measures with local complexity management, ATC and Arrival Management. The solution addresses the integration of Local Network Management with extended ATC planning and arrival management activities in the short-term to execution in a seamless process. After performing the first round of exercises in EXE-09.02-03, it was decided to split the exercise itself into two phases. The first phase was accomplished during the 4Q2018. Phase 1 validated the INAP concept and its implementation in local platforms. During the execution of the exercise, some incidents related to the communication with the INNOVE platform as well as some usability problems related to the local tools were identified. PJ.09 and the exercise teams have decided to perform a second round (phase 2) of the exercise during 1Q2019 to further continue the validation of the INAP concept. The following exercises are completed;
 - VAL921 Exercise Execution: INAP Processes and Knowledge Management
 - VAL922 Exercise Execution: Initial INAP (DCB/ATC link)
 - VAL923 Exercise Execution: DCB/ASM Integration and DCB/AMAN/A-CDM consolidation is under execution.
- Solution 09.03: Collaborative Network Management delivers subsidiary Network Management facilitated by a rolling NOP planning environment (including weather, demand pattern and capacity bottlenecks). Network Operations planning and Execution is managed by an agreed set of rules and procedures, guiding subsidiary DCB and UDPP measures under consideration of trade-offs and network performance targets. Collaborative 4D constraints management integrates AUs priorities and reconciles DCB measures with Airports, ACCs, AU and NM.
- Successful iterations of validation exercise (09.03-02 Collaborative NOP - iteration 1.b and 2.a), a successful gaming exercise for EXE 09.03-01 Collaborative DCB Framework and the core optimiser development for EXE 09.03.03 were executed. Deliverables (intermediate version of OSED, VALP and TS) have been produced and delivered.
 - VAL931 Exercise Execution: Collaborative DCB Framework is under execution.
 - VAL932 Exercise Execution: Rolling AOP/NOP Core Functions is under preparation.
 - VAL933 Exercise Execution: Const Reconciliation algorithm is under execution.



Enabling aviation infrastructure

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

The project **PJ.14 EECNS** ‘Essential and Efficient Communication Navigation and Surveillance Integrated System’ is an Enabling Infrastructure project that aims at providing an advanced, integrated and rationalised aviation infrastructure for Communication, Navigation and Surveillance (CNS). It provides the underlying technical capabilities to meet the required operational improvements in support of Optimised ATM Network Services, Advanced Air Traffic Services and High-Performance Airport Operations key features.

The 11 solutions addressed by PJ.14 EECNS cover:

- Solution PJ.14-01-01: CNS Environment Evolution will provide an integrated, global view of the future Communications, Navigation and Surveillance services. This would include: The evolution, Strategy and Roadmap for an Integrated CNS; Identify current CNS requirements; Assessing cross-domain CNS vulnerabilities; Identifying short-term and long-term CNS evolution for both ground and airborne system; Defining the future integrated CNS architecture; Defining the integrated CNS spectrum strategy; Identifying areas where the CNS efficiency could be improved; Ensure Civil-Military CNS interoperability.
- Solution PJ.14-02-01: FCI Future Terrestrial Data Link has the objective to develop and standardise the candidate future terrestrial data link system LDACS. The goal of this solution is to finalize the development and standardization of the LDACS technology. This includes security and digital voice concepts, and will contribute to the development of a harmonized global standard.
- Solution PJ.14-02-02: Future Satellite Communications Means (data link) is focused on the near and long satellite data link technologies for both continental and oceanic regions. It will also include digital voice as an element of the Future Communications Infrastructure (FCI). The main objectives include: Compliance with ATN baseline 2 requirement (especially Real time sharing of 4D trajectories); Development of technical specifications and validation procedures for Long Term SATCOM for ATM/Iris (class A SatCom) integrated in the FCI (IPv6 and ATN/IPS with multilink policy) and taking into account a seamless transition from SESAR baseline and considering the intermediate step of the i4D based on ESA Iris Precursor solution (Class B); Technical validation of satellite Air-Ground Datalink for Long Term SATCOM integrated in the FCI (ATN Baseline 3, ATN/ IPS, multilink); Standardization at global level (ICAO, EUROCAE) of proposed solution for Long Term SATCOM; validation to V2 in wave 1 followed by V3 validation in wave 2. There will be strong coordination with ESA Iris Programme and the reuse and consolidation of the ESA Iris programme prototypes where possible
- Solution PJ.14-02-04: FCI Network Technologies incl. voice solution and military interfacing seeks to develop and standardise the FCI elements that integrate all the future terrestrial data link systems. LDACS, SatCom and AeroMACS, delivered respectively by solutions PJ.14-02-01, PJ.14-02-02, and PJ.14-02-06. In addition, this solution will address transversal topics including security, safety, and civil- military interoperability with ground/ground communications networks. The solution will demonstrate support of symmetric communications via multi-link to a mobile end system (e.g. airplane) by means of LDACS, AeroMACS, and SATCOM data links. This will be validated by demonstration of 4D-trajectory based/sector-less operation in both laboratory and (emulated) mobile environments.
- Solution PJ.14-02-05: Development of new services similar to FIS-B to support ADS-B solutions for General Aviation. The solution will investigate suitable means to provide

supplementary information for GA and thus, to increase safety particularly in mixed traffic environments. This includes the use of an appropriate infrastructure (3G/4G/5G) as well as the bundling and provision of additional services (FIS [Weather/NOTAM/etc.] and TIS) to GA.

- Solution PJ.14-02-06: Completion of AeroMACS Development. The primary objectives of this activity are to integrate and verify the AeroMACS Data Link with ATN services, both at ground and on-board. Initially ATN/OSI will be considered, while ATN/IPS will be verified subsequently, in line with the ICAO roadmap. The AeroMACS A/G datalink will also be integrated with the multilink environment, with the definition and potential implementation handover from AeroMACS to VDL2 during take-off, and vice-versa during landing. The Network and Security System requirements will be finalised, also in relation to multilink. A digital voice communications solution over AeroMACS (VoIP) will be finalised and verified. The solution will also support the standardization process providing input to, and aligning with, the relevant standardization activities in ICAO, EUROCAE/RTCA, AEEC, ETSI, and WMF. AeroMACS is expected to reach a V3 maturity level within Wave 1.
- Solution PJ.14-03-01: GBAS. The objective is to advance GBAS as a technical enabler and to take advantage of the operational benefits that GBAS can provide. The operational benefits include: Capacity increase in low visibility conditions; Shorter routes and fuel-saving approaches, providing cost-savings, less emissions and noise; Provide precision approach on runways where ILS is not feasible
 - The GAST D-related activities in PJ.14-03-01 aim to further mature GBAS to address conditions outside the mid latitudes, to meet the requirements of a globally deployable system. It will also develop and validate the infrastructure needed for operations on complex airports.
 - The plan for the GAST F activities is to provide initial standards to address multi-constellation/multifrequency GBAS, to provide enhanced robustness, especially against challenging aspects of the ionosphere environment.
- Solution PJ.14-03-02: Multi Constellation / Multi Frequency (MC/MF) GNSS. The objective of solution is the maturation of the framework and the technical enablers so that GNSS receivers processing any constellation(s) in Multi Frequency can be developed to support the different foreseen expectations from the deployment of GNSS navigation taking profit of multiconstellation and multifrequency. The operational benefits remaining to be identified shall be further assessed, but it is expected that MC/MF GNSS/SBAS would contribute to support: PBN; Approaches with horizontal and vertical guidance; Surveillance (ADS-B); 4D concepts; Autoland capability; Lower minima SVGS operations; Surface movement; Ground infrastructure rationalization.
- Solution PJ.14-03-04: Alternative Position, Navigation and Timing (A-PNT). The objective is to develop an A-PNT system as a technical enabler to support PBN/RNP operations in case of a GNSS degradation or outage. The solution aims to provide both a feasible short term solution and a long term improvements to support more demanding operational positioning and navigation requirements.
 - The short term work will seek to enhance legacy technologies (e.g. DME, IRS), and hence make use of existing infrastructure and equipage.
 - The medium term will investigate the possibility to improve DME based localization algorithms in the airborne FMS to fully support the OBPMA integrity requirements defined for a RNP navigation specification in the PBN manual.

- For the long term upgrade, new technologies (e.g. LDACS, eLoran) will be studied. A goal will be to improve the performance while increasing spectrum efficiency and creating synergies.
- Solution PJ.14-04-01: Surveillance Performance Monitoring. The objective is to enable a harmonised performance monitoring of surveillance systems. Such monitoring will seek to identify degradation trends early, using both off-line and in continuous quasi real-time processes. The specification of surveillance performance monitoring tools supporting both Cooperative and Non-Cooperative surveillances techniques are addressed by this Solution (Ground-based and Space-based, ADS-B, WAM, MLAT, SMR), covering en-route, TMA and Airport surface and the surveillance monitoring performance will be applied both at sensor level and at the output of the entire surveillance chain (“End-to-end”). The solution targets at the end of wave 1 Maturity V2 for Cooperative Sensor level (WAM, ADS-B and MLAT) and V1 for Non-Cooperative Sensor level and “End-to-end”.
- Solution PJ.14-04-03: New use and evolution of Cooperative and Non-Cooperative Surveillance. The objective of this solution is to address the separate evolution of non-cooperative surveillance systems like MSPSR and Video Trackers, and cooperative surveillance systems such as ADS-B, Airport and Wide Area Multilateration (MLAT/WAM) systems. New systems like MSPSR, and additional functionalities for cooperative sensors, such as security screening and reporting methods will be demonstrated in real environments. Evolution of ADS-B datalink and the exchange of data between sensors, and composite surveillance are planned to improve sensor ambiguity resolution performance. A dedicated task will adapt multi sensor tracker systems for the new input data characteristics and implement additional functionalities on multiple platforms. The solution will demonstrate the achievement and proposed improvements using one or more prototypes in real environment.

In 2018, all solutions remain on schedule and within expectations. Key deliverables within the reporting period for the transversal Solution 14.01.01 CNS Environment Evolution include, the second release version of the “CNS Evolution, Roadmap and Strategy” accompanied by a CNS Evolution Workshop. Another key deliverable was the first release of the Performance Based integrated CNS.

From the 5 Communication related solutions, the following key points include: for “Solution 14.02.01 FCI Terrestrial Data Link”, the PMP the LDACS A/G Specification and LDACS deployment report is superseded by the first version of the LDACS Technical Specification-Interface Related Requirements (TS-IRS). For “Solution 14.02.02 Future SATCOM datalink”, interaction with ESA is ongoing and a first version of an SATCOM Initial Technical Specification (TS-IRS) coordinated. The “Solution 14.02.04 FCI” TRL2 Data Pack was approved including the Initial Concept Description, FRD and Identification of potential benefits and risks. Solution 14.02.05 New Services for GA is back on schedule and their V1 Data Pack approved, including their FRD, OSED and VALR. The last COM “Solution 14.02.06 Completion of AeroMACS” provided an Interim TS/IRS, Interim VALP and updated standardisation report.

From the three Navigation-related Solutions, the key points of progress include: for “Solution 14.03.01 GBAS”, for the extended scope of GAST D remains on schedule along with GAST F (MC/MF) developments. The “Solution 14.03.02 MC/MF GNSS” provided the TS/IRS and VALP for TRL4 and showed progress in the prototype developments. The “Solution 14.03.04 A-PNT” now addresses short term solution for DME/DME (towards TRL6), Mid-Term solution for Airborne Multi DME Architecture (towards TRL4) and Long Term (towards TRL2).

From the 2 Surveillance related Solutions, the key progress include: for “Solution 14.04.01 SPM”, the TS/IRS was submitted and approved and the identification of an additional Data Pack. For the “Solution 14.04.03 on the evolution of C and NC Surveillance”, has provided an updated TS/IRS and VALP.

The project **PJ.15 COSER** ‘Common Services’ concerns the implementation and validation of a series of independent common services solutions:

- Solution PJ.15-01. Sub-Regional Demand Capacity Balancing Service
- Solution PJ.15-02. Extended-AMAN
- Solution PJ.15-08. Trajectory Prediction Service
- Solution PJ.15-09. Data Centre Service for Virtual Centres
- Solution PJ.15-10. Static Aeronautical Data Service
- Solution PJ.15-11. Aeronautical Digital Map Service

In 2018, the project PJ.15 work was on-going and all solutions except one common service 15.09 reached TRL level 2 maturity. They did this by presenting a business model and high-level architecture including the analysis of different options of these architectures. Once achieved the project continued its way to develop and validate solutions with the aim to achieve TRL 4 or TRL 6 in 2019.

The solution 15.09 was reoriented so to bring it closer to the development of the technical services that are being done in the project PJ.16 solution 16.03 who is researching the technical capability to transfer data between geographically separated data service providers and ATSUUs using interoperable services and (to-be) standardised service interfaces. Concretely this means that the projects was asked to work out and develop operational requirements related to the capability to support the delegation of airspace and contingency use cases by extending the ability to exchange data between centres.

The project **PJ.16 CWP/HMI** concerns two distinct and independent solutions:

- Solution 16.03 - Virtual Centre: researching the technical capability to transfer data between geographically separated data service providers and ATSUUs using interoperable services and (to-be) standardised service interfaces.
- Solution 16.04 - HMI CWP: brings together a series of various HMI CWP technologies / improvements

In 2018, work was on-going and could be summarised as follows:

- 16.03: succeeded to create a common view and realistic roadmap to make progress on the complex and ambitious topic. This was done by involving intensively all partners in and outside the project via several well organised workshops. The project reached TRL 2 in the autumn of 2018 while at the same time developing, preparing and validating researched work at the level of TRL 4. The forecast is that the TRL level 4 will be obtained in March 2019 while TRL level 6 will be fully or partially reached by end 2019.
- 16.04 (HMI CWP): succeeded bringing together a series of various HMI CWP technologies and improvements. The solution reached TRL 2 in the November 2018 while at the same time developing, preparing and validating researched work at the level of TRL 4. The forecast is that the TRL level 4 will be reached in 2019

The project **PJ.17 SWIM-TI** ‘SWIM Technical Infrastructure’ (SWIM) relies on a network of SWIM nodes (also called ‘ATM intranet’) which dramatically reduces the number of interfaces, decouple the information providers from the information consumers, and capitalize on open standards. At the SWIM nodes, SWIM-enabled applications use interoperable services to exchange information conveyed through a SWIM Technical Infrastructure (SWIM-TI) middleware based on an IP-based network.

The three PJ.17 solutions build on the SESAR 1 results to extend the SWIM-TI (which will be a key communication enabler for other SESAR 2020 solutions) include:

- PJ.17-01 “SWIM-TI Purple Profile for Air/Ground Advisory Information Sharing” will support ATM operational improvements that depend on Air/Ground (A/G) information exchanges to enable a better situational awareness and collaborative decision making, with a focus on advisory information. The targeted maturity level in wave 1 is TRL6. The Data Pack will be made available to the SESAR Deployment Manager to complement the initial European SWIM Infrastructure (iSWIM) components. This will enable in particular operational applications to uplink meteorological or aeronautical information using SWIM. Solution PJ.17-01 will also anticipate the Air/Ground Safety-Critical Information Sharing (“Feasibility Study for Air/Ground SWIM for Safety Critical Information sharing (PJ.17-07) task”. This objective was not applicable in this reporting period (introduced in the 2nd Grant Amendment).
- PJ.17-03 “SWIM-TI Green Profile for G/G Civil Military Information Sharing” will focus on the evolutions to be implemented and the constraints (e.g. in the cyber-security area) to be taken into account for connecting SWIM networks used by the civil ATM community to military networks. The interconnection of these networks will contribute to increase collaboration between the civil ATM community and the military stakeholders, as pointed out in the European ATM Master Plan. PJ.17-03 contributes to the interconnection of the civil and military domains on top of the civil IP network infrastructure, therefore at middleware level (transport and application messaging). The targeted maturity level in wave 1 is TRL4. This TRL4 Data Pack will become the first baseline technical specification for SWIM systems supporting civil-military communications.
- PJ.17-08 “SWIM-TI Common Runtime Registry” will extend the work done in SESAR 1 on the Design-Time Registry to the Runtime Registry which is needed for late binding to SWIM services, provision of routing information to SWIM services, provision of SWIM service status information and lookup of policies. The targeted maturity level in wave 1 was modified from TRL6 to TRL4 (partial) due to the need for operational requirements and closing early 2019, with an associated release of budget. A Technical Specification and OSED will be available within the Data Pack.

The project **PJ.18 4DTM ‘4D Trajectory Management’** deals with several different and independent types of solutions all related to 4D Trajectory Management: long term ATM Solution such as Trajectory Based Operations (TBO – Solution 18-02a) as well as various technological Solutions (such as Interoperability, Aeronautical Information Management, Meteorology or Enhanced Trajectory Predictor) are progressed towards various maturity levels. It has to be noted that in 2018, following the Project Review, the following changes were agreed:

- Solution 18-01 has been deleted and transformed into 2 set of activities supporting respectively Solution 07-03 and Solution 18-02a.
- Solution 18-02 has been split into
 - one ATM Solution (18-02a for Trajectory Based Operations) and
 - two Technological Solutions (18-02b for Fight Object INTEROPERABILITY IOP, and 18-02c for eFPL Supporting SBT Transition to RBT)
- Solution 18-04 has been split into three technological solutions
 - 18-04a dealing with Aeronautical Information Management (note that a set of activities are also supporting other solutions);

- 18-04b dealing with Meteorological solution (note that a set of activities are also supporting other solutions);
- 18-04c dealing with MET and AIM information services in the aircraft information domain;
- Solution 18-06 has been split into 2 technological solutions
 - 18-06a dealing with Air Traffic Control (ATC) Planned Trajectory Performance Improvement, and
 - 18-06b dealing with Tactical and Network Manager (NM) Trajectory performance Improvement.

All solutions progressed their respective activities performing eight validation exercises and delivering 18 deliverables in preparation for respective Maturity Gates that are mainly planned in 2019 (except for Solution 18-02b FO IOP which is planned for September 2020). The developments of the IOP are subject of a close monitoring by the Programme Committee and therefore, further information on activities carried out on the IOP Solutions can be found above in the paragraph 2.1.5.3 related to the Programme Committee contributions to SESAR 2020.

2.3.1.2 Wave 1 grant budget amendment

In 2018, the SESAR JU applied the approved grant amendment procedure for adjustment of maximum grant amount and associated EU contribution. Since the first IR/VLD call for proposals (Wave 1) had a total value of EUR 260,075 million and the available funding for grants awarded before 2017 was limited to EUR 50 million (+EUR 1,47 million EFTA contributions), this grant amendment procedure was introduced in the Amendment 1 to the Annual Work Programme 2015, adopted by the Administrative Board on the 23 October 2015. This procedure, further detailed in Section 3.5.1 of the amended Annual Work Programme 2016 and in Section III paragraph 3.1.6 of the Single Programming Document (SPD) 2017-2019, was followed in order to amend all grant agreements under the call for proposals H2020-SESAR-2015-2. The process can be depicted as follows:

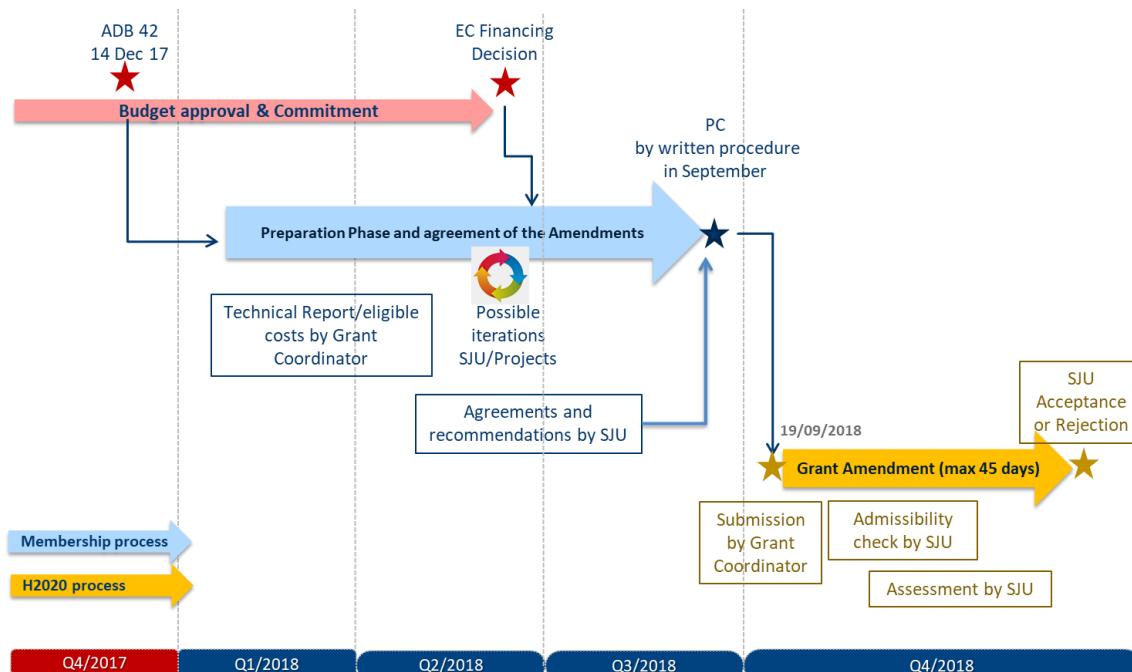


Figure 15: Grant budget amendment process overview in 2018

It consisted of the following phases:

- Phase 1: Preparation phase and agreement of the amendments:
 - The SESAR JU has requested from each Action a specific report detailing the technical results and eligible costs incurred for the Action activities undertaken with the initial grant amount (tranche of funding) based on:
 - For 2018: the available deliverables (e.g. ethics and PMP) or
 - For 2019 onwards: the technical and financial reports stemming from the previous reporting period.
 - The projects were entitled to request up to the maximum EC contribution (following evaluation) except in cases where project are releasing budget.
 - In the light of the technical and financial results of the work previously done in each Action, and the proposed allocation of additional budget calculated by each project, the SESAR JU and its Members have discussed and agreed, in the context of the governance arrangements foreseen in the SESAR 2020 Membership Agreement (in particular the PC and the DMSC), the update of next set of activities of the selected proposals to be performed and the allocation to be effectively awarded as additional budget to each Action within the limits of the total maximum additional budget available.
- Phase 2: Formal H2020 Budget Grant Amendment phase
 - After completion of this preparatory process, the standard H2020 grant amendment process has been initiated by the grant coordinators. The content of the amendments corresponded to the technical and budgetary outcomes of the 2nd phase. The process has been documented in the H2020 tool Compass/Sygma with specific supporting documents.
 - The Members have been invited to sign the grant amendments to increase the grant amount up to the level decided after the evaluation.

The total amount of budget increase resulting from Wave 1 of grant budget amendment in 2018 has been EUR 90.765.748,86 EUR (for all Wave 1 projects). The updated total maximum EU co-financing for IR projects (including the transversal activities PJ.19, PJ.20 and PJ.22, see chapter 2.1) amounts to EUR 206.709.765,25 broken down per project as follows:

Project Acronym	Max. total EU co-financing value (EUR)
PJ.02 EARTH	15.592.782,56
PJ.03a SUMO	12.925.436,15
PJ.03b SAFE	8.228.382,22
PJ.04 TAM	8.802.429,88
PJ.05 Remote Tower	9.013.121,17
PJ.07 OAUO	2.247.335,66
PJ.08 AAM	2.738.348,92
PJ.09 DCB	6.899.246,93
PJ.01 EAD	17.521.363,86
PJ.06 ToBeFREE	6.029.408,15
PJ.10 PROSA	26.388.518,93

PJ.11 CAPITO	5.073.600,91
PJ.14 EECNS	22.970.581,14
PJ.15 COSER	5.349.616,86
PJ.16 CWP HMI	12.742.753,83
PJ.17 SWIM-TI	9.386.744,41
PJ.18 4DTM	22.193.941,15
PJ.19 CI	7.227.142,34
PJ.20 AMPLE	3.327.676,40
PJ.22 SEabird	2.051.333,78

Table 3: Updated maximum EU co-financing as a result of the grant budget amendment for IR and TA projects

2.3.2 SESAR Solutions delivery: the Release process in 2018

2.3.2.1 Release 7 outcome

The Release 7 was launched into execution early 2017 and concluded by April 2018. Its final scope covered the development and validation of 12 SESAR candidate Solutions, of which two in V3 maturity level and 10 up to V1/TRL2 maturity level, allowing the projects to further develop the Solutions up to the V2/TRL4 maturity level in the context of future Releases.

Solution ID	Solution Name and description	Maturity Level
	 High-performing airport operations	
PJ.03b-06	<p>Safety support tools for runway excursions:</p> <p>Safety support tools for runway excursions provide controllers and/or pilots with the appropriate alerts where there is a risk of runway excursion (take-off and landing).</p> <p>Enhanced runway condition awareness for the Airport Operator, using data from the following external sources:</p> <ul style="list-style-type: none"> • Runway built-in sensors; • weather-based runway condition model; • aircraft on-board sensors providing runway friction data. <p>Expected performance benefits:</p> <p>The solution aims at improving safety by reducing the number of runway excursions and the airport capacity in ensuring keeping continuous traffic throughput.</p>	V1
PJ.04-02	<p>Enhanced Collaborative Airport Performance Management:</p> <p>Enhanced Collaborative Airport Performance Management 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,</p>	V1

Solution ID	Solution Name and description	Maturity Level
	<p>taxiway and runway capacities, and taking into account the prevailing and/or forecast weather and other operational conditions.</p> <p>Expected performance benefits:</p> <p>The solution aims at improving airport punctuality and resilience by reducing the delays at departure thanks to a better prediction of events (especially MET impact), anticipation of degraded situations and quicker solution finding to degraded performance with the use of pre-defined solutions.</p>	
Solution #117	<p>Reducing Landing Minima in Low Visibility Conditions using Enhanced Flight Vision Systems (EFVS):</p> <p>While key main airports are capable of Type B landing operations (CATII or CATIII) with typical published minima of 100ft DH - RVR 300m, which allows facing to most adverse weather conditions that can be encountered in day to day operations, most of small/medium airports are only capable of Type A landing operations with typical 300ft DA/ DH - RVR 800m minima, which potentially limit their access during winter period and early in the morning.</p> <ul style="list-style-type: none"> • The “Enhanced Flight Vision Systems (EFVS)” displays a real time image of the external scene that gives a visual advantage to the pilot and improves his capability to detect required visual references that may not otherwise be visible using natural vision in some degraded weather conditions. The image delivered by the EFVS is displayed conformal to the real world in Head Up. • A unique advantage of the EFVS on board solution is that it is mainly supported by the aircraft system instead of airports and the need of complex and costly ground infrastructures as those implemented in CATII/III airports. • From a global ATM network standpoint, the EFVS operation allows to retain traffic at most of secondary aerodromes by providing operational credit at most of runway ends with precision or non-precision landing minima. The operational credit provided by EFVS is particularly important regarding secondary aerodromes because they usually have CAT1 or higher than CAT 1 RVR – DA/DH minima and are therefore potentially more frequently impacted by adverse weather conditions. • In addition, EFVS capability is a key operational advantage more especially for the business aviation community that is mainly composed of small/ medium operators with limited resources and operating frequently at small/ medium airports. Beyond operational credit, the Vision Systems such as the EFVS improves situational awareness in all weather conditions for all operators at all airports contributing supporting decision making and increasing safety margin all the time. • On the aerodrome/ATC side, adaptations are necessary to allow these operations in low visibility conditions. Adaptations are comparable to those existing for low visibility take off and should be therefore financially affordable by small and medium aerodrome. • Enabling EFVS operations with operational credits provides a greater availability of suitable destination and alternate aerodromes during periods of reduced visibility. 	V3

Solution ID	Solution Name and description	Maturity Level
	<ul style="list-style-type: none"> This effectively reduces the number of weather-related delays, cancellations or diversions of flights to CAT II/III aerodromes, and allow a faster return to scheduled operations and less passenger inconveniences. <p>Expected performance benefits:</p> <p>The solution aims at improving access to secondary airports in low visibility conditions, which could help alleviating congestion at nearby main hubs. The solution also intends to improve fuel efficiency by reducing the number of diversions and go around.</p>	
PJ.01-03a	<p> Advanced air traffic services</p> <p>Improved Parallel Operations:</p> <p>“Improved parallel operations” improves parallel approach operations through the application of PBN/RNP navigation specifications and the development of enhanced ATC procedures. The Solution will provide alternative options for independent parallel operations in medium to high density TMAs, using RNP to replace in particular vectoring to final intercept with closed loop routes and associated operating methods.</p> <p>Expected performance benefits:</p> <p>The expected benefits of this solution are mainly related to higher TMA airspace capacity thanks to the increased throughput based on the parallel runway operations, improved fuel efficiency (and reduced environmental impact) with more precise approach path and safety.</p>	V1
PJ.06-02	<p>Management of Performance-Based Free Routing in Lower Airspace:</p> <p>Management of Performance-Based Free Routing in lower airspace sees the application of FRA for airspace users beyond the PCP expectations (below FL310), improving predictability, efficiency and flexibility for a wider range of different airspace users.</p> <p>Expected performance benefits:</p> <p>This solution aims at improving fuel/flight efficiency and environmental sustainability in allowing Airspace Users to fly trajectories closer to their business needs.</p>	V1
Solution #118	<p>Basic Extended ATC Planning function:</p> <p>The “basic Extended ATC Planner (EAP)” aims at bridging the gap between Air Traffic Flow and Capacity Management (ATFCM) and Air Traffic Control (ATC) providing real-time and fine-tuning measures to solve ATFCM hotspots and to perform early measures to alleviate complexity closest to ATC activities.</p> <ul style="list-style-type: none"> The solution consists of an automated tool and associated procedures supporting the basic communication between the Local DCB position and the Controllers' Work Positions allowing the EAP and the ATC team in identifying, assessing and resolving local complexity situations. The basic EAP relies on a real time integrated process for managing the complexity of the traffic with capability 	V3

Solution ID	Solution Name and description	Maturity Level
	<p>to reduce traffic peaks through early implementation of fine-tuned solutions to solve workload imbalances at the local level, compatible with the short term timeframe of execution phase of the flights.</p> <ul style="list-style-type: none"> The basic EAP concept introduces also a new role, the EAP role (Extended ATC Planning), which is intended to fill the gap between ATFCM and ATC: <ul style="list-style-type: none"> The EAP is not an additional staff: it is a role covering a set of services/functions that can be assumed by different personnel of the ATSU (already existing actors, like TC or new actors like MSP or LTM); It is highly recommended that the EAP is holding or has held an ATCO rating in the relevant ATSU's airspace <p>Expected performance benefits:</p> <p>The main benefits expected from the basic EAP function are mainly:</p> <ul style="list-style-type: none"> To help providing a better service to airspace users through reduced delays, better punctuality, less ATFCM regulations, whilst maintaining or even increasing safety. To increase the controllers' productivity contributing thus to increase the overall en-route capacity of the ACC. 	
 Enabling aviation infrastructure		
PJ.15-01	<p>Sub-regional Demand Capacity Balancing Service:</p> <p>The objective of the solution is to define and develop the Sub-Regional Demand Capacity Balancing service. The service focuses on the sub-regional element of the Network Management Function (NMF), supporting planning and execution time frames with the objective of validating the cost benefits of common service supply to multiple consumers.</p> <p>Expected performance benefits:</p> <p>The solution aims at improving usage of the airspace at sub-regional level and facilitate tactical interventions when necessary, ensuring that any potential disruptions could be correctly managed.</p>	TRL-2
PJ.15-02	<p>Delay Sharing Service:</p> <p>The Delay Sharing Service described in PJ.15-02 provides functions necessary to operate Arrival Management with an extended horizon (XMAN, Cross Border Arrival Management) in an environment where multiple actors are involved e.g. multiple Airports, AMANs, ACCs, UACs and NM. PJ.15-02 will describe ways of improved overall cost effectiveness for delivering the necessary capability to the stakeholders involved.</p> <p>Assuming that providers are capable of a provision of E-AMAN, based on a SWIM foundation, deploying this common service results in:</p> <ul style="list-style-type: none"> The requirement to deploy fewer engineered capabilities; 	TRL-2

Solution ID	Solution Name and description	Maturity Level
PJ.15-08	<ul style="list-style-type: none"> Service improvement roadmap across Europe is consistent and the associated costs are spread across common service ANSP consumers. <p>Expected performance benefits:</p> <p>The solution aims at improving cost-efficiency thanks to reduction of the cost of deployment because a lower number of system needs to be implemented and the reduction of the yearly operating costs because a lower number of technical systems needs to be securely maintained in operation.</p>	
PJ.15-10	<p>Trajectory Prediction Service:</p> <p>Fundamental SESAR concepts rely upon a consistent and appropriately accurate view of trajectories being presented to various geographically separated actors in varying time frames. There are numerous means of achieving this objective; however the Trajectory Prediction Service solution aims to define the minimal set of features that would enable the essential interoperability without unnecessarily restricting implementation. Further, the solution will develop and demonstrate – through validation activity – the cost efficiencies gained by adopting a common service approach amongst a number of consumers.</p> <p>Expected performance benefits:</p> <p>The solution aims at improving cost efficiency through economy of scales with the provision of commonly required capabilities for the 4D trajectory information sharing.</p>	TRL-2
PJ.15-11	<p>Static Aeronautical Data Service:</p> <p>Static Aeronautical Data Service is key for most of the operations related to the trajectory. This solution provides static aeronautical data in digital form to be used by different ATM systems. The output is an AIXM-compliant dataset whose subsets can be retrieved by individual requests demanding specific geographical areas, attributes or functional features.</p> <p>Expected performance benefits:</p> <p>This Common Service expected benefits are higher cost efficiency since it expects to reduce the operating costs of using the Static Aeronautical Data.</p> <p>Aeronautical Digital Map Service:</p> <p>Aeronautical Digital Map Service is key for most of the operations related to the ATM HMIs. The Service collects aeronautical data from authorised sources, filters them and produces individual graphical maps depending on the specific usages as geographical area or system functionality. In this sense, configuration management tools should be implemented to better satisfy the consumers requirements.</p> <p>Expected performance benefits:</p> <p>This Common Service expected benefits are higher cost efficiency since it expects to reduce the operating costs of using the Aeronautical Digital Map.</p>	TRL-2

Solution ID	Solution Name and description	Maturity Level
PJ.17-08	<p>SWIM TI Common runtime registry:</p> <p>SWIM TI Common runtime registry facilitating the definition of the interfaces for publication, look-up, management and network of registries as well as the definition of non-functional requirements.</p> <p>Expected performance benefits:</p> <p>The SESAR solution aims at improving safety/resilience by allowing the user to switch to an alternative service in case the primary service fails.</p>	TRL-2

Table 4: Outcome of the Release 7

In relation with the outcome of Release 7, three VLD projects successfully performed initial iterations of their demonstrations activities, providing initial results that will be further consolidated with Release 8 and Release 9 results:

The VLD project **PJ.24 NCM** ‘Network Collaborative Management’ executed initial demonstration activities. In particular:

- DEMO EXE#4 Iterations 1 and 2: The initial results showed that the Collaborative Advanced Planning (CAP) process is favourably accepted by FMP (and AUs): it is coherent with FMP work and it is assessed as having a beneficial impact on ATFCM network measures, collaborative decision making (CDM) and regulations management. FMPs assessed it as very positive and beneficial for AUs thanks to reduction of delays and decision making taking into account AUs constraints and business needs. Consequently, CAP seems to improve, optimize and bring benefits to the network. However, this new process requires new methods, working procedures and interactions between ATM actors in order to reach full efficiency. The CAP process needs to be improved, namely the induced workload and the need to speed up the process with an additional tool to ease the selection of candidates for CAP proposals.
- DEMO EXE#6 Iteration 1: In general, the results obtained after this first run were very positive. The situation awareness increased but further data is needed to have a better understanding of the situation regarding transparency and involvement of the AUs. CAP processes and procedures were in line with the operating methods. FMPs reported either no significant impact on their current activities or, to a lesser extent, a positive impact. There was a decrease regarding the number of regulation declared once using CAP process. No negative impact could be measured regarding fuel consumption with the data gathered. Because of the use of the proposed tool, the workload, stress level, etc. are incremented at least for the FMP not used to work with it. However, benefits obtained make acceptable this increment.

The VLD project **PJ.25 XSTREAM** ‘Cross Border SESAR Trials for Enhanced Arrival Management’ performed the first live trial of EXE-VLD-WP7-1 “Collaborative extended arrival sequence” between Orly and Charles de Gaulle airports and Paris ACC. This exercise took place from July to September 2017 in Paris area, and the initial results showed:

- A significant decrease in additional airborne time per flight (90s in average during the targeted peak) and holdings;
- An optimal and continuous runway feed (capacity improvement);
- Very positive feedback from all ATCOs and Paris FMP;
- Positive feedback regarding the electronic coordination of speed requests.

The VLD project **PJ.31 DIGITS** 'Initial Trajectory Information Sharing', in its early phase, performed DEMO 1, a test flight to download ADSC data to MUAC, from September 2016 to June 2017.

- The first exercise (Production Flights) has been successfully completed. This exercise consisted on collecting ADS-C data with Airbus aircraft production flights between Hamburg and Toulouse.
- Also, the second exercise (Simulator Session) has been initiated, consisting on end-to-end verification and validation of the DIGITS infrastructure and operational procedures. Successful simulator coupling has been achieved between EUROCONTROL-EEC & PJ.31 ANSP partners and between Airbus & PJ.31 ANSP partners using the last updated software release. The test sessions included ADS-C contracts establishment associated with EPP exchanges as well ADS-C non-nominal situations. These simulators coupling sessions have been performed over SITA CSP operational ATN VDL Mode 2 infrastructure.
- Thanks to the positive simulator sessions, the validation stage using Airbus development aircraft has been launched. A first successful coupling with an Airbus development aircraft on ground and EUROCONTROL-EEC has been performed, followed by a first successful flight with an Airbus development aircraft and EUROCONTROL-EEC.

2.3.2.2 Release 8 execution

The Programme Committee approved the Release 8 Plan at its session on 6 March 2018, launching the Release 8 into execution until 2019. The Release 8 covers:

- 11 SESAR Solutions that expect to achieve V1/TRL2 in the course of Release 8 timeframe through different validation exercises and activities;
- 12 SESAR Solutions that are expected to complete V2/TRL4.

Solution ID	Solution Name and description	Target Maturity Level
	 High-performing airport operations	
PJ.03a-09	<p>Surface operations by RPAS:</p> <p>The SESAR Solution "Surface operations by Remotely Piloted Aircraft Systems (RPAS)" facilitates the operation of IFR RPAS at airports and their integration into an environment which is dominated by manned aviation. To the maximum extent possible, IFR RPAS 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 the manned operations, providing operational requirements for technological developments that could mitigate them.</p> <p>Expected performance benefits:</p> <p>The solution aims at improving access and equity to airports since the solution will facilitate the safe integration of IFR RPAS at airports.</p>	V1

Solution ID	Solution Name and description	Target Maturity Level
PJ.02-08	<p>Traffic optimisation on single and multiple runway airports:</p> <p>The SESAR Solution aims at the traffic optimisation on single and multiple runway airports providing tower and approach controllers with system support to optimise runway operations arrival and/or departure spacing and make the best use of minimum separations, runway occupancy, runway capacity and airport capacity.</p> <p>The geographical spread corresponds to all airports operating with congested mixed mode runways (both arrivals and departures on same runway) or dependent runways: around 20 European airports.</p> <p>Expected performance benefits:</p> <p>The solution aims at increasing airport capacity, punctuality and predictability.</p>	V2
PJ.04-01	<p>Enhanced Collaborative Airport Performance Planning and Monitoring:</p> <p>The solution aims at extending the airport performance monitoring process to the airport landside and ground access processes that may have an impact on the airside operations in both planning and execution timeframes. It sees the development of rationalised dashboard(s) fed with all landside and airside key performance indicators and covering total airport management processes.</p> <p>Expected performance benefits:</p> <p>The solution aims at increasing predictability and accuracy, by identifying deviations and disruptions at an earlier stage, which lead to earlier implementation of mitigation actions (allocation of resources within the airport, slot allocation, etc.); increased punctuality and, as consequence increased flexibility, as the solution supports earlier and better decision making.</p>	V2
PJ.05-02	<p>Remotely Provided Air Traffic Service for Multiple Aerodromes:</p> <p>The solution includes the provision of Aerodrome Control Service or Aerodrome Flight Information Service for more than one aerodrome by a single ATCO/AFISO from a remote location, i.e. not from a control tower local to any of the aerodromes. The ATCO (or AFISO) in this facility performs the remote ATS for the concerned aerodromes. It includes further development of the CWP and MET information from multiple airports.</p> <p>Expected performance benefits:</p> <p>The solution aims at increasing efficiency per ATCO by introducing Multiple Remote Tower for aerodromes with larger amounts of traffic than those validated in SESAR 1 (more aerodromes could be paired with others during longer periods per day) while keeping safety.</p>	V2

Solution ID	Solution Name and description	Target Maturity Level
	 Advanced air traffic services	
PJ.10-01b	<p>Flight centred ATC:</p> <p>The solution sees the provision of ground-based automated support for managing separation provision across several sectors in order to enable larger sectors to be used. Rather than managing the entire traffic within a given sector. With this solution ATC is responsible for a certain number of aircraft throughout their flight segment within a larger airspace or along flows of traffic.</p> <p>Expected performance benefits:</p> <p>The solution aims at improving en-route airspace capacity, cost efficiency (increase of ATCO productivity), fuel Efficiency and predictability.</p>	V1
PJ.10-05	<p>IFR RPAS Integration:</p> <p>The solution provides the technical capability or procedural means to allow IFR RPAS to comply with ATC instructions.</p> <p>Expected performance benefits:</p> <p>The solution aims at improving access and equity to TMA and en-route environments since the solution will facilitate the safe integration of IFR RPAS in different types of airspace e.g. airspace class A to C.</p>	V1
PJ.10-06	<p>Generic' (non-geographical) Controller Validations:</p> <p>The solution refers to the development of advanced tools and concepts that will help to remove the qualification constraints imposed on ATCOs for controlling a single volume of airspace. This approach would allow ATCOs to operate in any airspace classified as a particular type.</p> <p>Expected performance benefits:</p> <p>The solution aims at improving cost efficiency (ATCO productivity) by improving sector team organization and human performance aspects.</p>	V1
PJ.11-A2	<p>Airborne Collision Avoidance for Remotely Piloted Aircraft Systems – ACAS Xu:</p> <p>The solution ACAS Xu provides airborne collision avoidance to RPAS, building on optimised resolution advisories and additional surveillance data, while taking into account the operational specificities of RPAS (the additional surveillance sources could be ADS-B but also any other sensor installed on the RPAS).</p> <p>Expected performance benefits:</p> <p>The solution aims at improving safety by preventing Near Mid-Air Collision for RPAS. The preliminary analysis of ACAS Xu alerting in today's operational mixed-equipped scenarios shows that ACAS Xu will typically alert more often and earlier than manned aviation systems (TCAS II or ACAS Xa).</p>	V1
PJ.11-A4	Airborne Collision Avoidance for General Aviation and Rotorcraft – ACAS Xp:	V1

Solution ID	Solution Name and description	Target Maturity Level
	<p>The solution ACAS Xp provides Airborne Collision Avoidance to General Aviation and Rotorcraft, taking into account their limited capability to carry equipment and their operational specificities.</p> <p>The scope addressed in Release 8 relates to the Enhanced Traffic Situation Awareness with Alerting (TSAA+) capability. The introduction of TSAA+ is expected to improve safety due to:</p> <ul style="list-style-type: none"> • Less near mid-air, and mid-air collisions; • Decreased GA/H/military vs. TCAS II-equipped contradictory manoeuvring risk. 	
PJ.10-02a	<p>Improved Performance in the Provision of Separation:</p> <p>The solution 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. This would allow future aircraft predictions to be predicted with less uncertainty.</p> <p>Expected performance benefits:</p> <p>The SESAR solution aims at increasing en-route and TMA airspace capacity and cost efficiency (ATCO productivity) thanks to the reduced amount of ATC clearance, the time spent on monitoring the traffic.</p>	V2
PJ.07-03	<p>Mission Trajectory Driven Processes:</p> <p>The solution refers, through a full integration of the WOC within the ATM system, to the updating of wing operations centre (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 optimum ATM system outcome and the performances of all stakeholders.</p> <p>Expected performance benefits:</p> <p>The SESAR solution aims at improving civil military coordination with due respect to military ATM requirements using automated systems; at increasing flexibility to facilitate short notice military requests and at Safeguarding military confidentiality requirements through security gates.</p>	V2



Optimised ATM network services

Solution ID	Solution Name and description	Target Maturity Level
	 Enabling aviation infrastructure	
PJ.14-02-04	<p>FCI Network Technologies incl. voice solutions and military interfacing:</p> <p>The solution sees the migration towards Internet protocol, enabling network-centric SWIM architectures, interfacing with military.</p> <p>Expected performance benefits:</p> <p>The SESAR solution aims at improving capacity, efficiency, safety and resilience of the current CNS infrastructure together with a positive economic impact on the deployment of the overall future communications system.</p>	TRL-2
PJ.14-02-05	<p>Development of new services similar to FIS-B to support ADS-B solutions for General Aviation:</p> <p>The solutions aims at developing new services similar to Flight Information System-Broadcast (FIS-B) to support Automatic Dependent Surveillance - Broadcast (ADS-B) solutions for General Aviation such as broadcast (ADS-B) solutions for GA.</p> <p>Expected performance benefits:</p> <p>The SESAR solution aims at improving safety through the provision of real-time traffic information and updated weather data during flight that will allow safe GA pilots' decisions in due time (e.g. diversions to alternate routes or airports) and avoidance of unauthorised airspace penetration due to better planning information available in real time, allowing for early decisions regarding the flight execution.</p>	TRL-2
PJ.15-09	<p>Data Centre Service for Virtual Centres:</p> <p>The solution aims to the geographical decoupling of the ATM Data Service Providers (ADSPs) from the Air Traffic Service Units (ATSUs). The scope of the service is to provide the data needed for the Virtual Centre.</p> <p>Expected performance benefits:</p> <p>The solution aims at enabling Europe to move to an interoperable, cost-effective and flexible service provision infrastructure. Decoupling of the CWP should enable a more efficient use of the most valuable and expensive resource, the human. By enabling increased flexibility the ANSPs should better manage staffing for prevailing traffic conditions and assure service continuity.</p>	TRL-2
PJ.16-04	<p>Workstation, Controller productivity:</p> <p>The solutions includes the development of new human machine interface (HMI) interaction modes: Multi-Touch Inputs (MTI), Automatic Speech Recognition (ASR), Attention Guidance (AG), User Profile Management Systems (UPMS), and Qualification of CWP Virtualisation (CWPV).</p> <p>Expected performance benefits:</p> <p>The solution aims at improving the ATCO productivity thanks to the new HMI interactions that would increase automation and reduce ATCO actions.</p>	TRL-2

Solution ID	Solution Name and description	Target Maturity Level
PJ.17-03	<p>SWIM TI Green profile for G/G Civil Military Information Sharing:</p> <p>The solution 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 SWIM Purple Profile for advisory services.</p> <p>Expected performance benefits:</p> <p>The solution aims at improving civil-military coordination and cooperation supporting a wide range of SWIM services covering military expectations.</p>	TRL-2
PJ.15-01	<p>Sub-regional Demand Capacity Balancing Service:</p> <p>The solution 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 AOP information is integrated in the NOP through existing B2B services through a standard (common) interface validated in SESAR 1.</p> <p>Expected performance benefits:</p> <p>The solution aims at improving usage of the airspace at sub-regional level and facilitate tactical interventions when necessary, ensuring that any potential disruptions could be correctly managed.</p>	TRL4
PJ.15-02	<p>Delay Sharing Service:</p> <p>The solution operates the AMAN functionalities within an extended horizon to provide local and overall arrival sequences for planning and tactical operational purposes in a cross border environment.</p> <p>Assuming that providers are capable of a provision of E-AMAN, based on a SWIM foundation, deploying this common service results in:</p> <ul style="list-style-type: none"> • The requirement to deploy fewer engineered capabilities; • Service improvement roadmap across Europe is consistent and the associated costs are spread across common service ANSP consumers. <p>Expected performance benefits:</p> <p>The solution aims at improving cost-efficiency thanks to reduction of the cost of deployment because a lower number of system needs to be implemented and the reduction of the yearly operating costs because a lower number of technical systems needs to be securely maintained in operation.</p>	TRL4
PJ.15-10	<p>Static Aeronautical Data Service:</p> <p>The solution is to provide 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.</p> <p>Expected performance benefits:</p> <p>This Common Service expected benefits are higher cost efficiency since it expects to reduce the operating costs of using the Static Aeronautical Data.</p>	TRL4

Solution ID	Solution Name and description	Target Maturity Level
PJ.15-11	<p>Aeronautical Digital Map Service:</p> <p>The solution provides digital maps ready to be used by different ATM systems (e.g. Safety Nets) when performing separation functions. The output is highly customizable in order to meet the different requirements from the consumers and easily convertible among different digital formats, as AIXM, GML, XML, etc.</p> <p>Expected performance benefits:</p> <p>This Common Service expected benefits are higher cost efficiency since it expects to reduce the operating costs of using the Aeronautical Digital Map.</p>	TRL4
PJ.16-03	<p>Work Station, Service Interface Definition & Virtual Centre Concept:</p> <p>The solution will provide an operating environment in which different ATS units, even across different ANSPs, will appear as a single unit and will be subject to operational and technical interoperability. It includes the development of the ATSU architecture from a service oriented approach with a focus on the technical services and common interfaces. Based on the Virtual Centre concept, the CWP/HMI needs to interface with multiple ATM Data Service Providers (ADSPs). A high performing and reliable underlying communication infrastructure may be needed. This solution encompasses enroute and TMA and airport/TWR environments.</p> <p>The ambition of this solution is to develop 2 aspects: Integration of the Virtual Centre concept in the operational environment agreed by the ATM community and details technically the interface services between CWP and ADSP.</p> <p>Expected performance benefits:</p> <p>The solution aims at enabling Europe to move to an interoperable, cost-effective and flexible service provision infrastructure. Decoupling of the CWP should enable a more efficient use of the most valuable and expensive resource, the human. By enabling increased flexibility the ANSPs should better manage staffing for prevailing traffic conditions and assure service continuity.</p>	TRL4
PJ.17-01	<p>SWIM TI Purple Profile for Air/Ground Advisory Information Sharing:</p> <p>The solution 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.</p> <p>PJ.17-01 solution supports ATM operational improvements that depend on Air/Ground (A/G) information exchanges to enable a better situational awareness and collaborative decision making, with a focus on advisory information.</p> <p>Expected performance benefits:</p> <p>The solution aims at contributing positively to global interoperability by designing and validating in collaboration with EU members innovative and</p>	TRL4

Solution ID	Solution Name and description	Target Maturity Level
	open standards based solution for the integration of the Aircraft into the SWIM “network”, ensuring that safety and security requirements are met.	
PJ.17-08	<p>SWIM TI Common runtime registry:</p> <p>The solution facilitates the definition of the interfaces for publication, look-up, management and network of registries as well as the definition of non-functional requirements.</p> <p>Expected performance benefits:</p> <p>The SESAR solution aims at improving safety/resilience by allowing the user to switch to an alternative service in case the primary service fails.</p>	TRL4

Table 5: Planned outcome of the Release 8

In addition, two VLDs performed demonstration activities in the Release 8 timeframe:

- PJ.24 NCM “Network Collaborative Management” addressing the effective and efficient planning of network resources, by linking local optimisation processes (including airport processes) with network optimization processes, taking into account stakeholders’ preferences where possible. This facilitates also the innovative usage and application of fine-tuned tailored measures (including target times) to further enhance of performance.
PJ.24 NCM executed the following demonstration activities:
 - Iteration #1 of DEMO EXE #1 aimed to analyse, identify the links between applied measures and hotspots in a non-geographically related areas and to possibly find better (sets of) measures from a network performance perspective. The objective is to reduce the ATFCM impact of combined network measures on Airspace Users
 - Iteration #2 of DEMO EXE #2 aimed to demonstrate that an electronic ATFCM measure coordination mechanism can be employed to Lower the FMP workload associated with the creation and coordination of ATFCM measures and reduce the number of constrained flights, as a result of replacing conventional CASA regulations with more targeted MCP measures.
 - DEMO EXE #3a “AOP-NOP integration and Arrivals Management” demonstrating the improvement of the airport and network performance through the integration of airports and airlines solving airport arrivals DCB imbalances during the planning phase and the monitoring during the execution phase of the applied measure; and demonstrating the increase in the accuracy and predictability of the traffic demand in the ATM network through a full integration of the airports into the ATM network exchanging information beyond the current A-CDM.
 - Iteration #1 of DEMO EXE #5 aimed to demonstrate a better use of available airport and airspace resources in case of adverse weather situation by implementing a common decision making process between local FMPs, Airport and the Network Manager.
 - Iteration #3 of DEMO EXE #4 aimed at extending geographical scope and number of partners involved in Collaborative Advanced Planning (CAP), as well as the interaction with the regulation mechanism.
 - Iteration #2 of DEMO EXE # aimed to identify complex situations at local level, to declare a hotspot when required, and to analyse which is the most appropriate DCB measure to be coordinated / implemented with the most appropriate actor in each case: the Network Manager, the neighbouring ACCs or the AUs.

- PJ.25 XSTREAM "Cross Border SESAR Trials for Enhanced Arrival Management" demonstrates the use of arrival management techniques for pre-departure aircraft, the calculation, updating and passing of arrival management actions for airborne aircraft such as target time, time-to-lose/gain, or speed advisory from the destination arrival management system to upstream control units, and the impact of multiple arrival constraints within an Upper Airspace Control unit

PJ.25 XSTREAM performed several flight trial demonstrations major European hubs (London, Paris and Zurich) in particular:

- EXE-VLD-WP6-1 “Coupled AMAN-DMAN” displaying Gatwick arrival and departure data on the same runway timeline, along with arrival and departure predicted delay values, at Gatwick Airport ATC and in London Terminal Control
- EXE-VLD-WP6-2 “Gatwick XMAN” to demonstrate extended arrivals management to a single mixed-mode runway
- The second part of EXE-VLD-WP7-1 “Collaborative extended arrival sequence” in Paris area to mainly build a collaborative arrival sequence between Orly & CDG approach and Paris ACC by sharing operational constraints and assess capacity gains
- EXE-VLD-WP7-2 “COP sequencer for hotspot resolution” in Paris area to improve the sequencing in entry sectors of Paris ACC in order to reduce complexity, smooth traffic, increase flight efficiency and reduce ATC workload.
- EXE-VLD-WP7-3 “Improved Arrival Planning Management and Airspace user’s preferences” in Paris area to develop a collaborative decision method between ATC and AUs to establish the optimal arrival sequence, and improve extended AMAN procedures; and to demonstrate how the use of Target Times of Arrival (TTA) can improve arrival planning management and interact with extended arrival management procedures.
- EXE-VLD-WP8-2 “Collaborative tool between Airspace Users, ATC and Network Manager (UDPP)” in Zurich area to improve service to AUs and provide flexibility using the User Driven Prioritization Process (UDPP) for Arrivals and to improve AUs’ operations (secure passengers connections, optimize curfew managements etc.).
- EXE-VLD-WP8-3 “Arrival Planning Management & NM integration” in Zurich area to integrate NM in the loop in forwarding the established sequence.

These achievements were regularly monitored against plan and reported into the SESAR JU’s advisory bodies (see paragraph 2.1.5), notably the Programme Committee.

2.3.2.3 Release 9 planning

The Programme Committee approved the Release 9 Plan at its session on 9 December 2018, launching it into execution. The Release 9 consists in 67 Solutions that will be validated across 2019 until the end of Wave 1. Subject to the confirmation of the validation results through the Maturity Gates, the Release 9 should deliver:

- 6 SESAR Solutions at V1/TRL2 maturity level;
- 38 SESAR Solutions at V2/TRL4 maturity level;
- 23 SESAR Solutions at V3/TRL6 maturity level.

The 23 V3/TRL6 Solutions in the areas of High-level Airport Operations, Advanced Air Traffic Services and Enabling Aviation Infrastructure will represent the concrete outcome of the Wave 1 that can be pushed towards deployment. They are the following:

Solution ID	Solution Name	Target Maturity Level (Release #9)
	 High-performing airport operations	
PJ.02-01	Wake turbulence separation optimization	V3
PJ.02-02	Enhanced Arrival Procedures	V3
PJ.02-03	Minimum-Pair separations based on RSP	V3
PJ.02-05	Independent Rotorcraft operations at the Airport	V3
PJ.02-08	Traffic optimisation on single and multiple runway airports	V3
PJ.03a-04	Enhanced Visual Operations	V3
PJ.03b-05	Traffic Alerts for Pilots for Airport Operations	V3
PJ.05-02	Multiple Remote Tower module	V3
	 Advanced air traffic services	
PJ.01-06	Enhanced Rotorcraft and GA operations in the TMA	V3
PJ.06-01	Optimized traffic management to enable Free Routing in high and very high complexity environments.	V3
PJ.10-01a	High Productivity Controller Team Organisation	V3
PJ.10-02a	Improved Performance in the Provision of Separation	V3
PJ.11-A1	Enhanced Airborne Collision Avoidance for Commercial Air Transport normal operations - ACAS Xa	V3
	 Enabling aviation infrastructure	
PJ.14-02-02	Future Satellite Communications Data link	TRL-6
PJ.14-02-06	Completion of AeroMACS development	TRL-6
PJ.14-03-04	Short-term Alternative Position, Navigation and Timing (A-PNT) – Short term	TRL-6
PJ.16-03	Work Station, Service Interface Definition & Virtual Centre Concept	TRL-6
PJ.17-01	SWIM TI Purple Profile for Air/Ground Advisory Information Sharing	TRL-6
PJ.18-02b	Flight object interoperability	TRL-6
PJ.18-02c	eFPL supporting SBT transition to RBT	TRL-6
PJ.18-04a	Aeronautical Information Management (AIM) information	TRL-6
PJ.18-04b	Meteorological (MET) information	TRL-6
PJ.18-06a	Air Traffic Control (ATC) Planned Trajectory Performance Improvement	TRL-6

Table 6: Solutions planned to be delivered through Release 9 and their target maturity level

2.3.3 Wave 2 call preparation

The SPD 2018-2020 adopted by the SESAR JU Administrative Board defines the Advisory Bodies consultation process with a view to ensuring that the topic development is aligned to scientific objectives and not subject to undue influence³⁷.

The phasing of the call consultation and preparation was depicted as follows:

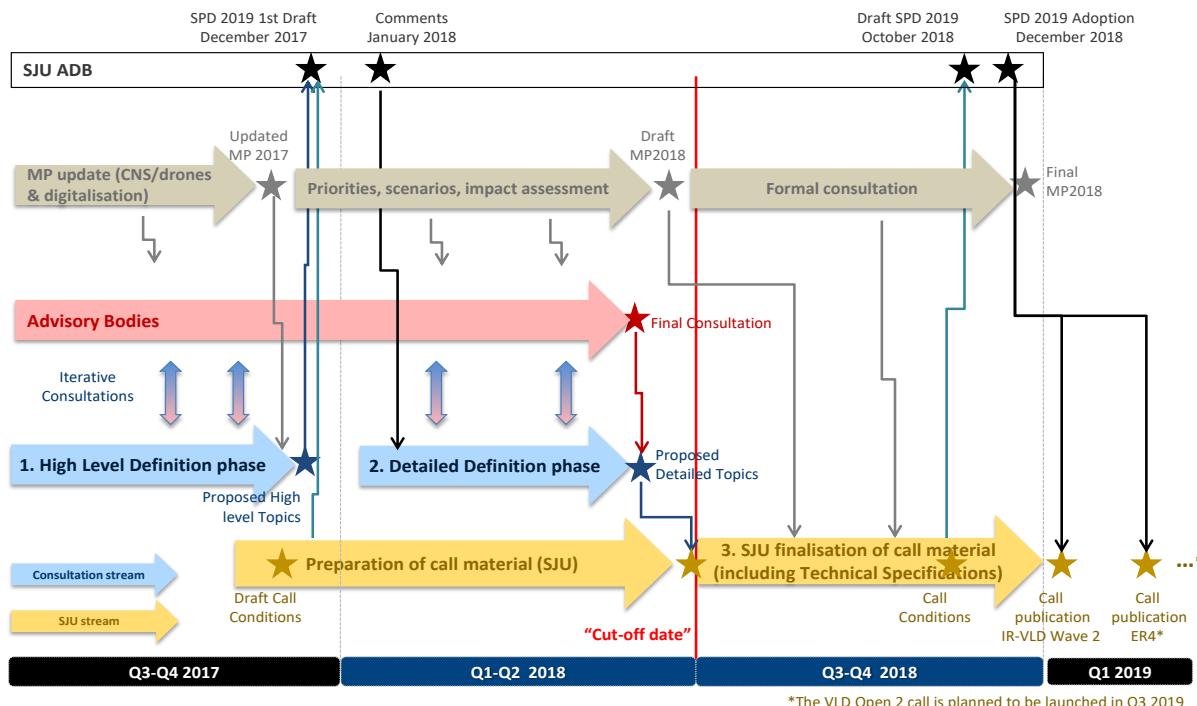


Figure 16: Wave 2 preparation procedure

1. The “High-Level Definition” phase consisted in identifying the Topics to be addressed in each call. During this phase, the consultation with the Advisory Bodies was based on getting comments on the draft SPD document, with the main objectives to ensure the scientific relevance of the proposed Topics and to prepare the review and adoption of the SPD by the SESAR JU Administrative Board.

At this stage, Topics were defined in the draft SPD 2019-2021 (submitted for review by the Administrative Board at the end of 2018) in the form of a list and short description of Topics (at this stage, not at Solutions or Projects level) together with other call conditions, namely:

- Reference to the basic act and the budgetary line,
- Overall Call budget (at this stage, indicative),
- Type of Action and related funding rate,
- High-level budget allocation per Topic (at this stage, this should remain at the level of Key Features and remain indicative),
- Application of the H2020 Work Programme 2018-2020 General Annexes,
- Call timeline,
- Eligibility, selection and award criteria (in relation with the Type of Action).

³⁷ The importance of this information was highlighted in the report of the Internal Audit Services on H2020 Grant Process audits performed in Joint Undertakings (13 June 2017)

The draft SESAR JU Single Programming Document (SPD) 2019-2021 provided therefore an initial list of topics and concept elements (candidate solutions) to be considered as a starting point and as a baseline for the subsequent consultation and scope evaluation. This list was the result of an initial wide consultation process (e.g. Programme Committee meetings, SESAR JU Members comments) held from October to December 2017.

2. The “*Detailed Definition*” phase consisted in further defining the different Topics (at the level of the Solutions) and the related proposed co-financing level taking into consideration the comments from the Administrative Board in the beginning of 2018 on the draft SESAR JU SPD 2019-2021. Considering the wide scope of the initial list together with the available budget, there was a need to set up a prioritisation activity aiming at achieving a procurement scope satisfying both SESAR ambition level (as captured in the ATM master plan) and budgetary constraints.

To do so, the following activities were performed as depicted in the picture below:

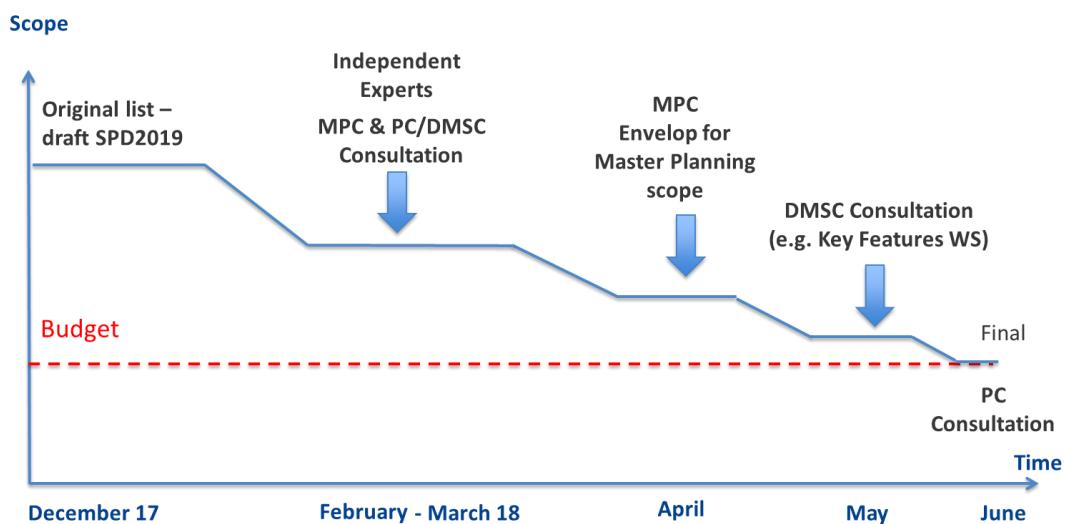


Figure 17: Detailed Definition phase consultation activities

- Independent Expert Review and first consultation of governance and advisory bodies: a pool of H2020 independent experts was selected and tasked to review the list of candidate solutions and to evaluate their potential to achieve SESAR ambition. Based on a set of criteria the prioritisation process did deliver a proposed selection of topics that align best with SESAR strategy:
 - ATM Performance Improvement Potential: demonstrating performance gains in Capacity, Cost Efficiency, Operational Efficiency, Safety, Security and Environment.
 - ATM Digitalisation Potential: advancing Automation, Connectivity/Sharing of information, Virtualisation, Integration of all vehicles, Flight- and flow-centric operations, Lean and modular systems
- The independent expert screening was considered with the view of the SESAR JU governance (MPC/PC/DMSC). The Master Planning Committee evaluated the alignment with the SESAR priorities. The Programme Committee (PC) and its subcommittee evaluated the programmatic aspects. This process was also an important step to explore opportunities for merging and splitting concept elements. Stakeholders were given the opportunity to provide additional information related to the potential of the candidate solutions.

- Second consultation of SESAR JU governance: the SESAR JU performed a review of all received feedback (e.g. additional information, merging and splitting opportunities). Close coordination with the outcome of the Master Plan update campaign was performed to ensure consistency and get a top-down performance view and disruptive solutions driven approach allowing prioritisation of the Solutions by the SESAR JU. As a result, the SESAR JU identified a proposed research envelope that was tabled to the MPC for baseline. This list was not final, but it represented “key research needs” to be considered for materialising the SESAR ambition.
- Third consultation of SESAR JU governance: At this stage, the ATM Master Plan research envelope had been baselined at MPC level. The SESAR JU governance (i.e. PC & DMSC) was again consulted to seek further scope refinement and to evaluate budgetary aspects in order to converge on a content that was commensurate with the available funding. This consultation was done in close collaboration with the SESAR JU Members through workshop and meetings.
- Final consultation and cut-off: the final consultation with the SESAR JU governance was started at the seventh session of the Programme Committee held on the 20 June and fully completed at a dedicated PC meeting held on the 13 July. This final consultation delivered a proposed list of Topics and solutions together with proposed budget allocation.

3. On 13 July 2018 (cut-off date), the SESAR JU closed the consultation with its advisory bodies and opened the “*Finalisation of call material*” phase conducted in total isolation. The aim was to finalise the definition of the Topics and candidate SESAR Solutions and to introduce them into the call material as technical specifications. The final call conditions were documented in the Single Programming Document 2019-2021 (adopted by the SESAR JU ADB in December 2018) and served for the financing decision authorising the launch of the Calls and the use of the dedicated budget. Based on the call conditions adopted through the SPD 2019-2021 and on the technical material established through previous steps, the SESAR JU prepared the material required to launch the call based on the H2020 requirements (including technical specifications, execution framework, proposal templates, call conditions and evaluation procedure, etc.). The call was then ready for publication, on the EC funding & tender opportunities portal, which took place on 10 January 2019 as planned.

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

The SESAR JU met all its objectives related to Very Large-Scale Demonstrations in 2018. This includes the following achievements and results:

- *Call reference H2020-SESAR-2015-2 (IR –VLD Wave 1 Call) - Wave 1 VLD activities delivery of results: VLD projects were in execution and delivered their expected result*
- *Call reference H2020-SESAR-2015-2 (IR –VLD Wave 1 Call) - conduct Wave 1 VLD grant budget amendments campaign: the four grant agreements related to VLD projects in execution were amended by the end of 2018*
- *Call reference H2020-SESAR-2016-2 (VLD Open Call) - delivery of initial results: five new grant agreements were signed, and in total nine VLD Open 1 projects started their execution and delivered their first results*
- *Call reference H2020-SESAR-2017-1 (VLD Geo-fencing Call) - grant agreement signature and launch of the project: the grant agreement was signed and the project started its execution*
- *Call reference CEF-SESAR-2018-1 (U-space Call) launch, evaluation and award: the call for proposals was launched for drone U-space demonstration activities, ten proposals received and evaluated, six projects were awarded; all grant agreements were signed and the projects started their execution*
- *Call reference H2020-SESAR-2019-1 (VLD Wave 2 Call) - preparation of content and call material: call conditions were approved in the SPD and call material, including technical specifications, were ready at the end of year, through the consultation process as documented in the SPD 2018-2020*
- *Call reference H2020-SESAR-2019-3 (second VLD Open Call) - call preparation: the preparation of the second open call for proposals for VLD started but the launched of the call was postponed to 2020, in agreement with the Administrative Board. The preparation of the call material will finish in 2019*

In 2018, the SESAR 2020 Programme counts twenty projects devoted to Very Large-Scale Demonstration activities. These projects result from four calls for proposals:

- Two calls for proposals launched under the H2020 Programme:
 - The Wave 1 call within the call with reference H2020-SESAR-2015-2 common with IR Wave 1, restricted to SESAR JU Members other than the Union,
 - The first open VLD call, VLD Open 1, within the call with reference H2020-SESAR-2016-2 (common with ER3 mentioned above),
- Two open calls for proposals launched under a framework other than H2020:
 - One dedicated to active geo-fencing, launched under a specific framework, with reference SESAR-2017-1,
 - The U-space call for proposals, launched under the Connecting Europe Facility Programme, with reference CEF-SESAR-2018-1.

The following paragraphs provide information on the status and delivery of these twenty projects.

2.4.1 Status and outcomes of calls for proposals under the H2020 Programme

2.4.1.1 Status of the Wave 1 VLD projects (call for proposals with reference H2020-SESAR-2015-2)

The first call on Very Large-Scale Demonstrations, which was restricted to SESAR JU Members other than the Union, within the call with reference H2020-SESAR-2015-2³⁸ also covering IR, was closed on 20 April 2016. It resulted in five VLD activities, of which one (PJ.27 IOPVLD) was terminated in 2017.

2.4.1.1.1 Project activities and results in 2018

In 2018, the four remaining VLD projects (a fifth one, PJ.27, was terminated in 2017) delivered 22 deliverables were received from these VLD projects and 105 were assessed and approved, eight deliverables being still under review at the end of 2018. Furthermore, VLD activities followed validation exercises as presented above in the paragraph 2.3.2. It is expected that all VLD projects will continue over 2019 and will complete their delivery in late 2019, with the exception of one (PJ.28 IAO) which will deliver final results in early 2020 in accordance with the Programme Committee recommendation. The main outcome of these projects is summarised in the paragraphs below.

The VLD project **PJ.24 NCM** ‘Network Collaborative Management’ is based on a collaborative approach in Air Traffic Flow and Capacity Management (ATFCM), involving the whole spectrum of ATM actors: Airspace Users (AUs), Airports, Air Navigation Service Providers (ANSPs) and Network Manager (NM).

The project demonstrates in a network collaborative environment the following objectives:

- optimization of the traffic delivery into sectors and airports and
- minimisation of the need for Air Traffic Flow and Capacity Management (ATFCM) measures.

The demonstration scope is to prove that the performance targets and expectations at the network and local level could be better achieved only through a collaborative synchronized effort of all the involved actors. An important part of improving the performance of network and airport operations is the effective and efficient planning of network (including ground) resources, by linking local optimization processes (including airport processes) with network optimization processes, taking into account stakeholders’ preferences where possible. This facilitates also the innovative usage and application of fine-tuned tailored measures (including target times) to further enhance of performance and predictability.

The focus of this project is placed on four major areas, each of them corresponding to a local or network level perspective of ATFCM issues:

- Scenario Management (including Hotspot Awareness, network level, with local input) - The identification of a local DCB imbalance (possibly supported by automated local tools) will initiate a local/network coordination process between relevant local stakeholders and NM based on pre-defined scenario selections by local FMPs, and based on network impact assessments (including What-If simulations) performed by NM. Coordinated implemented scenarios and measures will be monitored by both local stakeholders and NM to verify the operational results.
- Tactical Capacity Management (local level) – The focus of this area will be the necessity to adjust the STAM/M-CDM (STAM coordination process) functionality in the ANSP local tool (e.g. iFMP for MUAC/EUROCONTROL) to support the changes resulting from the harmonisation of operational requirements.

³⁸ Call documentation is available on the [Funding and Tenders Portal](#)

- Airspace User Preferences (local level, could use NM in certain cases) - AUs will be supported to optimise their business in the network whilst still optimising congested airport capacity and maintaining predictable operations. Where appropriate they will have more flexibility to select the flights to which specific measures will be applied, including if possible automated processes where AUs provide timely information on the optimisation of departure sequences (for priority flights) in order to swap slots with other flights inside or outside the airline group.
- Airport Network Integration (local/network level) - An overview of Network capabilities are obtained by linking airport ground capacities obtained via the continuous update of the AOPs (through concepts of A-CDM, Airport Surface Traffic Management, Departure Management, Advanced Tower, Extended Arrival Management, and Airport Operations Centre - APOC) with the Network via the NOP. Where local DCB imbalances are detected, to supersede the need for blunt flow rates, the Airport will instead propose an optimal target time of arrival to resolve the situation.
- The results of these demonstrations will contribute to the definition of technical systems requirements for SESAR CONOPS implementation, and prepare the pre-deployment phase of enhanced DCB tools within the dynamic DCB (dDCB) toolbox.

In 2018 the VLD PJ.24 NCM Network Collaborative Management executed initial demonstration activities. In particular:

- DEMO EXE#2a: The second iteration of EXE2a (MUAC) was executed during the summer 2018. The aim was to optimise ground delay measures in close cooperation with Airspace Users, taking into account their preferences, using the ATM portal (MUAC collaboration platform). Preliminary results were:
 - Good collaboration and positive feedback from AUs.
 - Procedures through the ATM portal were well accepted.
 - 150.000 minutes of delayed saved during the trial.
 - Because of increased dynamicity of optimised measures, these new procedures give FMP/NM Controllers more work.
 - Bilateral coordination with local partners should be avoided; AOs need only one source of measures.
- DEMO EXE #2b - Use cases and scenarios were fine-tuned, systems are being developed.
- DEMO EXE #2c - Use cases and scenarios were produced.
- DEMO EXE #3b completed its first wave of Limited Trials (from 26 to 29 September and from 6 to 9 October). Goal was to assess the procedural interfaces and the stability of the TTA solution in response to rolling updates.
- DEMO EXE#4 Iterations 1 and 2: The initial results showed that the Collaborative Advanced Planning (CAP) process is favourably accepted by FMP (and AUs): it is coherent with FMP work and it is assessed as having a beneficial impact on ATFCM network measures, collaborative decision making (CDM) and regulations management. FMPs assessed it as very positive and beneficial for AUs thanks to reduction of delays and decision-making taking into account AUs constraints and business needs. Consequently, CAP seems to improve, optimize and bring benefits to the network. However, this new process requires new methods, working procedures and interactions between ATM actors in order to reach full efficiency. The CAP process needs to be improved, namely the induced workload and the need to speed up the process with an additional tool to ease the selection of candidates for CAP proposals.
- DEMO EXE #5 – Project team is working on the development of the platform to be used for the demonstration.

- DEMO EXE#6 Iteration 1: In general, the results obtained after this first run were very positive. The situation awareness increased but further data is needed to have a better understanding of the situation regarding transparency and involvement of the AUs. CAP processes and procedures were in line with the operating methods. FMPs reported either no significant impact on their current activities or, to a lesser extent, a positive impact. There was a decrease regarding the number of regulation declared once using CAP process. No negative impact could be measured regarding fuel consumption with the data gathered. Because of the use of the proposed tool, the workload, stress level, etc. are incremented at least for the FMP not used to work with it. However, benefits obtained make acceptable this increment.

Airspace User consortium for the SESAR 2020 VLD NCM started preparing their active contribution in EXE#1 where ANSPs local tools will be connected via B2B with NM for refilling FPLs and procedural analysis of the future operation at AOC with combine several tools issuing measures to flights. Participation in EXE#3a was delayed implying a re-schedule of the exe). Regarding EXE4 and EXE6 ATEAM is participating in the post-analysis of the latest iteration.

The VLD project **PJ.25 xStream** ‘Cross Border SESAR Trials for Enhanced Arrival Management’ aims at extending arrival management horizon up to at least 200 nautical miles from destination airport and at evaluating its impacts and benefits. The project demonstrates how arrival constraints can be computed and provided to upstream Area Control Centres (ACC). The main objectives are to improve flight efficiency, flight predictability and to reduce workload in terminal area (TMA).

The project explores concepts related to extended arrival management and their impacts on the following KPA:

- Capacity : Airspace capacity,
- Cost efficiency: ANS Cost efficiency,
- Environment : Fuel efficiency,
- Predictability and punctuality: Variance of actual and reference business trajectories,
- Flexibility: ATM System & Airport ability to respond to changes in planned flights and mission,
- Safety: Accidents/incidents with ATM contribution,
- Interoperability: Capability of ANSP systems to share/manage arrival constraints.

Demonstrations consist in flight live trials in major European hub airports: London Gatwick & Heathrow airports, Paris CDG & Orly airports, Zurich airport, Frankfurt airport.

The project also involves the largest number of upstream ACCs around those platforms (Reims, Maastricht, Bordeaux, Karlsruhe, Brest, Geneva, Zurich, London, Milano, etc.).

Some trials are/will also be performed in en-route airspace to demonstrate how multiple arrival constraints can be handled. The project also associates Airspace Users in order to implement collaborative processes for the management of arrival sequence (A-Flex). As part of the SESAR 2020 Programme, the demonstrations will contribute to SESAR CONOPS definition and engineering standardization work concerning the benefits brought by Extended Arrival Management (E-AMAN).

The VLD PJ.25 XSTREAM “Cross Border SESAR Trials for Enhanced Arrival Management” performed the first live trial of EXE-VLD-WP7-1 “Collaborative extended arrival sequence” between Orly and Charles de Gaulle airports and Paris ACC. This exercise took place from July to September 2017 in Paris area, and the initial results showed:

- A significant decrease in additional airborne time per flight (90s in average during the targeted peak) and holdings;
- An optimal and continuous runway feed (capacity improvement);
- Very positive feedback from all ATCOs and Paris FMP;
- Positive feedback regarding the electronic coordination of speed requests.

In the last quarter of 2018, trials restarted concerning WP7 “Paris Implementation” on “COP Sequencer” and “Improved Arrival Planning” scenarios up to end October, with the participation of ACCs Paris, Geneva, Zurich, Reims and Milan, Network Manager and Airspace Users.

New trials were launched for WP07. Extended AMAN procedure in Paris Orly has been extended in November for the management of taxiway/parking stand works and LVP procedures. Then in mid-December, trials started during ski weekends for the handling of Lyon and Geneva arrivals via Paris ACC, using the COP Sequencer procedure.

The VLD project **PJ.28 IAO** ‘Integrated Airport Operations’ aims at demonstrating the benefits brought by mature SESAR solutions, focusing on the following sub-functionalities of the Pilot Common Project (PCP) ATM functionality #2 – Airport Integration and Throughput:

- Departure Management Synchronised with Pre-departure sequencing;
- Automated Assistance to Controller for Surface Movement Planning and Routing;
- Airport Safety Nets.

The solutions that will be addressed in these demonstrations are considered to:

- Improve airport safety;
- Improve predictability;
- Reduce fuel consumption;
- Reduce overall delays on the airport.

The project also aims at demonstrating the adequate performance of ADS-B to support on-board traffic alerting.

In 2018 the project progress in the planning of its demonstration activities in Nice, Budapest and Hamburg. All three demonstrations are planned in Q1-Q2 2019.

A first round of ADS-B data collection was completed and the corresponding analysis was performed.

The demonstration report and maturity gate are planned in Q4 2019.

Due to the lack of airspace user support so far in the project (intended through open VLD call 1 – H2020-SESAR-2016-2) and the termination of one of the PJ.28 beneficiaries, the demonstrations of the manual taxi routing function and D-TAXI solution were removed from the scope of the project.

The VLD project **PJ.31 DIGITS** ‘Initial Trajectory Information Sharing’ supplemented by **DIGITS-AU** aims at demonstrating the ATM benefits that can be realised through the usage of downlinked 4D trajectory data (EPP) in ground systems. The project plans to validate the downlinking of ADS-C/EPP data according to ATN baseline 2 standard. Complementing the project PJ.31, the Project DIGITS-AU aims at using the avionics supporting ADS-C/EPP in eight airlines and at demonstrating its use in the airspace of DFS, ENAV, Maastricht Upper Air Centre and UK NATS. Consequently, PJ.31 DIGIT will capture and analyses the big data stemming from the DIGITS-AU flights.

The DIGITS and DIGITS-AU projects therefore jointly propose the following demonstration activities in Europe:

- The airborne industry will develop up to certification the worldwide first airborne unit capable of downlinking ADS-C data according to ATN Baseline 2 standard in compliance with PCP AF#6 (Initial Trajectory Information Sharing).
- The ANSPs and ground industry will build up validation and pre-operational system platforms capable of receiving and processing ADS-C data including the Extended Projected Profile (EPP). For MUAC, this will be implemented in the operational system, whilst for DFS, ENAV & NATS, it will be integrated into their test platforms
- DIGITS plans to have revenue flights becoming available. These commercial flights will downlink ADS-C data to be processed in ATM ground systems of participating ANSPs, covering together a substantial part of European airspace and air traffic under a variety of operational conditions in order to demonstrate the Operational Benefits of Initial Trajectory Information Sharing:
- DIGITS will contribute to reinforce the “Enabling Aviation infrastructure” key feature of SESAR 2020 by demonstrating the ATM benefits that can be realized through the use of downlinked 4D trajectory data in ground systems.

The certification of the EPP package to be installed in the airline FMS requires further work due to the need to correct non-PJ.31 functionalities that will be delivered within the same FMS package that delivers PJ.31 ADS-C/EPP, leading to delay the certification date from November 2018 until March 2019. This new certification date would lead to retrofitting equipment on-board of the a significant number of aircraft during the summer period, when the flight schedule gets denser, with reduced opportunities to interrupt revenue aircraft operations for installing the ADS-C/EPP capabilities leading to more time to get the revenue flights ready.

Success story #3: First aircraft equipped with 4D-trajectory technology delivered for a demonstration activity



The first FANS-C-equipped A320 aircraft was delivered for a demonstration activity in the context of the DIGITS project. This aircraft will be the first to take part in a large-scale SESAR project demonstrating how sharing trajectory data with air traffic control can improve the predictability of air traffic. Known as 'DIGITS' - Demonstration of air traffic management Improvements Generated by Initial Trajectory Sharing - the project will now begin its operational phase involving commercial flights later this year. FANS-C technology will enable airlines to optimise their aircraft's trajectories and

make traffic flows more fluid and aircraft speed easier to manage, which will help them to save fuel and reduce noise. In particular, the sharing of predicted trajectories with air traffic control will enable smooth aircraft sequencing on approach and in the airspace surrounding airports, known as the terminal manoeuvring area."

Hugh McConnellogue, Group Head of Network Operations at easyJet said: "We are very pleased to be the first airline to receive this new FANS-C technology in our Airbus aircraft – and to try it for real in the SESAR demonstration. Our early hands-on experience already indicates that it promises to be an important enabler to increase the efficiency, safety and on-time performance of our expanding operations – especially in the congested European airspace."

Jean-Brice Dumont, Executive Vice President of Engineering, Airbus Commercial Aircraft said: "We congratulate easyJet on the delivery of the first FANS-C equipped Airbus aircraft, which marks the start of this very large demonstration of 4D initial trajectory sharing across Europe." He adds: "We are proud to lead this SESAR project and to play our part in helping ATM respond to the increase in air traffic volume while enhancing safety, and to bring about a positive environmental impact thanks to a more efficient ATM system."

From now until mid-2020, seven European airlines, which are all taking part in DIGITS, will progressively equip up to 100 of their A320 Family aircraft with the FANS-C technology. The very large-scale demonstration (VLD) will last more than a year and collect data from over 20,000 revenue flights, allowing stakeholders to demonstrate benefits of this technology during live day-to-day operations.

Paving the way for start of the DIGITS operational phase and to ultimately deploy this technology across Europe and the rest of the world, Airbus achieved the world's first certification of FANS-C 4D avionics on a commercial aircraft in November 2018 – the initial aircraft type being the A320 Family. Moreover, to complement the airborne FANS-C technology, air navigation service providers (ANSPs) throughout Europe will develop the respective ground ATC

2.4.1.1.2 Wave 1 grant budget amendment

As explained in paragraph 2.3.1.2 above, all Wave 1 grant agreements were subject to a grant budget amendment procedure in 2018. The updated total maximum EU co-financing for Wave 1 VLD projects amounts to EUR 31.736.706,02 broken down per project as follows:

Project Acronym	Max. total EU co-financing value (EUR)
PJ.24 NCM	4.091.801,53
PJ.25 XSTREAM	3.909.904,50
PJ.28 IAO	3.546.846,12
PJ.27 IOP VLD (terminated)	1.233.047,49
PJ.31 DIGITS	18.955.106,38

Table 7: Updated maximum EU co-financing as a result of the grant budget amendment for Wave 1 VLD projects

2.4.1.2 Status of the VLD Open 1 call (within the call with reference H2020-SESAR-2016-2)

The second call for proposals on Very Large-Scale Demonstration, which was an open call within the call with reference H2020-SESAR-2016-2 also covering Exploratory Research (ER3), was open on 15 December 2016 and closed on 11 May 2017. The evaluation of the proposals was completed in December 2017 for the 'Very Large-Scale Demonstration' Work Area with the award of 9 projects for a total value of EUR 16,9 million. The subsequent grant agreement signature process started in 2017 and was concluded in early 2018. The grants awarded in that context will deliver their results in the period from 2018 through to 2020.

The table below provides an overview of the projects currently in execution following the successful completion of the grant signature process. In addition, in 2017 and 2018 the SESAR JU prepared grant agreements for the following projects which were signed in 2018³⁹:

³⁹ One additional project under this call for proposals was still in the grant agreement preparation phase at the end of 2018

Topic description	Projects	Max. total co-financing value (in EUR)
Arrival Management Extended to en-route airspace	Airline Team xStream (Airspace User Support to Arrival Management) – AU support to project PJ.25	1.800.962,64
Network collaborative Management	Airline Team NCM (Airspace User support to the development of Network Collaborative Management) – AU support to project PJ.24	2.008.650,00
Initial Trajectory Information sharing	DIGITS-AU (Demonstration of ATM Improvements Generated by Initial Trajectory Sharing- Airspace User Part) – AU support to project PJ.31	4.527.147,32
Safe integration of drones	SAFEDRONE (Activities on drone integration and demonstration in VLL operations)	1.169.074,13
Safe integration of drones	USIS (U-space Initial Services)	1.308.671,13
	PODIUM (Proving Operations of Drones with initial UTM Management)	1.395.649,25
Solutions for General Aviation and Rotorcraft	GRADE (GNSS Solutions for increased GA and Rotorcraft Airport Accessibility Demonstration)	1.156.015,38
	GAINS (General Aviation Improved Navigation and Surveillance)	1.453.690,00
Increased access to airports for low visibility mixed fleet operations	AAL2 (Augmented Approaches to Land 2)	2.110.729,47

Table 8: Very Large-Scale Demonstration activities selected as a result of the call H2020-SESAR-2016-2 in 2017 for which grant agreements were signed in 2018 and their max. co-financing value

The following paragraphs outline the outcome of the VLD Open 1 projects in 2018.

The VLD project **AAL2** focuses on increased access to airports for low visibility mixed fleet operations. It builds upon the results from the former award winning SESAR 1 project AAL, and will demonstrate augmented approach and landing operations based on the solutions:

- GBAS (Ground Based Augmentation System) CAT II with CAT I airborne and ground equipment, enabling lower decision heights to CAT II minima (DH 100ft) (addresses hubs and medium size airports);
- EFVS (Enhanced Flight Vision System) to Land using Head Up /or Mounted Display, with operational credit down to 300 meters RVR in non- CAT II/III airports (addresses medium and small size airports).

Over 150 flight trials in total are targeted comprising revenue flights as well as flight test aircraft. Flights will cover the full scope of airport categories – small/medium/large airports (Antwerp, Le Bourget, Bremen, Newark, Payerne and Perigueux).

In 2018 the project team focused their effort on setting up the project and planning the demonstration activities, including the preparation of the ground and airborne equipment required for the

demonstrations, design of the procedures and prepare the approval from the relevant authorities to perform the trials.

Airline Team NCM: this project complements PJ.24 NCM in bringing the required Airspace Users expertise and they synchronise their activities with the aim of combining their delivery as described in section 2.4.1.1 related to Wave 1 VLD activities.

Airline Team xStream: this project complements PJ.25 xStream in bringing the required Airspace Users expertise and they synchronise their activities with the aim of combining their delivery as described in section 2.4.1.1 related to Wave 1 VLD activities.

The VLD project **GAINS** ‘General Aviation Improved Navigation and Surveillance’ has the objective to validate concepts enabled by Global Navigation Satellite System (GNSS) and EGNOS. These include specifically electronic conspicuity and instrument flight procedures to meet the needs of GA, including both fixed wing and rotorcraft. GAINS aims to demonstrate to the wider aviation community how improvements being developed by SESAR can be adapted to enhance GA operations without prohibitive cost or certification requirements. This project aims to demonstrate, through live flying exercises, the ability of GA to utilise new technology and procedures in flight, and to test the viability of adapting SESAR solutions to improve GA’s operations and integration within a variety of operational contexts and environments. Hence, contributing to better GA integration at controlled and uncontrolled aerodromes, as well as improving safety, efficiency and predictability of operations. Maybe allowing the provision of basic air traffic services at aerodromes where this is not economically viable. The project activities are currently on track based on the revised timescales the project encountered a strong engagement from GA pilots (+200 response +20 selected) to participate to the Navigation demonstration in 2019. On the Surveillance leg, MoU with small and medium size airports have been signed and early validations executed.

The VLD project **GRADE** aims at demonstrating, through flight trials, the applicability to General Aviation and Rotorcraft, equipped with non-certified or specific on-board avionics, of the SESAR Solutions #51, #55, #103 and #113. These SESAR Solutions concern: terminal approaches by using LPV procedures (Sol#51 and Sol#103), final approach CAT II/III based on GBAS augmentation (Sol#55), and low level IFR route using PinS procedure for TMA operations (Sol#113). The project is well on track; the activities concerned with the preparation and execution of the real time simulation exercises were performed. The completion of fixed wing and rotary real time simulations execution and reporting allowed achieving the project milestones for 2018. Meetings between CIRA and ENAC for the acquisition of the Permit to Fly for the flight trials are ongoing.

The VLD project **PODIUM** is a multi-sites demonstration knowing each site has its specificities:

- The urban & U-space users mix (Odense, Denmark) – at least 45 flights: Wide representation of U-space users; U-space usage for remote areas over sea and urban areas; interface with ATC.
- The Repetitive and extensive scenario (Brétigny, France) – at least 100 flights: Usage of U-space in highly dense VLL traffic in the vicinity of Orly CTR and suburb area; U-space daily

operation, including repetitive flights by a wide representation of drone operators (17+ companies); Dynamic geo-fencing or geo-caging in a protected airspace.

- The CTR scenario (Toulouse, France) – at least 10 flights: Tracked long range and endurance operation displayed on U-space interfaces (electricity infrastructure surveillance); interface with ATC.
- The unexpected scenario (Eelde, The Netherlands) – at least 30 flights: U-space usage in a specific contingency situations; U-space usage for a mix of different flight rules (VFR/IFR/VLOS, BVLOS); interface with ATC introducing normal and abnormal conditions.
- In 2018, the project has prepared the scenarios, test cases, plans and necessary infrastructure to support the 2019 flight trials.

The VLD project **SAFEDRONE** performs VLL operations that demonstrate the integration of different types of manned and unmanned vehicles in the same airspace using U-space services and procedures. It covers a large representation of future drone traffic, considering:

- Visual Line Of Sight (VLOS) and Beyond Visual Line Of Sight (BVLOS).
- Diverse types of aerial operations in Very Low Level (VLL) airspace and under Visual Flight Rules (VFR).
- Integration with general aviation.
- Operations in rural and semi-urban environments.
- uncontrolled and controlled airspaces
- The two major drone configurations (Fixed-wing and Multicopters drones)
- Different levels of autonomy: teleoperated in VLOS, way-point navigation in BVLOS and automatic detect & avoid and multiples UAVs operated by one pilot.
- Specific situations such as geo-fencing failure, No fly zone activation, and Loss of C2 link failure

In 2018, the project has prepared the scenarios, test cases, plans and necessary infrastructure to support the 2019 flight trials.

The VLD project **USIS** aims to demonstrate the technical and operational feasibility of providing in a very short time frame U-space services to drone operators and to authorities focusing on registration, Flight Wish/Mission Notification & Authorization, U-space NOTAM (including dynamic NOTAM for VLL), and drone Traffic Monitoring (including non-conformance vs regulation/authorized mission). The project combines the expertise Civilian Aviation Authorities/Air National Service Provider, drone operators, Industries and Law enforcement authorities in order to insure that the services demonstrated fit for purpose to their requirements, constraints and needs. The demonstration includes any type of operations (from visual line of sight to very long range beyond visual line of sight) in all environments (from rural to urban). The demonstration in France is plugged to real drone operations.

With grant agreement signed and kick-off project taking place in 2018, the project has prepared the scenarios, test cases, plans and necessary infrastructure to support the 2019 flight trials.

2.4.1.3 VLD Open 2 call preparation

The SPD 2018-2020 mentions the launch of the second open VLD call for proposals, referred to as 'VLD Open 2' call. In the course of 2018, the SESAR JU decided to postpone the launch of the VLD Open 2 call to early 2020. The purpose of that postponement is to address all the topics raised by the Airspace

Architecture Study (see above in paragraph 2.1.2) and the update of the European ATM Master Plan that is planned to be completed in Q1 2019 (see above in paragraph 2.1.3). The Administrative Board approved this approach through the adoption of the SPD 2019-2021 in December 2018.

2.4.2 Status and outcomes of calls for proposals under Programmes other than H2020

2.4.2.1 Status of the Geo-fencing call (with reference SESAR-2011-1)

The SESAR Joint Undertaking signed a delegation agreement with the European Commission in 2016 to organise a call for proposals on Active Geo-fencing Service⁴⁰. It is targeting demonstrations of web-based Geo-fencing solutions that use location signals to prevent drones from flying in no-fly zones. No-fly zones can be generated, monitored and controlled by the authorities responsible.

In 2018, in continuation of activities conducted in 2017 to implement this delegation agreement, following the conclusion of evaluation process and the submission of the evaluation report by the evaluation committee, the Executive Director adopted the award decision with reference SJU/ED/668.

Subsequently, as planned in the Single Programming Document 2018-2020, in 2018 the SESAR JU completed the grant agreement preparation process leading to the signature of the grant agreement on 23 July 2018.

The grant agreement preparation did last some months because of the missing documentation (for 5 of the 6 consortium members. During that period, the SESAR JU regularly monitored the submission of these documents with the aim of the completing the pack of the required evidences annexed to the Grant.

When finally all documents were received, the SESAR JU was in a position to go ahead with the signature of the grant agreement, which took place on 23 July 2018.

The project is called GEOSAFE. The project kick-off took place on 4 September 2018. Since this date, the project team has prepared the demonstration plan that:

- describes the demonstration approach;
- provides a baseline plan for the execution of the project;
- explains the alignment with the U-space initiative and the wider SESAR Programme;
- describes communication plan to present results and findings.

The demonstration activities will take place in France.



At the end of 2018, the work is in progress and this demonstration plan will be submitted in the beginning of 2019.

Following the award decision, a budgetary commitment for a total value of EUR 497.402,97 was created in 2018, and one payment relating to a pre-financing request was executed for a total amount of EUR 248.701,23. The aforementioned Budgetary Commitment and Payment were done following the standard SESAR JU procedures, fully in line with the SESAR JU Financial Rules. All expenditures were used for the intended purpose as defined in the Delegation Agreement.

⁴⁰ Delegation Agreement EC/SESAR JU with reference MOVE/E3/DA/2016-669/SI2.743803 on the implementation of Active Geofencing services

Local Key	User Ref.	Committed Amount	Consumed Amounts (by Payments)
SES.2771	GEOFENCING GRANT AGREEMENT, CALL SESAR-2017-1, SJU/LC/0335-CTR - THALES AVS FRANCE SAS	497.402,97	248.701,23
SES.2570	EXPERT CALL EVALUATION GEO-FENCING	2.740,99	2.740,99
			500.143,96
			251.442,22

Table 9: Budget implementation in relation with the Geo-fencing delegation agreement in 2018

2.4.2.2 Status of the U-space call (with reference CEF-SESAR-2018-1)

The SESAR Joint Undertaking signed a delegation agreement with the European Commission in 2017 to perform U-space demonstration activities under the Connecting Europe Facility (CEF) Programme⁴¹. The objective of this initiative is to study and execute a number of large-scale demonstrations for the U-space services that support the management of drone operations in the context of growing autonomy of drones and growing traffic density. The U-space services may include: flight planning, flight approval, safe and robust navigation and dynamic geo-fencing enabled by EGNOS and Galileo, tracking, airspace dynamic information, and dynamic interfaces with air traffic control, as outlined in the U-space Blueprint. This call aimed at complementing ongoing U-space activities, speed up U-space deployment and stimulate close cooperation with EASA, standardisation bodies and industry including newly emerging stakeholders.

The Delegation Agreement has a total value of EUR 10 million.

2.4.2.2.1 Operational implementation of the delegation agreement

In response to this Delegation Agreement, in 2018 the SESAR JU has, in accordance with the principles of sound financial management, transparency and non-discrimination detailed Title VIII of the Financial Regulation⁴²:

- Prepared and launched a call for proposals focusing on the purposes of the Delegation Agreement: the ‘CEF-SESAR-2018-1 U-space’ Call (with call reference 2018-1),
- Received and evaluated proposals,
- Awarded grants and carried out the grant agreement preparation steps leading to the signature of six grant agreements,
- Launched the projects and conducted supervision and monitoring activities.

As documented in the Single Programming Document 2018-2020 (section III paragraph 2.6.1.2), the SESAR JU was looking to award 5-10 projects in response to the call for proposals, with a maximum duration of 18 months and an end-date no later than March 2020, covering the following scope: comprehensively prepare and de-risk a rapid deployment of U-space initial services (U2) as outlined in the U-space Blueprint. U2 provides the initial set of key services building on the foundation services (U1) by adding game-changing improvements enabling initial beyond visual line-of-sight operations (BVLOS) in rural, urban and sub-urban environments and facilitating the processes for authorisations for some drone operations.

The value of the call for proposals was EUR 9,5 million. As per the terms of the delegation agreement, an amount of EUR 500.000 out of the total delegation agreement value is devoted to SESAR JU’s

⁴¹ Delegation Agreement EC/SESAR JU with reference MOVE/E3/DA/2017-564/SI2.771010 on U-space demonstration activities

⁴² Title VIII of Regulation (EU, Euratom) No 2018/1046 of the European Parliament and of the Council of 18 July 2018 on the financial rules applicable to the general budget of the Union, amending Regulations (EU) No 1296/2013, (EU) No 1301/2013, (EU) No 1303/2013, (EU) No 1304/2013, (EU) No 1309/2013, (EU) No 1316/2013, (EU) No 223/2014, (EU) No 283/2014, and Decision No 541/2014/EU and repealing Regulation (EU, Euratom) No 966/2012

running costs related to the management of the call for proposals and grant agreements (for project ex-post audits).

The call was published in the SESAR JU website <http://www.sesarju.eu/procurement> on 31 January 2018, with a call closure on 15 May 2018, and with a plan to complete the evaluation and award process by the end of July 2018. This layout allowed for sufficient time for the proposal development by the applicants after the call announcement.

An information package was made available to the applicants on the dedicated SESAR JU web page, and included:

- The call for proposal, along with corrigendum documents, including the main information about the topic, timings and application rules,
- The technical specification of the call (Annex I of the call for proposals),
- The Grant Application Form (Annex II of the Call for Proposals), with a corrigendum document,
- The declaration on honour on eligibility, exclusion and selection (Annex II.a of the Call for Proposals),
- The model form for the proposal budget (Annex II.b of the Call for Proposals),
- The model of Grant Agreement under CEF (Connecting Europe Facility) (Annex III of the Call for Proposals),
- The model of financial statement and summary financial statement for the Grant Agreement (Annex III.a of the Call for Proposals),
- The model for the certificate on the financial statements for the Grant Agreement (Annex III.b of the Call for Proposals),
- Four batches of questions and answers documents (containing 58 questions in total), with background information on European Smart Cities. Last batch was published on 4 May 2018.

Ten proposals were received on 15 May 2018 in response to the call for proposals. These ten proposals represent 110 entities from 22 countries, from which 29% public entities and 71% private companies. 63% of the applicants were marked as SMEs.

The information in this section is a summary of the evaluation report which was submitted to the Executive Director in August 2018 on the evaluation process.

According to the process set forth in the call conditions section of the SPD 2018-2020, the proposals were first checked against the admissibility and eligibility criteria, and then against exclusion, selection and award criteria. The proposals were assessed as follows:

- Admissibility check,
- Eligibility check and verification against exclusion criteria,
- Assessment against selection criteria
 - Financial capacity check
 - Operational capacity check,
- Assessment of award criteria.

An Opening Committee was appointed by the Executive Director with ED Decision SJU/ED/655. The Opening Committee concluded that the ten submitted proposals were admissible and would be subject to the next evaluation steps.

The evaluation of proposals was carried out between 18 May 2018 and 25 July 2018 by an evaluation committee appointed by the Executive Director with ED Decision SJU/ED/655, including internal and Commission experts (from EASA, EDA, DG MOVE); they were assisted by three external independent

experts, selected in a way to ensure a high level of skills, experience and knowledge in the areas of the call (including domain expertise, project management, innovation, exploitation, dissemination and communication). The external experts were not members of the evaluation committee, and could not score the proposals, but their assessment was taken into account by the evaluation committee.

At the start of the evaluation, experts and members of the evaluation committee were briefed (on process, procedures, evaluation criteria and objectives of the research area concerned). All briefings emphasised confidentiality requirements and rules on conflicts of interests. Experts and members of the evaluation committee received the documentation with respect to the Programme and the call (e.g. call for proposals, technical specifications, etc.).

The proposals were first checked against the eligibility criteria, and then against the exclusion, selection and award criteria.

The ten proposals were verified for their compliance with the pre-announced eligibility and exclusion criteria (cf. sections 6 and 7 of the call for proposals procedure document).

Also, it was checked whether any of the future beneficiaries resulted in EDES. For all the 90 entities there was no flag in EDES system preventing them from being awarded under this call. Additionally, the EC Beneficiary register (PDM) was checked in order to identify whether any of these entities have been rejected under other Programmes (FP7 and H2020).

As a result of the verification, the committee concluded that, on grounds of eligibility criteria, one of the proposals should be rejected and the participation of one entity in a project should be rejected.

As per section 8 of the call for proposals procedure document, the evaluation of the proposals was done against financial capacity and operational capacity. As a result of this verification it was concluded that none of the proposals should be rejected based on their Financial Capacity. As a result of the verification of the operational capacity of participants, it was concluded that none of the proposals should be rejected based on their Operational Capacity.

As a result of the verification, it was concluded that none of the proposals should be rejected based on the call selection criteria.

The proposals were first assessed against the award criteria by each individual evaluator member of the evaluation committee, and external experts who briefed the evaluation committee on their findings.

The evaluation committee then conducted consensus meetings with the aim to discuss individual points of view of its members and receive the opinion of the external experts. As a result, the proposals were evaluated and ranked against the award criteria set out in the call for proposals Section 9 (based on the call conditions set forth in the SPD 2018-2020). The results of the expert evaluation were presented to an Award Advice Committee on 9 July 2018 aiming at assessing the contribution to the call objectives, coverage across EU Member States and the available maximum budget in order to prepare the final award recommendation to the SESAR JU Executive Director.

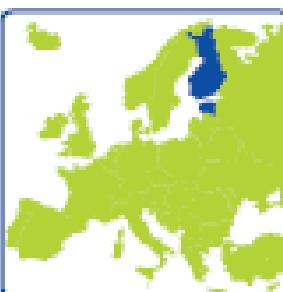
The evaluation committee provided a recommendation which together with the evaluation report was transmitted to the Executive Director who signed the final award decision on 14 August 2018 (SJU/ED/669).

The award decision was followed by the preparation and the signature of the grant agreements with the selected beneficiaries. The ex-post publication was done after the signature of the grant agreements. As a result of the award decision, the six selected proposals represent 77 entities from 14 countries, from which 18% are public organisations and 82% private companies. 50,6% of the beneficiaries are marked as SMEs.

The preparation of the grant agreements was done within the fourth quarter of 2018 and resulted in all grant agreements signed at the end of 2018. The total value of EU co-financing for the 6 projects is EUR 9.402.331,74.

After the grant agreement signature, the SESAR JU and the beneficiaries launched the six projects in execution on 20 November 2018. The SESAR JU invited the Commission, the EASA, EUROCONTROL and Global UTM Association (as a standardisation body) to attend to this meeting to ensure adequate coordination at European-level. The six projects are:

Project acronym, name and location	Projects	Max. total co-financing value (in EUR)
DIODE – D-flight internet of drones environment 	<p>The project aims to demonstrate how the implementation of the full set of the U-space services ensures a safe flow of drones that pursue specific business or recreational intents, fully integrated with manned aviation, and in all types of environment.</p> <p>Demonstrations will take place in Rieti, with several different geographical situations, including rural, mountain and remote territories, industrial, urban and semi-urban.</p> <p>The project covers the following missions: parcel delivery; road traffic patrol; professional photography; railway and power lines surveillance; search and rescue, airport operations; interaction with general aviation; firefighting.</p>	EUR 1.978.443
DOMUS – Demonstration of multiple U-space suppliers 	<p>The project aims to illustrate the full set of core U2 services, as well the demonstration of specific U3 services, such as tactical de-confliction and collaboration with ATM.</p> <p>Demonstrations will take place in Andalucía in Spain. They will involve three U-space service providers interacting with an ecosystem manager and several drone operators that will fly drones from different manufacturers.</p> <p>This project has a specific emphasis on questions such as “should the drone pilot receive voice communications from ATC? Should the controller be able to give commands to drone pilots (or in the future even to the drone directly) from ATM? In this case, what is the liability schema? Should both systems converge to a unique more automatized system? Etc.”</p> <p>One characteristic of this project is its architecture that mixes central and distributed services.</p>	EUR 1.989.400,21
EuroDRONE - A European UTM testbed for U-space	<p>The project aims to connect operators, regulators, law enforcement agencies, product developers and different systems in a unified environment. Specifically, the demonstration will test U-space functionalities up to U3.</p> <p>The demonstration will take place in Greece (in the Missolonghi region). It will be based on a sophisticated self-learning system offering fail-safe algorithms for conflict prevention/resolution and assets management.</p>	EUR 1.400.000

Project acronym, name and location	Projects	Max. total co-financing value (in EUR)
	<p>The main scenarios are:</p> <ul style="list-style-type: none"> • Scenario 1: some drones VLOS in cylinder, some drones in BVLOS but flying around the airport only; this scenario is for surveying, monitoring. Taking images and videos in general; • Scenario 2, show DAA with GA, with BVLOS plus as many VLOS as in first scenario; this scenario is for surveying, monitoring. taking images and videos in general; • Scenario 3, from the city to the airport, can be as the two previous, with VTOL drone from ELTA post office in city to landing on airport and B2B small parcel express logistics; • Scenario 4 from the city across the bay, as extension of scenario 3 and interacting with active ATZ. 	
GOF USPACE - Finnish-Estonian "Gulf of Finland" very large U-space demonstration 	<p>The project aims to establish a pre-operational Flight Information Management System (FIMS) with an architecture capable of integrating existing commercial-off-the-shelf UTM components.</p> <p>The demonstration will consider various missions such as International parcel delivery between Helsinki and Tallinn, dense urban drone fleet operations in Helsinki with Police intervention, Maritime traffic surveillance combined with search-and-rescue over Gulf of Finland and Drone Taxi flight from Helsinki-Vantaa airport to downtown Helsinki.</p>	EUR 1.617.098
SAFIR - Safe and flexible integration of Initial U-space services in a real environment 	<p>The demonstration will showcase an application for multiple drone operations that is viable, robust and ready-to-implement throughout Europe.</p> <p>A broad range of operations and services up to U3 linking to smart mobility will be demonstrated, including flights in both controlled and uncontrolled airspace</p> <p>The demonstration will take place in Belgium at three locations: City of Antwerp, Port of Antwerp and a DronePort Test Facility in Sint-Truiden.</p> <p>The demonstration will show multiple U-space service providers can cooperate in a same urban geographical area. Interfaces with ATC, dynamic geo-fencing and tactical deconfliction will be implemented to support this demonstration. The main missions are:</p> <ul style="list-style-type: none"> • BVLOS Oil spill inspection, • Parcel delivery, medical parcel delivery, 	EUR 1.328.441

Project acronym, name and location	Projects	Max. total co-financing value (in EUR)
	<ul style="list-style-type: none"> • High tension line mapping/inspection during construction, overhead line incident intervention and Pylon inspection, • Port inspection on Criminal offenses, Inspection container terminal for Port Authorities, • Monitoring cooperative and non-cooperative drones, • GA activities, Leisure drone activities, • Telecommunication network tests. 	
VUTURA - Validation of U-space by tests in urban and rural areas 	<p>The project aims to show how a common U-space framework with U1 and U2 services can enable multiple U-space service providers and multiple operators to execute commercially feasible B-VLOS operations. The demonstration will showcase these operations in a rural, urban and smart city environment. Each of the scenarios involve two service providers that have to coordinate their services and demonstrate many realistic elements.</p> <p>The demonstration will be performed at different locations in The Netherlands (Delft, near Rotterdam, near Enschede). Interfaces with ATC, with manned aviation will be implemented to support this demonstration that will take place different locations in the Netherlands (Delft, near Rotterdam, near Enschede). The main aspects that will be worked are</p> <ul style="list-style-type: none"> • Scenario 1 is in rural area and demonstrate how multiple service providers can coordinate in such environment. • Scenario 2 is performed in a real urban area (the city of Delft), which lies within the Control Zone of Rotterdam Airport. There are two service providers that provide their services to multiple drones in the same geographical area. • Scenario 3 is located between Twente Airport, representing a hub for packing delivery services, and the city of Enschede, representing a Smart City. There is one Service Provider for the area around the airport, and another for the city. The scenario uses five drones: two drones will fly over the city, two transport drones will fly from the airport to the city, and all flights shall give priority to the fifth drone that is operated by the fire brigade. 	EUR 1.088.949,53

Table 10: Very Large-Scale Demonstration activities selected as a result of the call CEF-SESAR-2018-1 in 2018 with their location and their max. co-financing value

In summary, all the retained proposals fully cover U1 and U2 U-space services & capabilities. Only one (DIODE) is limited to U1/U2 when the others cover additional topics related to U3 or even preparation for U4 services. Demonstration activities will cover various locations in Europe:

The project execution approach is summarised in the following figure:

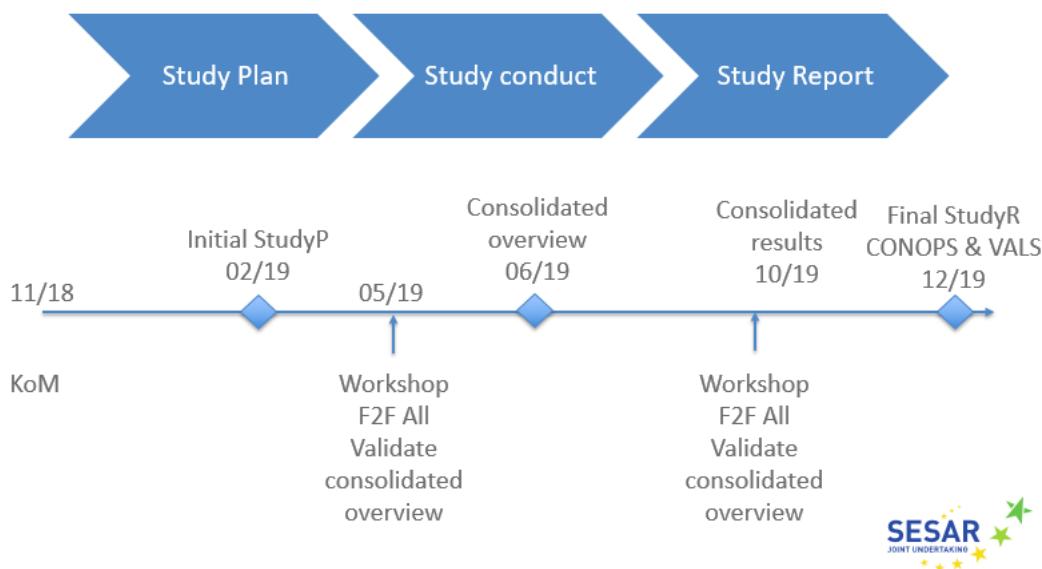


Figure 18: U-space project execution approach

2.4.2.2.2 Communication activities in relation with the implementation of the U-space delegation agreement

In 2018, the SESAR JU raised the visibility of the U-space and newly launched demonstration studies through a range of activities and communications channels. These activities aimed to show how Europe and its industries are making progress with the integration of drones into the airspace in a safe and secure manner, contributing to the overall objectives of the EU Network of Demonstrators. They are presented in section 2.5.3 below.

Furthermore, to coordinate communication activities, the SESAR JU carried out the following tasks:

- Ongoing liaison and coordination with demonstration projects on their communications activities, providing guidance material and support.
- Ongoing participation in the European Network of U-space Demonstrators platform to ensure that project results are shared and coordination is performed beyond initiatives under the SESAR JU direct responsibility.
- In addition to other initiatives, the SESAR JU has launched a cooperation initiative with its Founding Member EUROCONTROL to ensure the SESAR JU has all the resources and connections to deliver on its mandate for U-space.

2.4.2.2.3 Expenditure incurred in the implementation of the U-space delegation agreement

In order to assist with the evaluation of the submitted proposals external experts were used. For these activities, five commitments and payments were made in 2018 for a total value of EUR 14.207,55.

Following the award decision, six budgetary commitments for a total value of EUR 9.402.331,74 were created.

In 2018, five payments relating to pre-financing requests were executed, amounting to EUR 2.000.583,43 in total.

Local Key	User Ref.	Committed Amount	Consumed Amounts (by Payments)
SES.2779	USPACE GA CEF-SESAR-2018-1 GOF USPACE	1.617.098,00	404.275,00
SES.2780	USPACE GA CEF-SESAR-2018-1 SAFIR USPACE SJU/LC/0344-CTR	1.328.441,00	332.110,25
SES.2781	USPACE GA CEF-SESAR-2018-1 DIODE USPACE SJU/LC/0340-CTR	1.978.443,00	494.610,75
SES.2783	USPACE GA CEF-SESAR-2018-1 DOMUS USPACE SJU/LC/0341-CTR	1.989.400,21	497.350,05
SES.2785	USPACE GA CEF-SESAR-2018-1 EURODRONE USPACE SJU/LC/0342-CTR	1.400.000,00	-
SES.2786	USPACE GA CEF-SESAR-2018-1 VUTURA USPACE SJU/LC/0345-CTR	1.088.949,53	272.237,38
SES.2760	EXPERTS CALL EVALUATIONS U-SPACE	14.207,55	14.207,55
		9.416.539,29	2.014.790,98

Table 11: Budget implementation in relation with the U-space delegation agreement in 2018

The aforementioned budgetary commitments and payments were done following the standard SESAR JU procedures, fully in line with the SESAR JU Financial Rules.

2.5 Strategic Area of Operation 5: Deliver SESAR Outreach

The SESAR JU met all its objectives related to SESAR Outreach in 2018. This includes the following achievements and results:

- *Strengthen the Global Interoperability activities aligned with EC expectations, especially towards ICAO in close collaboration with U.S. FAA/NextGen and other global modernisation initiatives: active participation to the 13th ICAO Air Navigation Conference (ANC/13)*
- *Strengthen links towards Standard Making Organisations like EUROCAE, RTCA etc. with the involvement of SESAR JU Members and the availability of SESAR material in support of standardisation: the SESAR JU continued active cooperation with and contribution to the activities of EUROCAE, EASCG, RTCA and EUSCG*
- *Strengthen dissemination of SESAR Solutions/Demonstrations/ER activities and results through SESAR publications, workshops or communication events: all events and publications took place according to plan*
- *Active (existing) cooperative arrangement with all European (EU Member States and Regions), international actors and other modernisation initiatives in Aviation relating to SESAR Definition and Development: the SESAR JU continued active cooperation with global ATM stakeholders, especially through the active participation to the works of ICAO in the evolution of the GANP/ASBU and the Global Aviation Safety Plan*
- *Prepare new cooperative arrangement with European (EU Member States and Regions), international actors and other modernisation initiatives in Aviation relating to SESAR Definition and Development: no new agreement was required*

The SESAR JU is responsible for securing the support and buy-in of all stakeholders in the ATM value chain for the definition and development of SESAR technologies and procedures (SESAR Solutions). This requires continued and extensive outreach (communications activities and external relations) targeting a wide range of organisations, including air navigation service providers, airspace users, airports, the manufacturing industry, national aviation authorities and EASA; standards-setting organisations; professional staff organisations; as well as the relevant scientific institutions or the relevant scientific community. These outreach activities are supported by the core SESAR JU membership, as well as cooperation agreements and contracts with specific stakeholder groups. The SESAR JU also conducts outreach activities with international partners in support of global interoperability and harmonisation, recognising these as vital prerequisites for a safe, secure, efficient and sustainable global ATM system.

During 2018, the SESAR JU continued its outreach activities with external stakeholders under a range of cooperative arrangements as described in the sections below. This collaboration is crucial to the success of the SESAR JU's work and a major contributor to the SESAR JU deliverables.

2.5.1 International Affairs

The SESAR JU continued to engage during 2018 in international activities in the framework of the EU Aviation Strategy and in close coordination with the European Commission. The principal objectives were to secure SESAR's position as a global leader in ATM modernisation in support of ICAO's Global Air Navigation Plan (GANP), to support EU industrial leadership and to focus on SESAR Solutions for global interoperability and harmonisation.

A key milestone in 2018 was the 13th ICAO Air Navigation Conference (ANC/13) in October. The SESAR JU participated actively with the EC and ECAC States and European organisations, to prepare Europe's working papers and positions for the Conference. The collaboration followed a common European line to take ensuring that the European ATM Master Plan, the European Aviation Safety Plan and the SESAR ATM modernisation programme maintained a leading role in the evolution of the ICAO GANP/ASBUs and the Global Aviation Safety Plan. The ANC/13 outcome was consistent with Europe's objectives and follow-up work commenced immediately in order to prepare the 40th ICAO General Assembly in 2019.

The SESAR JU maintained its close cooperation, both formally and informally, with the FAA and its NextGen programme. The newly revised EU-U.S. MoC (Memorandum of Cooperation) on Air Traffic Management Modernisation, Civil Aviation Research and Development, and Global Interoperability, signed in December 2017, provided a modified basis for the SESAR JU's collaboration with FAA, aimed at ensuring harmonisation and interoperability between the two Programmes where appropriate. This resulted in particular in the need to integrate the SESAR/NextGen collaboration on R&D (under Appendix 1 of the MoC) more closely with parallel efforts in the domains of Performance (Appendix 2) and Deployment (Appendix 3). The aim is to establish three well-aligned work programmes with clear deliverables in place for 2019. Three Coordination Committee (CCOM) meetings were held with the FAA during the year. One major deliverable during 2018 was the publication in September of the 3rd Edition of the SESAR/NextGen State of Harmonisation report. The year 2018 also saw the delivery of an initial joint strategy for SWIM, further development of a harmonisation risk management framework covering the full ATM lifecycle from planning, development and deployment, and deepening cooperation in the fields of drones and cyber security.

Efforts also intensified during the year to build closer cooperation with other international partners. In 2018 the SESAR JU held discussions with a number of international partners with whom cooperative arrangements were already in place, either via the SESAR JU's own MoCs (notably Singapore and Qatar) or via arrangements at the level of the European Commission (Japan and China), as well as contacts with a number of countries to explore their interest in SESAR. The SESAR JU hosted a trainee from Japan's Civil Aviation Bureau for a one-year overseas fellowship, which has allowed each side to gain a better understanding of each other's ATM modernisation programmes. This will provide the basis for discussions in 2019 on how to develop cooperation further in the future.

The SESAR JU also participated in a number of international activities during 2018. This included the International Symposium for ATM in Civil Aviation in Beijing, China; Japan Drone 2018 in Tokyo, Japan; drones workshops in Shenzhen, China and in Singapore, under the umbrella of EU technical cooperation projects; and participation in a workshop in Bangkok on ATM master planning for the ASEAN countries.

2.5.2 Stakeholder engagement

2.5.2.1 SESAR Deployment Manager (SDM)

During 2018, the collaboration under the 2015 Memorandum of Understanding (MoU) between the SESAR JU and SDM continued with bi-monthly meetings to iron out areas of required cooperation fostering the good relationships between SESAR JU and SESAR DM teams. The MoU Steering Committee met twice where the cooperative work was reviewed, discussed and given a steering on key topics. The cooperative arrangement covers as described previously the ATM modernisation lifecycle all described in four annexes to the MoU. The SESAR JU and SDM respective focal points act as secretaries to the SC and the Annex leads work out common SDM/SESAR JU reports as steered by the SC meetings. Of particular interest during 2018 were the coordination around the MP campaign, PCP review and the SESAR JU and SDM roles under the revised U.S. – EU MoC on SESAR/NextGen interoperability. Continued coordination building on the common strategy for communications with

events and publications, specifically for events like the World ATM Congress 2018 and 2019. The collaboration between the SESAR JU and the SDM is part of the mitigation of risks recognised in the coordination of the ATM Master Plan (see in particular risks CORP01 and CORP04 in chapter 1.6 ‘Overall risk level of SESAR JU activities at end 2018’).

Having particular regard to Commission Implementing Regulation 409/2013⁴³ on the definition of common projects, the establishment of governance and the identification of incentives supporting the implementation of the European ATM Master Plan, the SESAR JU supported the Commission in monitoring the implementation of the Pilot Common Project. The efforts of the SESAR JU were geared at ensuring to the greatest extent possible continuous connection between SESAR research, development, innovation and validation activities and SESAR deployment and to ensure that common projects and the deployment programme are in line with the ATM Master Plan.

2.5.2.2 EASA

The cooperation and coordination between EASA and the SESAR JU under the Memorandum of Cooperation signed in 2016 was furthered strengthened in 2018. Results of this excellent cooperation were made visible with the delivery of the CP2 proposal including a direct set of solution to critical safety network performance deficiencies identified by EASA and the delivery by EASA of the updated European Aviation Safety Plan (EPAS) making a direct connection with the European ATM Master Plan for the first time in aviation history.

Cooperation with EASA was also strong to deliver the Airspace Architecture study which identified a number of changes needed to the regulatory framework such as the creation of a certification framework for ATM Data Service Providers (ADSPs) or a review of ATCO licensing schemes.

Last, the collaboration with EASA also focused on developing the regulatory framework for U-space ensuring that it is inspired by the growing portfolio of SESAR research and innovation projects dedicated to U-space.

Patrick Ky, Executive Director of EASA, said: “*The MoC signed in 2016 strengthened the cooperation between EASA and SESAR JU, and enabled EASA to be involved in a concrete and constructive way. It is essential that the regulator is able to intervene at an early stage of the development for new technologies, in order to facilitate their implementation at a later stage. This is vital for Europe to stay on the leading edge of ATM modernisation.*”

2.5.2.3 European Defence Agency

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

The SESAR JU and the European Defence Agency (EDA) have been engaged in close dialogue since 2011 and this relationship continued in 2018 to deepen on military matters and opinions into the

⁴³ OJ L 123, 4.5.2013, p. 1–7

Programme. EDA now serves as the main interface between SESAR 2020 and SESAR JU activities and military aviation and ATM and sets the responsibilities for EDA to facilitate the coordination of military views with regard to Single European Sky and SESAR.

The cooperation under the MoC resulted in 2 Steering Committees in 2018 aiming at securing military inputs into the Master Plan as well as technical advice to project evaluations and the programme in general. SESAR JU input into the EDA activities was at the same time increased in several areas such as: coordination between EDA, EUROCONTROL and NATO as well as with DG MOVE is established directly by EDA to make sure coordination with the greater military community in relation to key areas of the SESAR JU activities.

In 2018, the productive cooperation with EDA continued and focussed on the important area of IFR RPAS integration, where the activities of the two organisations were harmonised in order to promote coherence and to avoid duplication or omission. SESAR JU staff contributed to the definition and review of EDA projects, while EDA staff contributed to the definition of the SESAR 2020 Wave 2 definition. In addition, the SESAR JU participated in the EDA/EASA military IFR Conops definition, designed to support the accommodation of military RPAS operations within the ATM environment in the near to medium-term period.

Jorge Domecq, Chief Executive of EDA, said: *“Since the signing of the Memorandum of Cooperation between EDA and the SESAR JU in 2016, considerable progress has been achieved regarding civil-military collaboration in ATM modernisation. Today, the defence community is seen as a key and trusted partner for the successful implementation of the Single European Sky, notably regarding SESAR.”*

2.5.2.4 Civil Airspace Users

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

Civil airspace users are directly integrated within the Programme through four framework and related specific contracts reflecting the specific interests and skills of different categories of airspace users (Lot 1 European scheduled airlines; Lot 2 Global airlines, Lot 3 Business aviation and Lot 4 General aviation and rotorcraft). Their expertise is recognised as key in ensuring the overall success of SESAR 2020 activities.

In 2018 the airspace users supported the SESAR JU in the monitoring and steering of SESAR 2020 projects, providing substantial expertise into reviewing and commenting the Solution Projects' deliverables through delivery of technical analyses, priority and gap analyses, participation in maturity gate meetings and validation exercises, and provision of technical advices. This was key for a robust assessment of the quality of SESAR Solutions and the benefits expected from their implementation.

Beyond this support to the programme activities, their input was also crucial to provide airspace user communities' views, concerns and requirements on the Master Plan update through membership in the Master Planning Committee, Master Planning Group and in-depth involvement in all thematic expert groups, Key Focus Teams and Completion Teams, active all along the year 2018.

Airspace Users were also consulted during the process of development of the Airspace Architecture Study, through specific and targeted bilateral meetings as well as participation in the public workshops.

2.5.2.5 Professional Staff Organisations

The SESAR JU collaborated in 2018 under MoC's with the Professional Staff Organisations of the International Federation of Air Traffic Controllers' Associations (IFATCA), the European Cockpit

Association (ECA), the International Federation of Air Traffic Safety Electronics Associations (IFATSEA), the European Transport Workers' Federation (ETF), and the Air Traffic Controllers European Union Coordination (ATCEUC).

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

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

2.5.2.6 Airports Council International, Europe

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

In 2018, the close cooperation between ACI EUROPE and the SESAR JU continued allowing an efficient and constructive relationship, materialised by a new specific contract implementing the framework contract established in 2016. Through this contract, the following main activities were performed:

- ACI Europe and the SESAR JU organised two thematic workshops to promote airport related SESAR R&D and deployment activities:
 - A workshop titled 'Exploring new concepts in air traffic management and airports', hosted by Malta International Airport on 12 April 2018. See section 2.5.3 Communications for further details;
 - A workshop on the challenges and opportunities presented by drones and their safe and secure integration into the airspace and at airports, hosted by Avinor in Oslo on 26 November 2018. See section 2.5.3 Communications for further details.
- ACI EUROPE supported the SESAR JU in communication activities by publishing several SESAR related news items and articles in ACI EUROPE's newsletters and magazine;
- The SESAR JU promoted the work performed in SESAR and explained the benefits for airports at the main ACI EUROPE events: the General Assembly, Airport Exchange and the Technical and Operational Safety Committee bi-annual meetings;
- A team of operational and technical experts from ACI EUROPE's member airports delivered a report listing the priorities for airports in terms of ATM R&D;
- ACI EUROPE published, with the support of the SESAR JU, a publication titled '[SESAR and the digital transformation of Europe's airports](#)'. The publication was officially launched at the ACI EUROPE and ACI Asia-Pacific Airport Exchange conference and exhibition in Oslo at the end of November;
- The SESAR JU participated in an ACI EUROPE workshop on drone risk mitigation from an airport perspective;
- ACI EUROPE experts reviewed the initial U-space ConOps and provided comments to the SESAR JU.

Olivier Jankovec, Director General of ACI EUROPE, said: “Over the past years, as our cooperation has intensified, ACI EUROPE and its members have gained a deeper understanding of the solutions being developed and deployed by SESAR. Through active participation in projects and communication of SESAR to the wider airport community, we value our partnership with SESAR very highly. More than that, we share the goals of its passionate team, in the pursuit of a better, more sustainable and more seamless air transport system for Europe.”

2.5.2.7 Standard-Making Organisations

The collaboration between the SESAR JU and the standard-making organisations is part of the mitigation of risks recognised in the coordination of the ATM Master Plan (see in particular risks CORP01 and CORP04 in chapter 1.6 ‘Overall risk level of SESAR JU activities at end 2018’).

2.5.2.7.1 EUROCAE

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

During 2018, SESAR deliverables were made available in support of standardisation development work in several EUROCAE Working Groups covering several key content areas of the SESAR 2020 work as well as towards the coordination with the equivalent Special Committees of RTCA.

EUROCAE published standards in 2018 with contributions from and of direct relevance to SESAR Solutions.

Christian Schleifer, Secretary General of EUROCAE, said: “Our cooperation with the SESAR JU has been essential for the development of standards for innovative solutions and technologies and the recognition of these standards as Acceptable Means of Compliance (AMC) to support the regulatory requirements. Today we can see that European R&D leads to globally recognised and implemented solutions, by applying EUROCAE standards, as the reference worldwide. The spirit of cooperation and teamwork was portrayed clearly at the World ATM Congress through the joint stand under the motto ‘Europe for Aviation’. EUROCAE accompany the full cycle from R&D to industrialisation and deployment, but there is more to be done, we can get even better at integrating and liaising with our partner organisations and other stakeholders, take the lessons learned and improve the overall cycle and make it even more efficient and effective for a quick response to the challenges we are facing today”.

2.5.2.7.2 The European Air Traffic Management Standards Coordination Group (EASCG)

In 2018, the SESAR JU continued as an active participant in the European Air Traffic Management Standards Coordination Group (EASCG), with the objective to coordinate standardisation activities, identify their links with the R&D activities and to provide a forum for discussion. The SESAR standardisation roadmap is used as a major input in the European ATM Standardisation Rolling Development Plan, and provides not only the reference for ATM standardisation needs in European (including SESAR specific needs) but also serves as the basis for the European input of both the process and contents into the ICAO standardisation roadmap development.

2.5.2.7.3 The European UAS Standards Coordination Group (EUSCG)

In 2018, the SESAR JU continued as an active participant in the European UAS Standards Coordination Group (EUSCG), with the objective to coordinate UAS related standardisation activities and needs.

2.5.2.8 National Aviation Authorities

Within 2018, SESAR JU continued the cooperation arrangements with National Aviation Authorities. The main objective of the cooperation with NAAs is to secure their early involvement in R&D activities to minimise the risks inherent to the transition between SESAR development and deployment activities. Sixteen Aviation Authorities participates in the cooperation with SESAR JU under bilateral Memoranda of Cooperation. SESAR JU and National Aviation Authorities met on a quarterly basis and progresses according to an agreed work plan following up the work and discussing and detailing the main activities. In addition to the quarterly meetings with all NAAs, the SESAR JU conducted 7 bilateral meetings with NAAs at national level to provide an update on SESAR and strengthen the cooperation.

The main areas of interest for NAAs were the analysis performed in the context of the Airspace Architecture study as well as the preparatory activities for the update of the European ATM Master Plan as most of the development work related to the CP2 proposal was already completed in 2017.

2.5.2.9 Space

2.5.2.9.1 European Space Agency

The European ATM Master Plan clearly identifies the need for space-based positioning for navigation and communication services in support of time-based and trajectory-based operations, as well as for improved operations into less well-equipped airports or with differently equipped vehicles.

Within the context of a memorandum of cooperation (MoC) signed between the ESA and the SESAR JU in 2016, coordination between the two organisations has progressed well, particularly in relation to ESA/Inmarsat Iris activities and the SESAR JU PJ.14 project on satellite communications. This activity allowed the development of a shared view on the value chain and interdependencies between both Programmes.

Ultimately, this coordination with ESA and the finalisation the Iris system are key to enabling 4D operations worldwide. Magali Vaissiere, Director of Telecommunications and Integrated Applications at ESA, said: “*The Iris technology is ready for implementation. We and the industrial consortium led by Inmarsat have developed Iris into a vital, enabling tool for the aviation sector and our European Commission partners in SESAR. We are extremely pleased to have passed this very significant milestone on the road to safer, greener and more efficient air travel.*”

2.5.2.9.2 European GNSS Agency (GSA)

Informal coordination with GSA continued during 2018 pending the agreement of a MoC now scheduled for Q3 of 2019. This includes provision of SESAR views and exchange about potential overlaps, content issues, scope of ongoing and future calls and the development of a joint dashboard of GNSS projects/calls to avoid duplications and better manage the interdependencies.

2.5.2.10 Clean Sky

In 2018, the cooperative arrangements with Clean Sky 2 Joint Undertaking (Clean SKY 2 JU)⁴⁴ continued under the Memorandum of Cooperation signed in December 2015. The cooperation in 2018 covered areas like rotorcraft and general aviation capabilities and procedures, environmental performance measures and goals and to explore Clean Sky 2 JU’s process and relationship SME’s in European regions. A particular area investigated during 2018 was on a deep-dive on Clean Sky 2 JU and SESAR JU projects definitions and planning in order to avoid duplications and help to find synergies.

⁴⁴ Council Regulation (EU) No 558/2014 of 6 May 2014 establishing the Clean Sky 2 Joint Undertaking (OJ L 169, 7.6.2014, p. 77–107)

2.5.3 Communications

Over the course of 2018, the SESAR JU organised a series of events to maintain a high profile and engagement with relevant stakeholders across the ATM community. In addition, SESAR JU staff participated close to 150 further events, raising the visibility about the SESAR project. The following are highlights from events in which the SESAR JU actively participated:

2.5.3.1 Events

Information day on the open call on U-space demonstrators, 2 February, Brussels

As mentioned above in paragraph 2.4.2.2.2, the SESAR JU organised an information day to present the purposed and expected content for a call for proposals dedicated to U-space demonstrations. The aim was to provide potential applicants with information about the call, including the scope of the call, conditions and execution guidelines as well as the evaluation process. Applicants were also given an opportunity to ask questions in relation to the call and subsequent demonstrations.

Singapore Air Show 2018, 6-11 February, Singapore

The SESAR JU participated in the Singapore Air Show event with an exhibition stand in order to strengthen the international profile of SESAR and showcase the European public-private partnership as a leading research and innovation initiative for ATM modernisation. Throughout the course of the week, the SESAR JU was privileged to welcome several industrial leaders and international delegations to find out more about Europe's modernisation efforts. Using a 3D virtual tool, visitors were given the opportunity to step into the shoes of an air traffic controller and manage traffic at a busy airport using a range of digital tools delivered by SESAR.

World ATM Congress 2018, 6-8 March, Madrid

Visitors to the World ATM Congress 2018 (WAC 2018) got a taste of the transformation that is underway in air traffic management thanks to SESAR JU Members and other industry partners through the series of events and walking tours at the WAC 2018 in Madrid (6-8 March 2018). The 15 walking tours gathered around 400 participants who met and exchanged with experts from the SESAR community and saw first-hand the wide variety of solutions being delivered and deployed across Europe. The full lifecycle of SESAR, from innovation to deployment, was also presented in a session jointly organised by SESAR JU and SESAR Deployment Manager. The session updated stakeholders on the Pilot Common Project review, the Common Project (CP2), the next edition of the ATM Master Plan, as well as plans to rethink the airspace architecture.

To mark International Women's Day, the SESAR Joint Undertaking co-hosted a session on gender equality in the sector, which session highlighted the status of gender parity in the industry and what stakeholders are doing to strike the right balance. A central piece of the SESAR stand was a digital wall, where visitors could interact with the SESAR-enabled air traffic management system of the future. By tapping the wall, visitors could zoom into different parts of the system to check out the innovative digital solutions developed and delivered so far, as well as the deployment activities underway across Europe. The SESAR exploratory research project "Resilient Synthetic Vision for Advanced Control Tower ANS Provision" (RETINA) was among the winners of the 2018 ATC Awards, which took place on 6 March at the World ATM Congress in Madrid. The project received the coveted prize for its innovative research into the application of augmented technologies to improve situational awareness in control towers.

ACI-SESAR JU workshop: exploring new concepts in ATM and airports, 12 April, Malta

Encouraging new ideas and fresh thinking is critical for innovation in aviation in order to respond to the growing demand for air travel and the increasing number of air vehicles, such as drones, taking to the skies. A workshop organised by ACI EUROPE and the SESAR JU on 12 April, kindly hosted by Malta International Airport, presented promising results from a number of SESAR exploratory projects on topics addressing aspects of airport operations, as well as the broader ATM value chain. These included augmented/virtual reality and enhanced vision technologies, automation, complexity and data science and enhanced environment & meteorology solutions.

European Transport Arena, 16-19 April, Vienna

The EU Transport Research Arena (TRA) is the largest transport research and innovation conference in Europe. This year, the event was co-organised by the European Commission's DG RTD and DG MOVE with the Austrian Ministry for Transport and Innovation, and was hosted in Vienna from 16 to 19 April 2018. Under the heading of "A digital era for transport", the TRA explored, discussed and demonstrated how major trends such as digitisation, automation and decarbonisation are impacting Europe's transport sector. The SESAR JU supported the event, namely in the exhibition area as part of the main EU stand, which presented the results of EU-funded research projects. The SESAR area of the stand featured several digital tools to give users the chance to see the SESAR-enabled air traffic management (ATM) system of the future, including the management of drones and augmented airport tower control.

Airspace Architecture Workshops, 5-6 July/20-21 November, Brussels

The SESAR JU organised two workshops to openly exchange with stakeholders on the scope, objectives and initial insights of the Airspace Architecture Study. The workshops brought together 180 participants on both occasions as well as viewers via the live web streaming. The first workshop was hosted in July in order to receive early stakeholder input to help shape the outcome of the study, while the second focused on a concrete way forward. The workshops featured presentations and well as panel discussion between representatives from across the aviation chain. Together they discussed the current system and factors that are hampering performance. The workshops also looked at the key principles for optimising European airspace, as well as some of the game changing solutions, which if coupled with a re-configuration of the airspace, could bring maximum impact primarily in terms of increasing capacity. The proposals outlined in the study were well received by stakeholders who showed their support for the SESAR JU during the workshops.

ACI-SESAR drone workshop and ACI Airport Exchange, 26-29 November, Oslo

The SESAR JU in collaboration with ACI Europe co-hosted a workshop on the challenges and opportunities presented by drones and their safe and secure integration into the airspace. Bringing together a total of 70 stakeholders from the drone, airport and broader aviation community, the workshop was an opportunity to present several U-space projects recently launched by the SESAR JU. SESAR and its role in supporting the digital transformation of airports was also a focus of the ACI Exchange (27-29 November). In this respect and on the occasion of the conference, ACI EUROPE published SESAR and the Digital Transformation of Europe's Airports, aimed at further engaging the airport community in proven technological solutions for more efficient and sustainable airport operations. Participants were given further insights into SESAR's work on airports through two session

interventions by Peter Hotham, SESAR JU Deputy Executive Director, addressing ATM delays in the context of airports and digital transformation from a passenger perspective. A dedicated SESAR JU stand allow participants to discover SESAR innovation through a digital/VR experience.

SESAR Innovation Days, from 3 to 7 December, Vienna

As introduced above in paragraph 2.2.5.1, from 3 to 7 December 2018, over 330 participants gathered for the annual SESAR Innovation Days (SIDs) event, which was hosted by the University of Salzburg. This was the highest number of attendees at any SIDs conference to date, which not only demonstrates that the SESAR ER community is growing but also shows that industry and other partners are recognising the importance of the event. The weeklong event put air traffic management (ATM) exploratory research in the spotlight through a series of workshops, presentations, poster exhibitions and networking events. Now in its eighth year, the 2018 SIDs have grown into an established networking platform for Europe's academic and scientific aviation community. This year, the SIDs also welcomed a strong industry representation at the event, bringing together a very strong pool of scientific expertise in order to share research experiences, foster innovation and ultimately to sow the seeds of change in industrial ATM research. Further information on the nature of activities that took place during the event, can be found above in paragraph 2.2.5.1.

Against the background of the SESAR Innovation Days 2018, the SESAR Joint Undertaking hosted the 2018 SESAR Young Scientist Award (YSA 2018) Ceremony (see also above in paragraph 2.2.5.2). The YSA 2018 aimed to recognise young scientists with high potential contributing to the scientific research in the field of air traffic management and aviation. In addition, the award also provides a mechanism for further personal development and visibility. This year, the SESAR JU received approximately 20 applications from across Europe, including Spain, Italy, Germany, France, Slovenia, Ireland, Serbia, UK and Sweden. The jury was composed of representatives from our scientific Committee, Patrizia Marti and Rita Markovits and was chaired by the chairperson of the SESAR JU Scientific Committee Peter Hecker.

In addition, the SESAR JU provided guidance and support to SESAR JU project participants in promoting workshops, open days and conferences related to the SESAR research and innovation programme.

Events and meetings in relation with the U-space call for proposal

- Organised an information day/webinar on 2 February 2018, bringing together participants representing 80 companies and organisations from all over Europe, to present U-space and the technical specification of the open call.
- Presented/launched demonstrations during the [European Network of the U-space Demonstrators](#) (Antwerp, 19 October 2018), with over 100 stakeholders from air traffic management and the drone industry.
- Co-organised [a workshop with ACI Europe on drones and airports](#), at which the drone demonstrations were presented (Oslo, 26 November 2018), bringing together around 70 stakeholders from the airport and drone industries.
- All the projects attended a kick-off meeting during which they introduced their scope and objectives to the EASA, EUROCONTROL, and GUTMA representatives (Brussels, 20 November 2018).

2.5.3.2 Publications

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

SESAR Innovation Pipeline – 2018 Highlights

SESAR 2020 is a European research and innovation programme, which aims to transform air traffic management into a more modular, scalable, automated, interoperable system that takes advantage of advances in digital and virtualisation technologies. This brochure provides highlights of some of the SESAR research and development (R&D) activities that took place over the course of 2018 as well as what is coming in 2019.

[View publication](#)

SESAR INNOVATION PIPELINE



Exploring the boundaries of air traffic management

A summary of SESAR exploratory research results 2016–2018

By advancing promising research ideas and embedding them in a broader programme of work, the SESAR JU is helping to future-proof Europe's aviation industry and to maintain its global competitive edge. This publication captures the results from some 28 completed exploratory projects. Taking place between 2016–2018, the selected projects have brought together 80 academic and industry partners from across the EU and beyond

[View publication](#)

Exploring the boundaries of air traffic management

A summary of SESAR exploratory research results
2016–2018



NextGen – SESAR State of Harmonisation

Now in its third edition, the State of Harmonisation publication reflects the current and planned collaboration efforts by the U.S. and the EU to harmonise and secure the modernisation of ATM, not just across the Atlantic but globally in support of the ICAO GANP and ASBU programme. Both NextGen and SESAR recognise the need to integrate the air and ground components of their respective ATM systems. This requires greater efficiency in the planning and execution of flight trajectories and the seamless and timely sharing of accurate information.

[View publication](#)

NextGEN SESAR

State of Harmonisation

Third edition

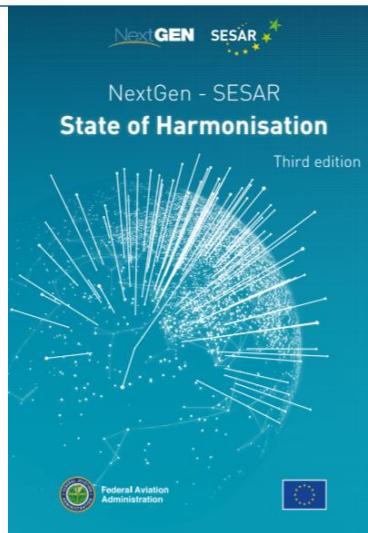




Table 12: Main publications by the SESAR JU in 2018

2.5.3.3 Online communications

2.5.3.3.1 Digital media

In 2017, the SESAR JU produced the following digital material:

SESAR Interactive wall

With the wall, users can interact with the SESAR-enabled air traffic management system of the future. By clicking on the "wall", users can zoom into different parts of the system to check out the innovative digital solutions developed and delivered so far, as well as the deployment activities underway across Europe. The interactive wall is a shared digital tool with the SESAR Deployment Manager. It was unveiled at the 2018 World ATM Congress and has been since adapted for use online via the SESAR JU website: [Access the interactive map](#).

SESAR JU innovation pipeline highlights

The highlights are an interactive timeline, which presents some key milestone of the SESAR JU in 2018: [View the SESAR innovation pipeline highlights](#).

Media and online news in relation with the U-space call for proposal

- Published a [news item](#), which was integrated in a European Commission press release, to mark the launch of the demonstrations at the same time as the [European Network of U-space Demonstrators](#),
- Promotion of demo launch through [SESAR e-news](#) (October 2018),
- U-space, including demos, was featured in interview by Florian Guillermot, Executive Director of the SESAR JU, in [Airport Business](#) (November 2018),
- SAFIR project was featured in [New York Times](#) article (December 2018).

2.5.3.3.2 Website and e-news

The SESAR website was updated to give greater visibility to new SESAR 2020 projects, including U-space exploratory research and demonstration projects. In 2018, the SESAR JU maintained its online readership with an average of between 30,000 and 40,000 visitors to its public website on a quarterly basis. Many of visitors were new, which may be attributed to the increased visibility of U-space R&D.

A monthly e-news was sent to external audiences (nearly 4,000 contacts, all GDPR compliant), as well as dedicated event mailshots and press releases attracting further readers to the SESAR JU website. Among the most popular items are the U-space Blueprint and drone developments, the digital agenda and calls notices.

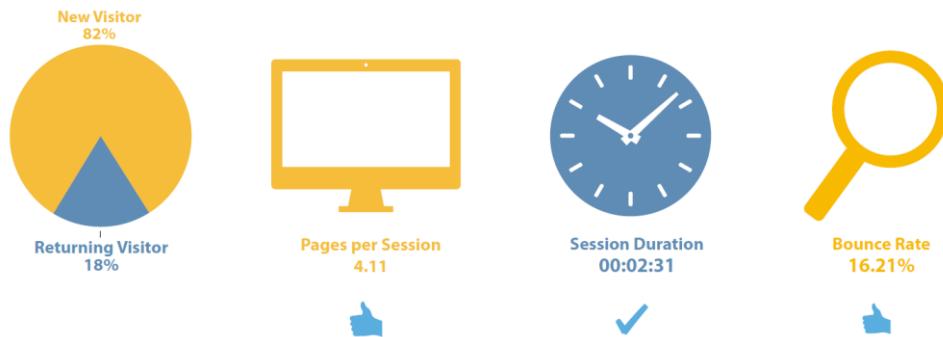


Figure 19: Key metrics on the SESAR JU website

Website and social media in relation with the U-space call for proposal

- Promotion of U-space demo projects on SESAR JU's U-space webpages: <https://sesarju.eu/U-space>,
- The launch of demonstration projects was promoted on Twitter and LinkedIn, and the SESAR JU coordinated social media campaign with the European Commissioner for Transport Violeta Bulc – see sample of tweets:
- All: https://twitter.com/SESAR_JU/status/1053272979298271236,
- All: https://twitter.com/SESAR_JU/status/1053268161984950272,
- VUTURA: https://twitter.com/SESAR_JU/status/1067015273109180417,
https://twitter.com/SESAR_JU/status/1067015273109180417,
https://twitter.com/SESAR_JU/status/1067015273109180417,
https://twitter.com/SESAR_JU/status/1067015273109180417,
- GOF: https://twitter.com/Bulc_EU/status/1085090350404943872,
- DIODE: https://twitter.com/Bulc_EU/status/1082552069540794368.

2.5.3.3.3 Social media, metrics and monitoring

The SESAR JU continued to make significant use of social media in 2018, in particular Twitter (3,178 followers), which proved to be an effective means to engage with stakeholders at events and promote validation and demonstration activities. The SESAR JU also continued to engage with stakeholders through LinkedIn (Company page: 3.889 followers and 6.071 members) through regular postings.

SJU online community increased on all social media networks. SJU Twitter community has witnessed the larger increase (+33%).

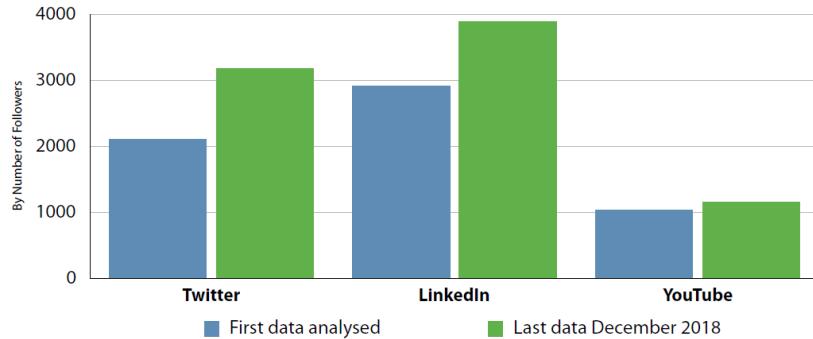


Figure 20: Key metrics on the SESAR JU social media

Peaks in engagement rate and view in both channels were reported thanks to the increase of posts by the SESAR JU and their multiplier effect at key events during the year, including: World ATM Congress, SESAR Innovation Days, Airspace Architecture Study workshops, Launch of the EU U-space Network of Demonstrators, ACI-SESAR JU workshop on drones and the EU Aeronautics Conference. The SESAR JU also supported DG MOVE and the Transport Commissioner with a campaign of tweets on U-space.

(2017-2018) Total number of posts **1,315**



Figure 21: Key metrics on the SESAR JU tweets

In 2018, the SESAR JU conducted reviews of the metrics and monitoring of its online communications in order to evaluate the value of this area of work and identify where best to concentrate its efforts. The reporting, which is done on a quarterly basis, provides hard data on the SESAR JU online channels, cross references social media with events and publications, benchmarks the SESAR JU against similar organisations, and offers recommendations on how improve communications in this area. With a view to increasing engagement through social media, the SESAR JU developed a social media user policy for staff coupled with a training session highlighting the dos and don'ts of using Twitter and LinkedIn.

Compared to the same quarter last year (2017):

	Followers		Posts		Engagements		Potential Reach		Mentions	
	Q4 2017	Q4 2018	Q4 2017	Q4 2018	Q4 2017	Q4 2018	Q4 2017	Q4 2018	Q4 2017	Q4 2018
TW	2,359	3,178	-	342	1,151	2,278	-	4.3M	1,837	1,607
LK	3,092	3,889	-	13	507	528	-	49.3K	-	20(*)
YT	-	1,161	5	4	78	13	-	236	5	4

Compared to the previous quarter (2018):

	Followers		Posts		Engagements		Potential Reach		Mentions	
	Q3 2018	Q4 2018	Q3 2018	Q4 2018	Q3 2018	Q4 2018	Q3 2018	Q4 2018	Q3 2018	Q4 2018
TW	2,961	3,178	79	342	915	2,278	1.8M	4.3M	542	1,607
LK	3,668	3,889	11	13	340	528	39.9K	49.3K	14(*)	20(*)
YT	1,125	1,161	2	4	6	13	193	236	2	4

2.5.3.4 Press

In 2018, SESAR JU continued its outreach to trade press and member/partner media channels, with more than 20 featured articles and interviews in a range of magazines and online media:

- Trade or specialised press, including International Airport Review, Airport Industry Review, Airport Business, Air Traffic Technology, Air Traffic Management, Horizon, Aerospace Europe, Sciences et Avenir;
- Brussels-based and international press such as the Parliament Magazine, New York Times, Horizon Magazine;
- Member/partner media (EUROCONTROL's Skyways, ERA, ACARE, ATCA, ECAC, French Ministry of Defence etc.).

The SESAR JU also collaborated with Politico on its Connected Transport Summit, where the SESAR JU Executive Director was invited to speak.

A dedicated space highlighted some of the press coverage from 2018:
<https://sesarju.eu/newsroom/press-coverage>

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

The SESAR JU met all its objectives related to Exploratory Research in 2018. This includes the following achievements and results:

- *Implement the Calls and grants management framework: all planned calls for proposals were published, evaluated and followed by awards according to the specific rules (namely: CEF regulation)*
- *Implement findings of EC's mid-term review of H2020 implementation: all recommendations were implemented as planned*
- *Follow up audit recommendations: all recommendations were implemented or progressed as planned*
- *Ensure full compliance with programming and reporting requirements (H2020, EC...): the planning and reporting activities took place in full compliance with the regulatory requirements, including reporting requirements set forth in the delegation agreements*
- *Monitor efficiency and effectiveness of SESAR JU's HR activities: the staff turnover rate was below 10% and occupancy level was above 90% at the end of 2018, the CDR and promotion exercise was completed within 2018*
- *Monitor efficiency and effectiveness of SESAR JU's financial activities: the total commitments made amount to 83,18% of the overall budget and the total payments executed amount to 47,23% of the total budget*
- *Monitor efficiency and effectiveness of SESAR JU's legal & procurement activities: the contractual aspects of the contract action planning were implemented in due course*
- *Monitor efficiency and effectiveness of SESAR JU's project audit activities: all required project audit activities took place as planned, in coordination with the CSC as regards Horizon 2020 project audits*
- *Monitor efficiency and effectiveness of SESAR JU's corporate and management activities: all process improvement and risk mitigation actions tools place in due course; the new Internal Control Framework was implemented; Data Protection regulation implementation progressed significantly*
- *Deliver infrastructure services to enable teams and the SESAR JU to operate smoothly: no major disruption of service occurred*
- *SESAR 1 material archived: the SESAR 1 material archive was implemented*
- *Ensure effective and efficient SESAR JU governance meetings: three meetings of the Administrative board took place and all decisions were adopted in compliance with the rules and procedures*

In 2018, the SESAR JU continued to fulfil its management, financial, legal and administrative obligations effectively, and implemented measures related to efficiency gains and cost control. These activities are presented in the following paragraphs.

2.6.1 Financial management and budget implementation

2.6.1.1 Execution of the 2018 budget

2018 budget

The 2018 budget approved by the SESAR JU's Administrative Board⁴⁵, included **revenue** (included cash forecasted to be received, additional appropriations coming from carry-overs and internal assigned revenues) of **EUR 153.437.961** and **payment appropriations** (cash forecasted to be spent) of **EUR 140.909.219** (EUR 20.995.293 for SESAR 1 and EUR 119.913.926 for SESAR 2020).

In terms of expenditure, the budget presented **total available appropriations** of **EUR 175.917.663** (of which EUR 18.374.377 for SESAR 1 and EUR 157.543.287 for SESAR 2020), which includes **commitment appropriations** of **EUR 153.437.961** and carry-overs from previous years and internal assigned revenues for an amount of EUR 22.479.702. The budget presented **total payment appropriations** of **EUR 166.465.285** (of which EUR 39.876.964 for the SESAR 1 Programme and EUR 126.588.321 for the SESAR 2020 Programme), which includes **payment appropriations** of **EUR 119.913.926** and carry-overs from 2017 of EUR 46.551.359.

The 2018 budget figures can be found in detail in the paragraph 3.3.1.

2018 budget implementation

The **revenues established (recovery orders issued)** amount to **EUR 98.653.425** (64,3% of the approved budget and of which EUR 84.184.652 is EU contribution) and **revenue actually received** to **EUR 97.887.180** (69,47% of the approved budget and of which EUR 84.184.652 as EU contribution). The breakdown of these figures per revenue source appears in section 3.3.1.1.

The total **commitments made** amount to **EUR 146.323.724** (83,18% of the total available appropriations budget, of which 81,30% for SESAR 2020 available appropriations and 99,31% for SESAR 1 available appropriations). The total **payments executed** amount to **EUR 78.625.670** which is 47,23% of the total budget (see the table in sub-paragraph 3.3.1.2): out of this amount, EUR 1.840.160 are for SESAR 1 (4,61% of the available appropriations) and EUR 76.785.510 are for SESAR 2020 (60,66% of the available appropriations).

The low payment implementation rate (47,23% of the total available appropriations) is mainly influenced by the following elements:

- For the SESAR 1 Programme (winding-up and financial closure of the SESAR 1 projects), SESAR took a very conservative approach when establishing the budget in order to insure the coverage of all potential outstanding obligations.
- SESAR JU's continuous effort to keep the running costs at the minimum necessary.
- Over the last two years, the SESAR Joint Undertaking has been operating under several financial regulatory systems because it had to implement simultaneously projects under FP7, TEN-T, Horizon 2020, Connecting Europe Facility (CEF) and delegation agreements for assigned revenue.
- Despite the multi-annual nature of SESAR 2020 Programme, the SESAR JU cannot use multi-annual commitments. Therefore, the SESAR JU has to proceed according to its Single Programming Document with yearly grant budget amendment. This process is dependent on the availability of the "Annual Financial Implementation Agreement"

⁴⁵ ADB decision ADB (D)04-2018 adopted through written procedure closed with positive results on 12 February 2018

from the EC, which enables the SESAR JU to commit funds for the year ahead (the SESAR JU received the Annual Financial Implementation Agreement for 2018 in early July 2018).

The detailed breakdown of budget planning and implementation rates' figures per Title appears in section 3.3.1.2.

With the SESAR JU being a multi-annual programme (with a limited life-time and fixed total budget ceilings), unused payment appropriations at the end of one budgetary year are not cancelled but inscribed as budget result in the revenues of the subsequent budget. The budget result for 2018 (i.e. total payment appropriations in revenues of EUR 97.887.180 minus EUR 78.625.670 total payments) amounts to EUR 19.261.510 (EUR 19.215.353 for SESAR 2020 and EUR 46.157 for SESAR 1). The 2018 cumulative surplus that remains within the Joint Undertaking amounts to EUR 77.237.034 (of which EUR 46.307.865 for SESAR 2020 and EUR 30.929.169 for SESAR 1).

2.6.1.2 Financial closure of SESAR 1

Furthermore, in 2018, the SESAR JU continued the process of financial and administrative closure of SESAR 1 (operational closure end 2016):

Programme execution

The actual overall programme execution rate is at 89,9%, and this rate is 92,7% for Title 3 only. With the remaining open obligations and adjustments derived from the 2019 ex-post audits, the overall programme execution rate is estimated to be finally at 89,9% (92,8% for Title 3 only):

Current situation:

	Commitment made	Payments made	Total programme	% Payments execution
Title 1	46.629.036	40.596.071	55.000.000,00	73,8%
Title 2	28.010.735	24.838.991	42.824.088,75	58,0%
Title 3	778.627.622	736.839.920	795.000.000,00	92,7%
Total	853.267.393	802.274.982	892.824.088,75	89,9%

Closure forecasts:

	Commitment made	Payments made	Total programme	% Payments execution
Title 1	46.629.036	40.596.071	55.000.000,00	73,8%
Title 2	28.010.735	24.838.991	42.824.088,75	58,0%
Title 3	778.627.622	737.392.665	795.000.000,00	92,8%
Total	853.267.393	802.827.727	892.824.089	89,9%

Payment Appropriations

With the 2018 carried forward appropriations, the payments already executed in 2019 and the revenues received in 2019, the current available payment appropriations is the following:

	PA available
Title 1	
Title 2	
Title 3	590.778,93
Total	590.778,93

The expected last movements in 2019:

- Remaining open obligations -552.744,44
 - Audit costs on IFS 2016 and FFS (SC13) EUR 386.616,44
 - Audit costs on IFS 2016 and FFS (SC14) EUR 138.000,00
 - Audit costs on IFS 2016 and FFS (SC6) EUR 28.128,00
- Adjustments on ex-post audits +504.004,83
 - Recoveries following audit findings.

These payments and recoveries will lead to a remaining payment appropriation of EUR 542.039,32:

	PA available	Recoveries	Payments	PA remaining
Title 1				
Title 2				
Title 3	590.778,93	504.004,83	-552.744,44	542.039,32
Total	590.778,93	504.004,83	-552.744,44	542.039,32

It should be noted that on going ex-post audits (audit reports not yet received) might lead to positive (recoveries from SESAR JU Members other than the Union) or negative (reimbursements to the SESAR JU Members other than the Union) adjustments to these figures above. Therefore, all the above figures must be taken as the best SESAR JU estimate with today's available information.

Cash situation

The SESAR JU currently has on its virtual bank account (managed by the Commission Treasury) EUR 30.659.433,82 to cover all its remaining obligations (SESAR 1 Programme). With payments and recoveries forecasts, the SESAR JU should close SESAR 1 Programme with an estimate cash surplus of EUR 30.610.694,21:

	Actual revenue received	Cash used during the year 2019	Cash at year end 2018
Payments forecasts		(552.744,44)	30.659.433,82
Recoveries forecasts	504.004,83		
	504.004,83	(552.744,44)	30.610.694,21

2.6.2 Human resource management

The SESAR JU staff consists of 39 positions + 3 SNEs, as per the Single Programming Document 2018.

The Staff Establishment Plan and its realisation are presented in section IIa chapter 3.4.

The effective allocation of staff resources also remained a priority for the SESAR JU during 2018. Efforts were focused on the professional and career development of its staff, in addition to ensuring that allocated staff resources are used in the most economic, efficient and effective way.

For the eighth year, in 2018 the SESAR JU conducted its Career Development Review exercise and was able to conduct the reclassification of 6 staff members.

The vacancy rate at the end of 2018 was of 5,13%. It should be noted that the SESAR JU Staff Establishment Plan only has 39 positions plus 3 SNEs positions, therefore each move in staff counts for more or less 2,5%. During the last quarter of 2018, the selection process for "Financial Assistant" took

place in order to create a reserve list. For one position, filled externally, the recruitment of the candidate was finalised in January 2019.

2.6.3 Legal advice in 2018

Over 2018, specific legal expertise was provided to the organisation to contribute to:

- the regularity and legality of all SESAR JU's binding agreements, contracts, H2020 and non-H2020 grants (U-space, Airspace Architecture Study, Geo-fencing), SESAR JU decisions, processes, measures,
- the respect of the PPP principles agreed with SESAR JU Members (Membership Agreement) and their development (including the signature and management of two secondment agreements);
- the respect of the agreements concluded with SESAR JU's Founding Members (EC Delegation agreements, SESAR JU-EUROCONTROL agreement);
- the development and update of the process related to the management of the exception and non-compliance event register.

2.6.4 Procurement activities in 2018

Over 2018, the SESAR JU effectively implemented its Procurement Plan (as per annex IX to the Single Programming Document for 2018-2020) and signed 48 contracts including 37 specific contracts implementing SESAR JU framework contracts and inter-institutional agreements. This significant increase in the number of Specific Contracts results from the signature of several Framework Contracts by SESAR JU in 2017. In 2018, there were 12 procurement procedures: five negotiated procedures without prior publication of a contract notice (Article 134 – see below), five very low, low and middle value negotiated based on Articles 137(2), 137(1) or 136a, three open calls for tender, and one prize. In addition, SESAR JU signed eight amendments including five to its Framework Contracts and Specific Contracts.

All procedures were carried out in compliance with the SESAR JU's Financial Rules to ensure the respect of transparency, fair competition amongst suppliers and the most efficient use of SESAR JU funds. The procurement procedures supported the SESAR JU objectives transversally.

Pursuant to Article 66 of the Financial Rules applicable to the general budget of the Union⁴⁶ and Article 53 of its rules of application⁴⁷, the SESAR JU Authorising Officer shall record, for each financial year, contracts concluded by the negotiated procedures referred to in points (a) to (f) of Article 314(1) of the rules of application. For the purpose of this document, the term 'contracts' refer to contracts awarded following a very low, low or middle-value negotiated procedure under Article 137(2), 137(1) and 136a of the rules of application accordingly, a negotiated procedure under Article 134(1), an open call or a restricted procedure.

⁴⁶ Regulation (EU, Euratom) No 966/2012 of the European Parliament and of the Council of 25 October 2012 on the financial rules applicable to the general budget of the Union and repealing Council Regulation (EC, Euratom) No 1605/2002 (OJ L 298, 26.10.2012, p. 1–96)

⁴⁷ Commission Delegated Regulation (EU) No 1268/2012 of 29 October 2012 on the rules of application of Regulation (EU, Euratom) No 966/2012 of the European Parliament and of the Council on the financial rules applicable to the general budget of the Union (OJ L 362, 31.12.2012, p. 1–111)

No	Contractor	Subject of the contract	Budget (EUR)	Type of procedure	Type of contract	Legal basis
1	ATCEUC	Provision of professional staff association expertise	200 000	Negotiated procedure without publication of a contract notice	Framework Service Contract	Art. 134(1)(b) RAP
2	IFATCA	Provision of professional staff association expertise	200 000	Negotiated procedure without publication of a contract notice	Framework Service Contract	Art. 134(1)(b) RAP
3	ETF	Provision of professional staff association expertise	200 000	Negotiated procedure without publication of a contract notice	Framework Service Contract	Art. 134(1)(b) RAP
4	ECA	Provision of professional staff association expertise	200 000	Negotiated procedure without publication of a contract notice	Framework Service Contract	Art. 134(1)(b) RAP
5	IFATSEA	Provision of professional staff association expertise	200 000	Negotiated procedure without publication of a contract notice	Framework Service Contract	Art. 134(1)(b) RAP

Table 13: Negotiated procedures under Article 134(1) RAP carried out in 2018

The SESAR JU publishes its annual list of contractors by 30 June of each year for the previous year on its website⁴⁸.

A list of procurement procedures concluded during the reporting period is included in Annex 1.3.

2.6.5 Corporate Planning and Reporting

In 2018, the SESAR JU released its Consolidated Annual Activity Report for 2017, which the Administrative Board approved through written procedure on the 22 June 2018 (ADB(D)11-2018).

Moreover, the SESAR JU prepared an amendment to the Single Programming Document for 2018-2020, which was adopted by the Administrative Board through written procedure on 12 February 2018 (ADB(D)04-2018). This amendment includes the inscription of unused 2017 appropriations into the 2018 budget.

Furthermore, in accordance with requirements of the Framework Financial Regulation, the SESAR JU further developed its Single Programming Document for 2019-2021, which was adopted by the Administrative Board on 12 December 2018 (ADB(D)19-2018). This adoption includes the approval of the 2019 work programme, the financing decision for the launch of the calls for proposals for Wave 2 and ER4 (see paragraphs 2.3.3 and 2.2.4 respectively), the financing decision of the adoption of the 2019 budget, the approval of the Staff Establishment Plan for 2019 and the approval of the Procurement Plan for 2019.

⁴⁸ <https://www.sesarju.eu/procurement-archive>

The SESAR JU also started off the drafting of its Single Programming Document for 2020-2022, in view of the submission of this document (in draft version) to the Authority by 31 January 2019.

Leverage Effect

At least four calculation methods have been used by the European Commission and by the European Court of Auditors at different times during the life of the SESAR JU operating under the 2014 amendment of its Founding Regulation:

1. Since the SESAR JU Founding Regulation was updated in 2014 there has been a simple assumption that leverage of the SESAR JU will be: the sum of SESAR JU Members other than the Union balanced contribution with the Union, divided by the total Union contribution.
2. In 2015 a Horizon2020 method was communicated by DG RTD for the purposes of the CAAR⁴⁹: “total amount of funds leveraged through Art. 187 initiatives, including additional activities, divided by the EU contribution”. Note: The SESAR JU does not use ‘additional activities’.
3. In 2017 the European Commission Interim evaluation (2014-2016) used another method⁵⁰: total SESAR 2020 contribution from SESAR JU Members other than the Union as per the SESAR 2020 Membership Agreement, divided by the total Union contribution.
4. In 2018 a variant of Method 3 was used by the European Court of Auditors⁵¹: SESAR JU Members other than the Union contribution (not including EUROCONTROL) divided by total Union contribution.

While each of these methods is broadly similar, in that leverage is calculated from the sum of the funds leveraged (financial and in-kind) divided by the total EU funds, the point in time the calculation is performed and the assumption about what is the ‘total funds leveraged’ and ‘total EU contribution’ mean that quite different figures have been published.

Beginning from this Consolidated Annual Activity Report (2018), the SESAR JU will now consistently report on a set of targets and the annual achievement towards them. The achievement figures will evolve over the lifetime of the programme. In order to do this it is essential to maintain consistency across years as well as meeting the SESAR JU reporting obligations. This means including a method suitable for reporting under Horizon2020 (consistency across funding), a method suitable for the SESAR JU formal reporting towards the European Parliament (in support of the discharge) and a method that is consistent with the Interim Evaluation that can be used during future evaluations of the SESAR JU. Meaning that:

- Method 1 will no longer be followed, as it does not reflect the fact there are more open calls than just Exploratory Research, nor does it include the effect of the Horizon2020 Rules for Participation as well as the applicable funding rates. These points materially affect the ability to achieve a balanced contribution.
- Method 2 (H2020) should continue to be used consistently in the Consolidated Annual Activity Report, but it should also be made clear that it differs from the other methods as it also includes the total EU contribution as part of the total amount of funds leveraged through the SESAR JU.

⁴⁹ DG RTD’s guidance on Annual Activity Reports for Joint Undertakings, 2015.

⁵⁰ Commission Staff Working Document ‘Interim Evaluation of the Joint Undertakings operating under Horizon 2020’ (2017).

⁵¹ European Court of Audit’s Report on the annual accounts of the Single European Sky Air Traffic Management Research Joint Undertaking for the financial year 2017 (page 14)

- Method 3 and Method 4 have a common basis of using SESAR JU Members other than the Union contributions established in the signed Membership Agreement and a target of 1.4 for the SESAR JU has already been published⁵². This target was calculated from the total contribution from the SESAR JU Members other than the Union (established in the Membership Agreement and adopted in the Voting Rights of the SESAR JU, including EUROCONTROL) divided by the total EU contribution. This method still excludes the effect of the open calls but can be easily adapted. Both the original and adapted method can be reliably monitored on an annual basis to report progress.

Therefore, from this Consolidated Annual Activity Report forwards the SESAR JU will use three Methods consistently to present the leverage of the SESAR JU:

- Method used by the Interim Evaluation;
- Method that is a refinement of the Interim Evaluation method but also includes all activities of the SESAR JU;
- Method used by Horizon 2020.

Some readers also expect to see a leverage that describes the contribution of the beneficiaries of SESR 2020 grants against that of the Union. As the industrial programme is only a part of the responsibility and work undertaken by the SESAR JU this must be calculated differently to be meaningful, a Partnership leverage is also calculated and will be consistently reported upon in this and future reports.

The set of leverage targets, the raw data and calculation methods used are depicted in the following figure:

		Maximum Leverage (target value)	
Partnership Leverage (SESAR Programme)		2016 Value	Information Source
1 Gross In-Kind contribution by Members		€702.193.736,33	Membership Agreement
2 Co-Financing requested by Members		€394.821.332,68	Membership Proposals
3 Net In-Kind Contribution of Members		€307.372.403,65	Calculated [=1-(2)]
4 Gross In-Kind contribution by Founding Member EUROCONTROL		€475.000.000,00	SJU - EUROCONTROL Agreement
5 Co-Financing requested by Founding Member EUROCONTROL		€7.743.219,00	Maastricht (ANSP) estimate; adopted Voting Rights 2016
6 Net In-Kind Contribution of Founding Member EUROCONTROL		€467.256.781,00	Calculated [=4-(5)]
8 EU Commitment Appropriations for Co-financing of Members & Founding Member		€398.000.000	Adopted Multi-Annual Work Programme 2015
Calculation Partnership Leverage = ((3)+(6)+(7))/(8)		1,95	Leverage for Partnership using Interim Evaluation method
Calculation Partnership Leverage = ((3)+(6)+(7)+(8))/(8)		2,95	Leverage for Partnership using Horizon2020 method
Union Body Leverage (SESAR JU)		2016 Value	Information Source
1 Net Contribution of Members (inc. financial)		€325.838.461,65	Voting Rights 2016
2 Net Contribution of EUROCONTROL (inc. financial)		€492.256.781,00	Voting Rights 2016
3 Net In-Kind contribution by Founding Member EU		€0,00	Adopted Voting Rights 2016
Finance Available for ER Open calls		€85.000.000,00	Adopted Multi-Annual Work Programme 2015
Finance Available for VLD Open calls		€37.000.000,00	Adopted Multi-Annual Work Programme 2015
Total Finance available for Open calls		€122.000.000,00	Calculated
5% contribution to Running Costs		€6.100.000,00	Calculated
Maximum Finance available for Open Calls		€115.900.000,00	Calculated
Forecast overall funding rate		0,80	Assumption for planning purposes
4 Net Contribution from Open calls (ER + VLD-Open) after		€23.180.000,00	Calculated [=Fin for Open Calls*(1-Funding Rate)]
5 Total EU Commitment Appropriations available to the SJU		€585.000.000	SJU Founding Regulation
6 EU Commitment Appropriations available to the SJU for ER		n/a	
Target Leverage established by Regulation = ((1)+(2)+(3))/(5-6)		n/a	
Target Leverage established by Interim Evaluation = ((1)+(2)+(3))/(5)		1,40	Leverage for SESAR JU using EC Interim Evaluation method
Calculation of SJU Union Body Leverage = ((1)+(2)+(3)+(4))/(5)		1,44	Leverage for SESAR JU using EC/ECA discharge method
Calculation of SJU Union Body Leverage = ((1)+(2)+(3)+(4)+(5))/(5)		2,44	Leverage for SESAR JU using Horizon2020 method

Figure 22: Target leverage and calculation method for the Programme and the SESAR JU

⁵² Interim evaluation of the SESAR Joint Undertaking (2014-2016) operating under Horizon 2020, Final Report June 2017.

Since the SESAR JU renewed the participation of its Members other than the Union to the membership and launched a new SESAR 2020 Programme, the first year when a target could be established was 2016, this data is shown in figure 22 above.

Progress reporting since 2016 includes validated figures for 2017, adopted by the Administrative Board in April 2019 as well as non-validated figures provided by the SESAR JU Members other than the Union for the year 2018. These 2018 figures will then be reported as validated in the CAAR 2019 and the 2019 Member submission figures reported and cumulative leverage again presented.

The cumulative leverage reporting and the forecasted leverage at the end of the Programme (2022) are shown in the figure below, which shows a gradual increase of the annual leverage effect up to a forecasted level at the end of the Programme which is close to the target. This trend and the forecasted leverage will be monitored and reported upon in the next CAARs each year:

Partnership Leverage (SESAR Programme)	Cumulative Leverage (Reporting)			Forecast Leverage
	2017 Actual	2018 Reported	2019 Estimate	
1 Gross In-Kind contribution by Members				€694.354.012,65
2 Co-Financing requested by Members				€387.307.337,70
3 Net In-Kind Contribution of Members	€56.011.817,00	€113.927.260,00	€164.453.009,30	€307.046.674,95
4 Gross In-Kind contribution by Founding Member EUROCONTROL				€389.403.159,00
5 Co-Financing requested by Founding Member EUROCONTROL				€6.239.434,74
6 Net In-Kind Contribution of Founding Member EUROCONTROL	€59.602.725,00	€119.268.466,00	€179.368.466,00	€383.163.724,26
8 EU Commitment Appropriations for Co-financing of Members & Founding Member	€180.610.284,00	€150.559.314,00	€214.094.687,08	€393.546.772,44
Calculation Partnership Leverage = ((3)+(6)+(7))/(8)	0,64	1,55	1,61	1,75
Calculation Partnership Leverage = ((3)+(6)+(7)+(8))/(8)	1,64	2,55	2,61	2,75
Union Body Leverage (SESAR JU)	2017 Actual	2018 Reported	2019 Estimate	
1 Net Contribution of Members (inc. financial)	€58.649.827,00	€119.203.280,00	€172.367.039,30	€325.352.827,82
2 Net Contribution of EUROCONTROL (inc. financial)	€66.284.725,00	€129.150.466,00	€190.250.466,00	€403.883.882,26
3 Net In-Kind contribution by Founding Member EU				
Finance Available for ER Open calls				
Finance Available for VLD Open calls				
Total Finance available for Open calls				
5% contribution to Running Costs				
Maximum Finance available for Open Calls				
Forecast overall funding rate				
4 Net Contribution from Open calls (ER + VLD-Open) after	€14.147.995,00	€14.147.995,00	€14.147.995,00	€23.000.000,00
5 Total EU Commitment Appropriations available to the SJU	€236.148.000,00	€348.711.000,00	€461.329.000,00	€585.000.000
6 EU Commitment Appropriations available to the SJU for ER				
Target Leverage established by Regulation = ((1)+(2)+(3))/(5-6)				
Target Leverage established by Interim Evaluation = ((1)+(2)+(3))/(5)	0,53	0,71	0,79	1,25
Calculation of SJU Union Body Leverage = ((1)+(2)+(3)+(4))/(5)	0,59	0,75	0,82	1,29
Calculation of SJU Union Body Leverage = ((1)+(2)+(3)+(4)+(5))/(5)	1,59	1,75	1,82	2,29

Figure 23: Cumulative leverage for the Programme and the SESAR JU

2.6.6 Corporate Quality Management

In 2018, the SESAR JU maintained its Quality Management System following a continuous improvement approach and further developed the Information & Document Management System (IDMS) to manage all SESAR JU corporate information and documentation.

In addition, in 2018 the SESAR JU took the necessary steps to implement the Commission Internal Control Framework revised in 2017 and continued the assessment of its internal control against that revised framework. Further information on this and the result of this assessment is provided under section 5.2.

Furthermore, following the closure of the SESAR 1 Programme, the SESAR JU finalised the archiving of all SESAR 1 information which is now available to the teams and not modifiable.

2.6.7 Information and Communication Technologies (ICT)

In 2018, the SESAR JU ICT continued using and developing the support services delivered by EUROCONTROL following the migration of the whole infrastructure towards them in 2016. Continuous improvements processes in place, strong working relationships between the SESAR JU ICT and the supplier combined with new initiatives for transformation, innovation and risk mitigation contributed to keep a high level of quality for the support service delivered during the whole year while keeping the costs of the support service stable and under control (about -1,2% compared to previous year).

Regarding the transformation projects, all approved by the SESAR JU QICT Committee involving all the SESAR JU sectors, a particular attention was given to initiatives related to guaranteeing the continuity of the service, either by anticipating some obsolescence, such as the replacement of the outdated telephony system, or by controlling risks, such as adding redundancy within some systems in order to avoid possible single points of failure or increasing the remote monitoring capabilities or improving the capacity to carry on in case of disasters or major incidents.

All the transformation projects foreseen in 2018 were delivered during the course of the year. Only a couple of initiatives were not fully deployed and postponed until the beginning of January 2019, following the proposal from SESAR JU ICT approved by the SESAR JU QICT Committee, to accept a system freeze period at year-end when the capacity of the ICT support organisation is smaller.

SESAR JU ICT was also involved in some major corporate initiatives like the Archiving of the old Extranet supporting the first SESAR Programme. This project contributed to enlarge the functionalities of the IDMS system, used to manage the corporate documentation and delivered in 2018 too as part of the project started in 2017.

2.6.8 Facility Management

In 2018, in terms of facilities management, work continued on a number of initiatives in SESAR JU's premises in Brussels to improve the productivity, safety & efficiency of the working environment and facilities offered to SESAR JU staff. To exemplify, landlord works in relation to lifts were closely monitored and concluded successfully with the minimum possible interruption. Moreover, the security access of the ICT storage was upgraded and a new system in relation to door locks was implemented.

The open call for tender SJU/LC/0139 was published during the Q1 of 2018 covering Cleaning Services and Facility Services for Maintenance and Renovations, which lead to the signature of two service contracts.

Additionally, the open call for tender SJU/LC/0146 was published during the Q4 of 2018 covering Reception and Back-office Reception services aiming to conclude one service contract in 2019.

In 2018, the SESAR JU's insurance contracts were renewed with coherence and respect of coverage.

In addition, throughout the year several steps were successfully taken in order to close actions arising from the Audit SIPP 2016.

Finally, in Q3 2018 the stocktaking was concluded successfully.

2.6.9 Travel Coordination

In 2018, the SESAR JU staff have achieved a total of 236 missions (not including missions related to the activities managed by the Programme Management Unit under the SESAR JU – EUROCONTROL agreement), a reduction of 12% in the number of missions compared to 2017. This represents a

significant investment of time and money to ensure the SESAR JU plays an active role in steering the activities conducted with the support of its stakeholders. It has to be noted that the SESAR JU has made an extensive use of web conferences, especially for recurring monitoring activities such as project reviews. Typically, for meetings related to ER, IR and VLD and except for critical meetings such as kick-off meetings and critical reviews, the SESAR JU has opted for web conferences to coordinate with grant beneficiaries by preference, which represents a significant benefit in terms of environmental footprint, efficiency and work-life balance. This is the reason why, out of the 236 missions, 118 (46%) are for Strategic Area of Operation #5 ('Deliver SESAR Outreach) and 43 (18%) to Transversal Steering (in particular, missions related to the delivery of the mandate on the Airspace Architecture Study and the Master Plan update campaign, see above in paragraph 2.1). The split and allocation per Strategic Area of Operation, and, within Strategic Area of Operation #5, by topic, is depicted in the following figure:

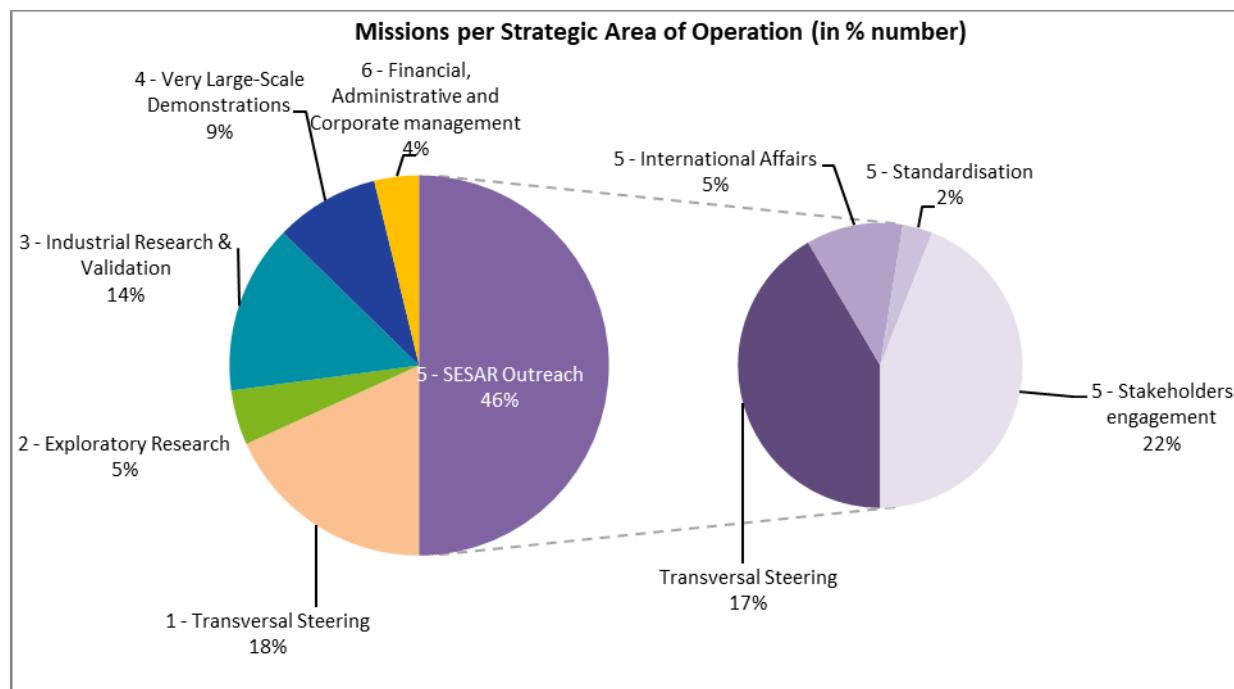


Figure 24: Breakdown of SESAR JU missions per Strategic Area of Operation (in percentage)

Mission management was executed on time and in line with the rules of the EC Mission Guide.

2.6.10 Risk Management and Audit

2.6.10.1 Risk management

Risk management at the SESAR JU aims at enabling the organisation to fulfil its mission and objectives in the most efficient and effective way by ensuring the timely and adequate identification, assessment (analysis and evaluation), management (treatment & escalation when required), monitoring and controlling of risks and opportunities.

The SESAR JU assesses and addresses risks through a dedicated Corporate Risk Management policy and the associated process, which were substantially reviewed in 2017. The overall approach was streamlined in order to increase the focus on the management of critical risks.

Due to the complexity of the SESAR Programme (number of projects and stakeholders involved), the SESAR JU implements risk management that encompasses a top-down as well as a bottom-up approach supported by proportionate controls to maintain the quality of risk information which is

reported. The bottom-up approach comprises the risk management performed by SESAR 2020 participants at project and Programme level and is aligned with H2020 requirements; additionally, bottom-up risks can be provided by any staff member notably in the context of an online survey sent to all SESAR JU staff. The top-down approach consists in an analysis of risks which might be detrimental to the achievement of strategic objectives of the SESAR JU.

Corporate risk management workshops are carried out at SESAR JU level to consolidate the bottom-up and top-down risks. It is at this stage also that key mitigation actions are confirmed and allocated to owners.

Overall, SESAR JU Risk Management addresses four threads of risks: Master Plan risks, SESAR JU internal risks, SESAR 2020 Programme risks and Corporate risks. The Corporate risks include the high criticality risks escalated from the three threads and strategic risks identified at corporate level.

One single register called the ‘SESAR JU Risk Register’ is used to capture and consolidate the four threads of risks. This register provides information including a description of the risk, the risk owner, the planned mitigating actions and their status.

In Q2 2018, along with the identification of new risks, a few actions were taken in view of updating the status of the mitigation actions and the criticality of the current risks for all risks.

- The risks included in the three threads (namely: internal risks, Master Plan risks and Programme risks) were updated at the level of the risk management team and presented to the corporate management team;
- A survey targeting all staff allowed to gather the general perception of criticality of current risks and propose new risks and mitigation actions;
- A corporate risk management workshop was conducted in July to report on risk management and validate main changes linked to corporate risks.
 - The positive effect of some mitigation actions allowed to decrease the criticality of two risks that are now managed at Master Plan and Programme levels,
 - The analysis of the outcome of the survey allowed to get the staff perception on risks: some additional actions on communication were agreed; there was no need to insert new risks,
 - The corporate risk management workshop included a reporting on fraud risks that are handled separately under the supervision of the Internal Audit Capability.

As a result of these Q2 activities, the SESAR JU updated its corporate risk register and froze it on the 31 August. The updated information on risk management was incorporated in the SPD 2019.

The status of risk management as presented in part III is a status of the SESAR JU corporate risk register at the end of 2018 and includes further updates linked to the update of the Master Plan.

In parallel of risk management performed by the SESAR JU in 2018, the IAS conducted a Strategic Risk Assessment of the SESAR JU in November 2018. This means that the IAS analysed all operational, administrative, financial and IT processes of the SESAR JU with the aim of identifying areas of risk and future audit topics. This Strategic Risk Assessment was performed in coordination with the SESAR JU IAC and will lead to a Strategic Internal Audit Plan (SIAP) 2019-2021. The report is expected in 2019.

2.6.10.2 Internal control

In continuation of the work undertaken in 2017 to monitor internal control against the new Internal Control Framework established by the European Commission in April 2017, the SESAR JU further updated its assessment tools.

The status of the SESAR JU in relation with the internal control framework are presented in part III (chapter 5.2).

2.6.10.3 Audit

Activities related to audit are presented in part IIa.

2.6.11 Data protection

The year 2018 is a milestone in the history of data protection and privacy in the European Union; it sets the transition towards the new data protection legal framework through the adoption of two, mainly relevant for the SESAR JU, new pieces of legislation, accordingly:

- Regulation (EU) 2016/679, the General Data Protection Regulation⁵³ (or GDPR) entered into force on 25 May 2018; and
- Regulation (EU) 2018/1725, the Internal Data Protection Regulation⁵⁴ (or IDPR), directly applicable to the SESAR JU entered into force on 11 December 2018.

Even if only the IDPR applies directly to the SESAR JU, the readiness for the entry into force required the Data Protection Officer (DPO) to provide legal advice, thorough assessment and guidance as per the implementation of a framework described in these two pieces of legislation by comparison to the previous Regulation 45/01⁵⁵. This is reflected in the Action Plan, adopted in July 2017 and further updated in November 2018.

Whereas most of the novelties and requirements of the IDPR have been embedded by the SESAR JU, tracked through the monitoring of the Action Plan, there is still ongoing actions to be performed within the upcoming years. In addition, through the accountability principle, the IDPR sets the obligation of not only ensure compliance but also the obligation of demonstration and verification of such compliance. Data protection became in 2018 a long-term commitment into a privacy practice and culture, which the SESAR JU strictly observes and applies.

The achievements in terms of data protection at the SESAR JU for the year 2018 are summarised as follows:

- The development of a new system of notifications of processing operation, transformed into records, with a new template of records and privacy notices. The register of records is available to all SESAR JU staff and a list of privacy notices is available in SESAR JU's public web;
- The implementation of data protection by design and by default in the definition of new services and tasks. The DPO, following the pilot of web services in 2017, introduced data protection requirements for procurement procedures at three different levels (definition, evaluation and reporting) as well as on the resulting contracts. Calls for tenders covered in 2018 include ICT coordination services and Communication services.

⁵³ Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation)

⁵⁴ Regulation (EU) 2018/1725 of the European Parliament and of the Council of 23 October 2018 on the protection of natural persons with regard to the processing of personal data by the Union institutions, bodies, offices and agencies and on the free movement of such data, and repealing Regulation (EC) No 45/2001 and Decision No 1247/2002/EC

⁵⁵ Regulation (EC) No 45/2001 of the European Parliament and of the Council of 18 December 2000 on the protection of individuals with regard to the processing of personal data by the Community institutions and bodies and on the free movement of such data

- The thorough assessment and advice to the Communication activities of the SESAR JU, including mapping of the use of social media, web services, newsletters and organisation of events and meetings. The DPO contributed to the drafting of the Social Media policy.
- The ongoing drafting of the SESAR JU policies such as DP Impact Assessments (DPIA), data breaches and notifications to EDPS, internal rules of the SESAR JU on DP and internal rules on restriction of access to rights from data subjects. The drafting exercise will continue through 2019.
- The organisation of dissemination and information sessions across the SESAR JU. Examples of it are
 - participation to the SESAR JU QICT Committee, the DPO has been a permanent member of which since 2018,
 - presentation on basic concepts and new obligations to the Corporate Management Team,
 - dedicated presentations during the unit meetings, and
 - a set of series of flash-presentations was launched in December 2018 with the aim of continuing on a regular basis.
- Advice to staff and Controller as well as contribution to reporting obligations.
- Extensive cooperation with relevant stakeholders with concrete outputs, such as:
 - European Commission – Participation in the pilot working group on Co-controllership, figure highly emphasised by the IDPR and under the strict scrutiny of the European Data Protection Supervisor (EDPS).
 - EDPS for the participation in the network of DPOs and the EDPS. Two main concrete actions of cooperation are:
 - Participation in the working ground on “contracts”- the SESAR JU DPO presented the pilot example of privacy by design and by default in the procurement procedure for web services.
 - First inspection by the EDPS on web services and interaction with the contractor.
 - First meeting and cooperation with the DPO of EUROCONTROL for setting the scene for the system of International transfers due to the nature of EUROCONTROL as an International Organisation. Further actions will be required during 2019.

2.6.12 Participation to support and coordination groups in 2018

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

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

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

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

2.7 Overall conclusion on the SESAR JU achievement in 2018

In continuation of the achievements of previous years, 2018 was a new year of delivery for the SESAR Joint Undertaking, which progressed towards the achievement of its strategic objectives over the period from 2014 to 2024.

Again, in 2018 the SESAR JU achieved all its annual objectives. The most noticeable ones are:

- The delivery of the Airspace Architecture study under a specific mandate;
- The execution of the Master Plan update campaign, preparing for the delivery of an updated European ATM Master Plan in Q1 2019;
- The delivery of ER projects providing promising results available for further elaboration in the context of the SESAR 2020 Programme of future research and innovation endeavours related to aviation modernisation in Europe;
- The further maturation of 25 candidate SESAR Solutions (two of which ready for deployment) and the preparation for the delivery of 44 others, including critical Solutions for the future ATM system such as IOP, Virtual Centres etc., which are key enablers to make the Single European Sky and the EU Aviation Strategy effective. The delivered Solutions and the ones in development provide the required responses to solve the challenges addressed by the Single European Sky, in terms of capacity (at airports, in TMA and en-route), safety, environment and ATM cost-efficiency. They provide means to mitigate major risks related to the development of aviation in Europe;
- The preparation of the Wave 2 of Industrial Research and Validation projects;
- The execution of 25 VLD projects, including seven related to Geo-fencing and U-space; according to two specific mandates of the Commission to the SESAR JU;
- The organisation of the SESAR Innovation Days and the Young Scientist Award 2018
- The active participation to the works of the ICAO in the thirteenth Air Navigation Conference, bringing Europe's position in the evolution of the ICAO GANP/ASBUs and the Global Aviation Safety Plan.

All achievements of 2018 were done in full compliance with applicable regulations.

With the successful execution of its work programme for 2018, and in line with the provisions set forth in its successive Single Programming Documents, the SESAR JU paved the way to further deliver results in the upcoming years and to contribute to the implementation of the objectives of the Single European Sky initiative.

3 Part IIa. Management Evaluation

3.1 Administrative Board

In 2018, the Administrative Board discussed and approved a standard suite of documents related to the annual programming and reporting cycles (Single Programming Document for the period 2019-2021, Consolidated Annual Activity Report 2017). In addition, specific matters addressed by the Administrative Board in 2018 included, *inter alia*: the adoption of the final list of foreground generated under SESAR 1; the endorsement of the "roadmap for the safe integration of drones into all classes of airspace" to be integrated in the European ATM Master Plan as part of the 2018 update campaign; several decisions related to HR matters.

Subject	Type of decision	Date of adoption
Draft SPD 2019-2021	Written Procedure	30.01.2018
ATM Master plan – drones roadmap	Written Procedure	01.03.2018
SESAR 1 final list of foreground	Written Procedure	09.02.2018
SPD 2018-2020 Amendment n. 1	Written Procedure	12.02.2018
IAC Annual Work Plan 2018	Written Procedure	12.03.2018
Approving applicable thresholds triggering the need for an audit certificate for the valuation of In-Kind Contributions under the SESAR JU Membership Agreement	Written Procedure	27.03.2018
Missions (HR)	Written procedure	29.03.2018
Opt out CA (HR)	Written Procedure	29.03.2018
Voting rights allocation	ADB(M)043-2017	03.05.2018
Appointment Vice-Chairperson	ADB(M)043-2017	03.05.2018
CAAR 2017	Written Procedure	22.06.2018
Guidelines on whistleblowing (HR)	Written Procedure (draft)	29.06.2018
Setting up a staff committee (HR)	Written Procedure (draft)	29.06.2018
Opinion on the SESAR JU Final Annual Accounts 2017	Written Procedure	29.06.2018
Authorising the Executive Director to inscribe the 2017 budget result into the 2018 budget	Written Procedure	29.06.2018
Adopting an amendment to the Rules of Procedure of the Administrative Board	Written Procedure	27.07.2018
Implementing Decision ADB(D)04-2017 on the Specific Amendment Procedure based on Budgetary Grounds for SESAR 2020 IR-VLD Wave 1 Actions	Written Procedure	22.10.2018
Final Accounts 2017	Written Procedure	06.12.2018
SPD 2019-2021	ADB(M)045-2018	12.12.2018

Table 14: Administrative Board decisions in 2018

3.2 Major developments

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

In 2018, following the signature of delegation agreements between the Commission and the SESAR JU in the previous years, the SESAR JU operates under four different sources of funding, each referring to the execution of grants (following calls for proposals) or studies (following calls for tender). This diversity of applicable legal frameworks under which the SESAR JU operates, with each its own templates and obligations, also comes with a high degree of complexity due to the number of derogations to the legal frameworks which have been defined in the corresponding delegation agreements.

3.3 Budgetary and financial management

3.3.1 Budgetary implementation

3.3.1.1 Revenue

Further to the information provided in section 2.6.1.1, the tables below provide the breakdown of revenues per revenue sources (for both SESAR 2020 and SESAR 1):

SESAR 1 + SESAR 2020 <i>all figures in EUR</i>		1	2	3=2/1	4	5	6=5/4	7	8
Type of revenue		Commitment appropriations	CA execution	% of budget	Payment appropriations	PA execution	% of budget	Outstanding (from 2018 only)	Outstanding (Total)
Contribution from the European Union	112.563.000	84.184.652	74,8%		84.184.652	84.184.652	100,0%	0	435.162.657
Assigned Revenues	10.000.000	4.000.000	40,0%		3.650.000	4.000.000	109,6%	0	6.650.000
Contribution from Eurocontrol	3.867.751	5.189.144	134,2%		3.867.751	5.189.144	134,2%	0	37.281.853
Contributions from other Members	3.087.011	2.638.010	85,5%		3.087.011	2.546.435	82,5%	91.575	15.919.621
Other sources of contribution and revenue	23.920.200	2.641.620	11,0%		46.119.806	1.966.949	4,3%	674.670	674.670
TOTAL REVENUE	153.437.961	98.653.425	64,3%		140.909.219	97.887.180	69,47%	766.245	495.688.801

3.3.1.2 Expenditure

Further to the information provided in section 2.6.1.1, the table below provides the breakdown of expenditures per Title (for both SESAR 2020 and SESAR 1):

SESAR 1 + SESAR 2020 all figures in EUR											
Type of expenditure	1	2	3=2/1	4	5	6 = 4 + 5	5=9+10	6=5/4	9	10	
	Final Commitment appropriations	Commitments		Payment appropriation s			Payments		Payments (against commitments of the year)	Payments (against previous years' commitments)	
			% of budget	Budget 2018	from 2017*	Total		% of budget			
Staff Expenditure	6.102.088	5.369.606	88,0%	6.040.300	514.410	6.554.710	5.219.663	79,6%	5.040.532	179.131	
Administrative Expenditure	3.486.422	3.263.224	93,6%	3.476.234	2.376.865	5.853.099	4.219.945	72,1%	2.443.484	1.776.462	
Operating Expenditure	166.329.153	137.690.894	82,8%	110.397.392	43.660.083	154.057.475	69.186.062	44,9%	58.945.884	10.240.178	
1. Studies/Development conducted by the SJU	43.358.161	21.489.023	49,6%	28.540.665	8.456.546	36.997.211	17.111.154	46,2%	6.870.976	10.240.178	
3. Studies/Development conducted by other Members	122.970.991	116.201.870		81.856.727	35.203.537	117.060.265	52.074.908	44,5%	52.074.908	0	
TOTAL EXPENDITURE	175.917.663	146.323.724	83,18%	119.913.926			166.465.285	78.625.670	47,23%	66.429.900	12.195.771
TOTAL REVENUE							97.887.180				
BUDGET RESULTS									19.261.510		

3.3.2 SESAR 2020 Multi-annual budget execution

The actual execution rate in terms of revenues committed (revenues established and recognised) reaches 58,6% and 36,8% for executed payments.

The validated in-kind contribution reaches EUR 113.837.543 (15,4% of the total estimated in-kind contribution in the SESAR JU Membership Agreement). This in-kind contribution validation concerns activities performed by the SESAR JU Members other than the Union from end of 2016 until end of 2017 (namely 12,5% of programme execution).

Multi-annual revenues all figures in EUR	1	2	3	4=2-3
	SESAR 2020 Programme Maximum	Total Entitlements (Commitments*)	Revenues/Contributions actually received ('Payments')	Open Entitlements still to be received
I. CASH CONTRIBUTIONS				
EUROPEAN UNION CONTRIBUTION (Title 1)	596.300.000	360.011.000	56.519.225 76.147.252 88.184.652	220.851.129 139.159.871
CONTRIBUTION FROM EUROCONTROL (Title 2)	25.000.000	11.871.144	6.682.000 5.189.144	11.871.144 0
CONTRIBUTION FROM OTHER MEMBERS (Title 3)	18.466.056	2.638.010		2.546.435 2.546.435 91.575
OTHER REVENUE (Title 4)	0	583.720	24.704 80.633	105.337 478.383
Total CASH Contributions	639.766.056	375.103.874	56.519.225 82.853.956 96.000.864	235.374.045 139.729.829
<i>Cumulative Budget implementation rates (of Prog. Max.):</i>	58,6%		36,8%	
II. IN-KIND CONTRIBUTIONS IKC (validated by the SJU)				
IKC from EUROCONTROL	433.418.444		59.602.725	59.602.725 373.815.719
IKC from OTHER MEMBERS	307.372.404		54.234.818	54.234.818 253.137.586
Total IN-KIND Contributions	740.790.848	0	0	113.837.543 113.837.543 626.953.305
<i>Cumulative Budget implementation rates (of Prog. Max.):</i>	0,0%		15,4%	
III. TOTAL CONTRIBUTIONS (I.+II.)	1.380.556.904	375.103.874	56.519.225 82.853.956 209.838.407	349.211.588 766.683.133
<i>Cumulative Budget implementation rates (of Prog. Max.):</i>	27,2%		25,3%	

On expenditure side, the commitments made reach almost 54% of the total programme forecasts and payments made almost 30% of the total programme's forecasts.

Multi-annual expenditure

	1	2	3	4=2+3			
I. Expenditure Budget Titles:	SESAR 2020 Programme Maximum	Total Commitments made	PAYMENTS			Open Commitments (RAL)	
			2016	2017	2018		
Running Costs (Titles 1 & 2)	72.716.056	17.278.194		6.089.978	9.270.138	15.360.116	1.918.078
Operational Expenditure Non-Members (Title 3.1)	169.050.000	87.397.145	9.919.493	15.443.239	15.440.464	40.803.196	46.593.949
Operational Expenditure Members (Title 3.3)	398.000.000	238.446.471	40.000.000	40.827.960	52.074.908	132.902.869	105.543.603
TOTAL Expenditure :	639.766.056	343.121.810	49.919.493	62.361.177	76.785.510	189.066.180	154.055.630
<i>Cumulative Budget implementation rates (of Prog. Max.):</i>		53,6%				29,6%	
II. Budget Results							
Cash Contributions (see Multi-annual revenues)	639.766.056	375.103.874	56.519.225	82.853.956	96.000.864	235.374.045	139.729.829
<i>Budget Result</i> (Revenues ./ Expenditure)	0	31.982.063	6.599.732	20.492.779	19.215.353	46.307.865	14.325.801

3.3.3 In-Kind contributions

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

In Kind contributions (Revenue) SESAR 2020

Type of revenue	all figures in EUR	1	2	3=2/1
		Commitment appropriation	CA execution	% of budget
Contribution from the European Union		0	0	
Contribution from Eurocontrol to be recogn	73.388.642	59.602.725		81,2%
Contributions from other Members to be re	57.585.592	56.011.816 (1)		97,3%
Other sources of contribution and revenue		0	0	
Budget surplus previous year		0	0	
TOTAL REVENUE	130.974.234	115.614.542		88,3%

(1) including EUR 1.776.998 of in-kind contributions to be validated

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

<u>Type of expenditure</u>	<i>all figures in EUR</i>	1	2	3=2/1
	<u>Commitment appropriation</u>	<u>s (Final budget)</u>	<u>CA executed</u>	<u>% of budget</u>
Staff Expenditure		0	0	
Administrative Expenditure*		0		
Operating Expenditure	130.974.234	115.614.542	88,3%	
1. Studies/Development conducted by the SJU**		0		
2. Studies/Development conducted by Eurocontrol**	73.388.642	59.602.725	81,2%	
3. Studies/Development conducted by other Members	57.585.592	56.011.816		
TOTAL EXPENDITURE	130.974.234	115.614.542	88,3%	
TOTAL REVENUE		115.614.542		
BUDGET SURPLUS			0	

3.3.3.3 In-kind contributions from the SESAR JU Members other than the Union for the 1st reporting period – Wave 1

During 2018, we assessed and validated the in-kind contributions of the SESAR JU Members other than the Union for the first reporting period (covering activities performed between ends of 2016 until end of 2017) for an amount of EUR 113.837.543. An amount of EUR 1.776.998 is still to be validated. This validation is subject to the submission of the Certificates for the valuation of IKOP certifying the actual costs incurred from the starting date of the H2020-SESAR-2015-2 Projects until the end of 2017:

SESAR2020 Members' IKOP for the first Reporting Period – Wave 1				
MEMBERS	Total Net Contribution	<i>Of which financial contribution</i>	Net in-kind contribution validated	Net in-kind contribution to be validated
	<u>EUR</u> <i>(Total for SESAR2020)</i>	<i>(Total for SESAR2020)</i>		
EUROCONTROL	492.256.781	25.000.000	59.602.725	0
AIRBUS	26.761.006	1.667.271	8.456.750	513.387
AT-ONE Consortium	12.495.693	627.887	2.182.055	
B4 Consortium	2.382.455	397.076	191.414	56.689
COOPANS Consortium	9.275.779	599.718	1.488.668	
DASSAULT Aviation	5.247.567	290.928	196.712	0
DFS	8.483.712	672.725	2.770.809	
DSNA	9.831.225	641.023	2.027.337	0
ENAIKE	16.452.269	834.917	2.648.178	0
ENAV	8.143.260	643.950	1.236.711	0
FREQUENTIS Consortium	6.885.998	475.866	808.991	152.480
HONEYWELL AEROSPACE	15.324.183	777.926	3.021.431	
INDRA	21.534.500	1.656.500	4.066.800	
LEONARDO	48.127.620	2.291.791	6.671.150	
NATMIG Consortium	10.472.227	511.804	2.050.535	
NATS	9.363.535	655.208	1.405.703	
SEAC2020 Consortium	3.485.625	222.625	0	323.133
SKYGUIDE	1.637.165	263.860	263.677	
THALES LAS	75.585.799	3.599.324	6.695.308	731.310
THALES AVS	34.348.844	1.635.659	8.052.589	
TOTAL	818.095.243	43.466.058	113.837.543	1.776.998

Table 15: In-kind contributions from the SESAR JU Members other than the Union for the 1st reporting period (Wave 1)

3.3.4 Budget Outturn

With the SESAR JU being a multi-annual programme (with a limited life-time and fixed total budget ceilings), unused payment appropriations at the end of one budgetary year are not cancelled but inscribed as budget result in the revenues of the subsequent budget. The provisional budget result for 2018 (i.e. total revenues of EUR 97.887.180 minus EUR 78.625.670 total payments) amounted to EUR 19.261.510 (EUR 19.215.353 for SESAR 2020 and EUR 46.157 for SESAR 1). The 2018 cumulative surplus that remains within the Joint Undertaking amounts to EUR 77.237.034 (of which EUR 46.307.865 for SESAR 2020 and EUR 30.929.169 for SESAR 1):

SESAR 2020		2018	2017
<i>all figures in EUR</i>			
<u>REVENUE RECEIVED FOR THE YEAR</u>			
Contribution from the European Union SESAR2020	88.184.652	82.853.956	
Contribution from Eurocontrol	5.189.144		
Contributions from other Members	2.546.435		
Other sources of contribution and revenue	80.633		
TOTAL REVENUE (1)	96.000.864	82.853.956	
<u>TOTAL PAYMENTS MADE FOR THE YEAR</u>			
Staff Expenditure SESAR2020	(5.219.663)	(4.748.615)	
Administrative Expenditure SESAR2020	(4.050.475)	(1.341.363)	
Operating Expenditure SESAR2020	(67.515.373)	(56.271.199)	
TOTAL EXPENDITURE (2)	(76.785.510,48)	(62.361.177,30)	
<i>BUDGET SURPLUS of the year (3)=(1)-(2) SESAR2020</i>	19.215.353	20.492.779	
Total Budget Surplus previous year (4) SESAR2020	27.092.512	6.599.732	
NEW TOTAL BUDGET SURPLUS (5)=(3)+(4) SESAR2020	46.307.865	27.092.512	

SESAR 1*all figures in EUR*

2018

2017

REVENUE RECEIVED FOR THE YEAR

Contribution from the European Union SESAR1	79.668.467
Contribution from Eurocontrol	
Contributions from other Members	
Other sources of contribution and revenue	1.886.316
TOTAL REVENUE (1)	<u>1.886.316</u> <u>79.668.467</u>

TOTAL PAYMENTS MADE FOR THE YEAR

Staff Expenditure SESAR1	
Administrative Expenditure SESAR1	(169.470)
Operating Expenditure SESAR1	(1.670.690) (82.423.704)
TOTAL EXPENDITURE (2)	<u>(1.840.159,63) (82.423.703,50)</u>

BUDGET SURPLUS of the year (3)=(1)-(2) SESAR1	<u>46.157</u> <u>(2.755.236)</u>
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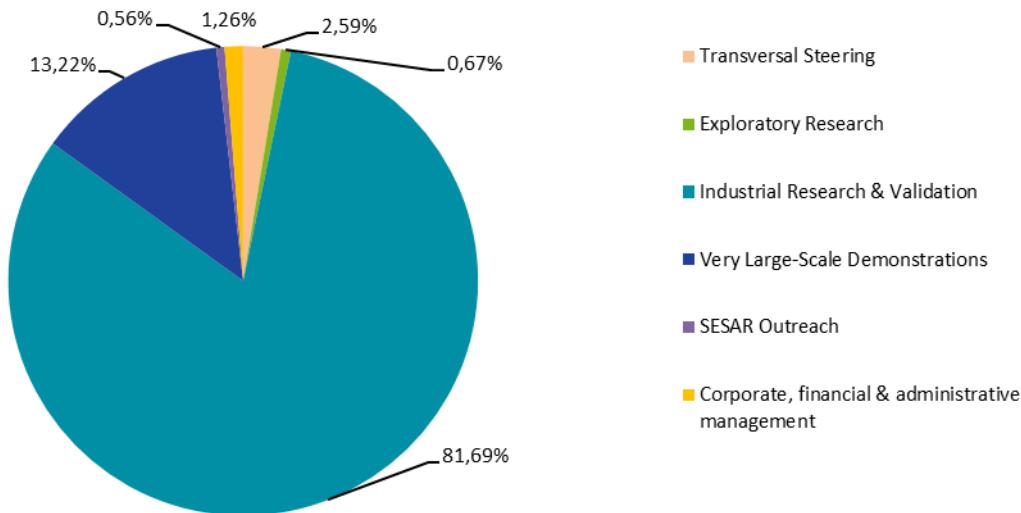
Total Budget Surplus previous year (4) SESAR1	30.883.012
Total Budget Surplus previous year (4) SESAR2020	33.638.248

NEW TOTAL BUDGET SURPLUS (5)=(3)+(4) SESAR1	<u>30.929.169</u> <u>30.883.012</u>
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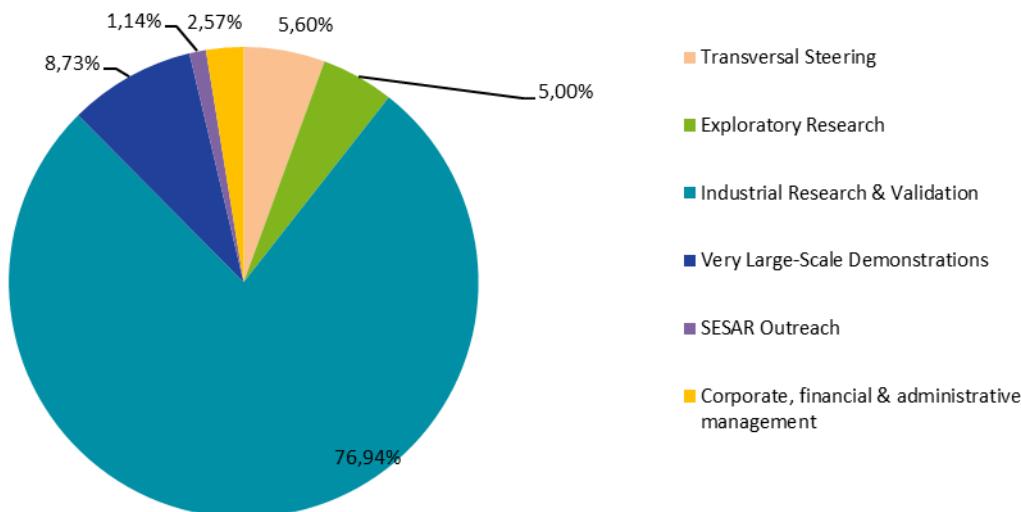
SESAR 1 + SESAR 2020		2018	2017
<i>all figures in EUR</i>			
<u>REVENUE RECEIVED FOR THE YEAR</u>			
Contribution from the European Union SESAR1	0	79.668.467	
Contribution from the European Union SESAR2020	88.184.652	82.853.956	
Contribution from Eurocontrol	5.189.144		
Contributions from other Members	2.546.435		0
Other sources of contribution and revenue SESAR1	1.886.316		
Other sources of contribution and revenue SESAR2020	80.633		
TOTAL REVENUE (1)	97.887.180	162.522.424	
<u>TOTAL PAYMENTS MADE FOR THE YEAR</u>			
Staff Expenditure SESAR2020	(5.219.663)		
Administrative Expenditure SESAR1	(169.470)		
Administrative Expenditure SESAR2020	(4.050.475)		
Operating Expenditure SESAR1	(1.670.690)	(82.423.704)	
Operating Expenditure SESAR2020	(67.515.373)	(62.361.177)	
TOTAL EXPENDITURE (2)	(78.625.670,11)	(144.784.880,80)	
BUDGET SURPLUS of the year (3)=(1)-(2) SESAR1	46.157	(2.755.236)	
BUDGET SURPLUS of the year (3)=(1)-(2) SESAR2020	19.215.353	20.492.779	
Total Budget Surplus previous year (4) SESAR1	30.883.012	33.638.248	
Total Budget Surplus previous year (4) SESAR2020	27.092.512	6.599.732	
NEW TOTAL BUDGET SURPLUS (5)=(3)+(4) SESAR1	30.929.169	30.883.012	
NEW TOTAL BUDGET SURPLUS (6)=(3)+(4) SESAR2020	46.307.865	27.092.511,57	
TOTAL BUDGET OUTTURN (7)=(5)+(6)	77.237.034	57.975.524	

3.3.5 Budget implementation allocation per Area of Operation

The figure below indicates the commitments budget allocation per Area of Operation (total: EUR 146.323.724):

Budget implementation 2018 (Commitments) allocated per Area of operation**Figure 25: The 2018 Budget allocation per Area of Operation (Commitments)**

The figure below indicates the payments budget allocation per Area of Operation (total: EUR 78.625.670):

Budget implementation 2018 (Payments) allocated per Area of operation**Figure 26: The 2018 Budget allocation per Area of Operation (Commitments and Payments)**

3.4 Human Resources management

Main activities in the field of HR are explained in section 2.6.2.

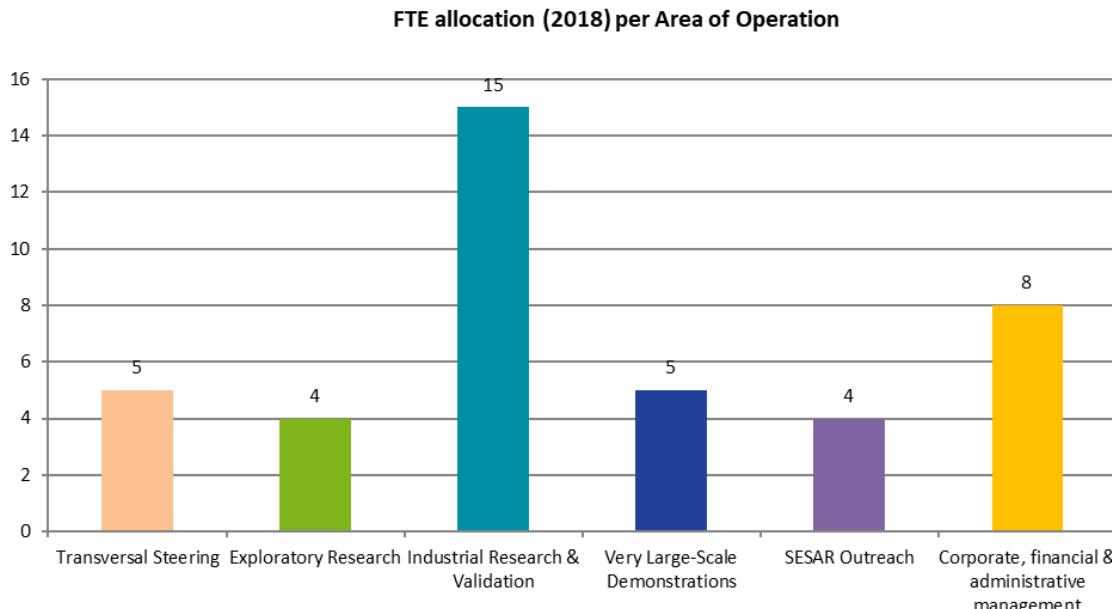
The Staff Establishment Plan appears in Annex IV. Based on this Staff Establishment Plan (and including in addition three Seconded National Experts), at the end of 2018 the benchmarking result is the following:

Job Type (sub) category	2017 (%)	2018 (%)
Administrative Support and Coordination	29,55%	28,57%
Administrative Support	16%	17%
Coordination	14%	12%
Operational	60,00%	61,67%
General operational	28%	29%
Programme management	18%	18%
Top-level operational coordination	10%	11%
Evaluation & Impact assessment	4%	4%
Neutral	10,45%	9,76%
Finance and Control	10%	10%
Linguistics	0%	0%

Table 16: Benchmarking on Human Resources

The slight difference observed for job type categories ‘Administrative Support & Coordination’ and ‘Neutral’ is explained by the termination in 2018 of the temporary staff increase of 2 Contract Agents (Function Group IV) in order to reinforce the resources in the Financial and in the Legal and Procurement Sectors, during the 2016 and 2017 exercises.

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

**Figure 27: Human resources allocation per Area of Operation**

3.5 Assessment by Management

Based on the procedures performed by staff of the SESAR JU, a **positive conclusion on the effectiveness, legality and regularity of transactions** can be drawn. This conclusion takes into consideration the following factors:

Overall Budget Implementation Rate

As a result of year budget monitoring throughout the year, budget execution rate is at 64,3% for revenue commitment appropriation execution and at 83,18% for expenditure commitment appropriation (see also paragraphs 2.6.1.1 and 3.3.1).

Legality and regularity

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

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

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

Procurement procedures

Twelve procedures were run and all completed in 2018, in addition to the ones launched in previous years and concluding in 2018. More details can be found in section 2.6.4.

Registration of exceptions

The SESAR JU has established an “exceptions and non-compliance events register” to manage and monitor possible deviations which are not initially foreseen by the procedures submitted to the Authorising Officer with a justification for endorsement. If such control-overrides or deviations are approved before action is taken (*ex-ante*), they are called “**exceptions**”. If they are detected after action was taken (*ex post*), they are “**non-compliance events**”. The non-compliance events might constitute a breach of existing regulatory and/or contractual provisions, can correspond to errors, flaws or even fraud. Non-compliance events reflect a deficiency in existing controls. They cannot be authorised (as in the *ex ante* cases), but should be reported by the appropriate management level. A new internal process for the management of the SESAR JU Exception Register was adopted in this regard in early 2018.

Over 2018, three non-compliance events have been recorded i.e. two finance related (budget and legal commitment) and one HR related (recruitment procedure).

Audit results and recommendations

During 2018, no critical recommendations were issued or closed and on 31 January 2018, no critical recommendations were open. Recommendations stemming from previous audits have been addressed according to plan. An overview of audits is presented in sections 3.7 and 3.8.

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

3.6 Budget implementation tasks entrusted to other services and entities

This section is not applicable for the SESAR JU in 2018.

3.7 Assessment of audit results during the reporting year

3.7.1 Internal Audit Service (IAS)

3.7.1.1 Audit on Coordination with the Common Support Centre (CSC)⁵⁶ and implementation of CSC tools and services

In April 2018, the IAS issued the final audit report on coordination with the CSC and implementation of CSC tools and services. The related fieldwork was performed in 2017. The scope of the audit included the coordination between the SESAR JU and the CSC on all levels of governance and the sub-processes directly supported by the CSC.

The final report included three recommendation as detailed below.

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

Table 17: Recommendations of the Audit on Coordination with the CSC and implementation of CSC tools and services

The audit highlighted that the difficulties encountered in the transition phase to H2020, mainly related to new procedures and IT tools, were dealt with in an efficient way. The audit also pointed out strengths of the SESAR JU, notably the fact that the SESAR JU Legal team has provided legal assessments in case the Common Legal Support Service could not, and expressed appreciation for the decision of the SESAR JU to set up a dedicated H2020 Grant Management Team.

⁵⁶ Under the SESAR JU Regulation, the SESAR JU receives the Union financial contribution from the H2020 Framework Programme to implement the SESAR 2020 Work Programme via calls for proposals. Horizon 2020 (H2020) is directly managed by Commission Directorates-General, Executive Agencies and other implementing bodies such as Joint Undertakings. In order to ensure that they apply the H2020 legislation consistently, the Commission created the Common Support Centre (CSC), administratively part of DG RTD, which is in charge of providing centralised support in the following areas: legal advice, ex-post audits, information technology systems and operations, business processes and programme information and data.

The SESAR JU set up a detailed action plan to address the risks underlying these recommendations. It is expected that this action plan will be implemented in the course of 2019.

3.7.1.2 Strategic Risk Assessment

In November 2018, the IAS conducted a Strategic Risk Assessment of the SESAR JU. This means that the IAS analysed all operational, administrative, financial and IT processes of the SESAR JU with the aim of identifying areas of risk and future audit topics. This Strategic Risk Assessment was performed in coordination with the SESAR JU IAC and will lead to a Strategic Internal Audit Plan (SIAP) 2019-2021. The report is expected in 2019.

3.7.2 Internal Audit Capability (IAC)

In 2018, the IAC performed activities in accordance with the IAC Annual Audit Plan 2018 which was approved by the SESAR JU Administrative Board⁵⁷.

These activities focused on assurance audits and consulting engagements. In this context, ad-hoc advice on efficient and effective management and ethics was provided on a regular basis. The IAC conducted a follow-up audit on recruitment (cf. section 3.8.) and contributed to the validation of ABAC user authorisations.

Furthermore, the IAC actively participated in the Risk Assessment exercise of the SESAR JU, liaised with the IAS, the ECA and all other relevant audit actors, monitored the implementation of several SESAR JU action plans related to past audits and followed-up on the discharge procedure regarding the SESAR JU accounts. Reporting on risks, audits and implementation of recommendations was ensured through regular presentations to the SESAR JU Board.

A detailed annual report on IAC and general audit activities at the SESAR JU in 2018 will be provided to the SESAR JU Board in Q2 2019.

3.7.3 European Court of Auditors (ECA)

On 12 November 2018, the European Court of Auditors published the final report on the annual audit of the SESAR JU accounts for the financial year 2017. The report concluded the following:

- the SESAR JU accounts present fairly, in all material respects, the financial position of the SESAR JU, the results of its operations, its cash flows, and the changes in net assets for the year 2017, in accordance with its Financial Regulation and with accounting rules adopted by the Commission's accounting officer,
- the revenue underlying the accounts for the year 2017 is legal and regular in all material respects,
- the payments underlying the accounts for the year 2017 are legal and regular in all material respects.

The Court made comments in the field of budgetary and financial management, implementation of the 2017 budget, multiannual budget implementation under FP7 and TEN-T and Horizon 2020, the internal control framework, procurement procedures and included information on the Commission's evaluations.

All items were addressed by the SESAR JU. As a result, the Finance and Budget team has been reinforced in terms of staff, a new budget procedure is in place and an information day on financial

⁵⁷ ADB(D)05-2018 Approval of the IAC Annual Audit Plan 2018

reporting, which addresses in particular research centres, universities, and SMEs will be set up in Q1 2019. Additionally, the Single Planning Document now includes a more comprehensive procurement plan and the exception reporting process has been revised.

The full report including the reply of the SESAR JU can be found here: <https://www.eca.europa.eu/en/Pages/DocItem.aspx?did=47664>.

Additionally, in 2018, the SESAR JU addressed two recommendations set out by the European Court of Auditors in the context of the performance audit of the EU's Single European Sky initiative (SES)⁵⁸ (cf. section 3.8).

3.8 Follow-up of recommendations and action plans for audits

Recommendations set out by the IAS

In Q1 2018, the IAS performed a follow-up engagement to assess the progress made in implementing the open recommendations that resulted from three past IAS audits:

- the **Audit on Risk Management** (3 recommendations dated September 2014),
- the **Audit on Operational governance and Master Plan update** (3 recommendations dated February 2016)
- the **Audit on H2020 Grant process** from the identification of the call topics to the signature of the grant agreements (5 recommendations dated March 2017).

The IAS concluded that the 11 recommendations related to these three audits were adequately and effectively implemented by the SESAR JU and these have therefore been formally closed.

Recommendations set out by the IAC

In December 2018, the SESAR JU IAC conducted a follow-up audit on recruitment to assess the implementation of actions related to an audit on HR/recruitment that was originally performed in 2014. At the time, three important recommendations and seven desirable recommendations were issued by the IAC. The follow-up audit showed that all important recommendations are now implemented by the HR sector and that desirable recommendations have been taken into account.

Recommendations set out by the European Court of Auditors (Performance audit of the SES)

End November 2017⁵⁹, the European Court of Auditors published an audit report related to a performance audit of the EU's Single European Sky initiative (SES). The overall objective of this audit was to determine whether the SES is resulting in a more efficient European Air Traffic Management. The Court issued 9 recommendations addressed to the European Commission and the EU Member States to help improve the effectiveness of the SES. An action plan was set up by DG MOVE and over the course of 2018, the SESAR JU worked to address two of these recommendations.

In particular, in the context of recommendation 8, the SESAR JU's CAAR now provides a synthetic overview of the global state of the SESAR Programme implementation. This overview builds on the state of SESAR implementation included in the Master Plan 2019 and the annual Master Plan level 3 report.

⁵⁸ Special report No 18/2017: <https://www.eca.europa.eu/en/Pages/DocItem.aspx?did=43538>

⁵⁹ Special report No 18/2017: <https://www.eca.europa.eu/en/Pages/DocItem.aspx?did=43538>

In parallel, recommendation 9 of the Court's report states that "funding should be prioritized towards ATM R&D solutions that promote defragmentation, interoperability, sharing of infrastructure and foster the conditions for a competitive environment". The SESAR JU took due account of the criteria highlighted by the Court and considered these when scoping the Wave 2 content. These criteria will be applied in the selection of proposals.

Recommendations stemming from external evaluations

Cf. Part IIb. External Evaluations

List of open Recommendations

The table below summarises the status of the recommendations not formally closed on 31/12/2018:

Author	Topic and date of final report	Recommendation	Criticality	Current Status
EC	Interim evaluation of the SESAR JU operating under Horizon 2020 June 2017	Take steps to further close the industrialisation gap	n.a.	Implementation is on hold. The implementation is subject to the next MFF perspectives
IAS	Audit on Coordination with the Common Support Centre and implementation of CSC tools and services February 2018	Internal Governance of the SESAR JU in its Cooperation with the CSC	Important	Implementation has started and is expected to be finalised over the course of 2019.
		Documentation of Decisions by SESAR JU Management	Important	
		Alignment of the Anti-Fraud Action Plan to the changed Control Environment	Important	
ECA	Performance Audit of the Single European Sky December 2017	Review the EU's support structure to ATM R&D in light of its objectives	n.a.	The action plan is led by DG MOVE
		Reinforce the accountability of the SESAR JU	n.a.	Implementation has started and is expected to be finalised over the course of 2019.
		Prioritize EU support to R&D solutions that promote defragmentation and a competitive environment	n.a.	

Table 18: Recommendations stemming from previous audits from the IAS, ECA and EC, still open

3.9 Follow-up of observations from the discharge authority

In April 2018⁶⁰, the European Parliament granted discharge to the SESAR JU regarding the financial year 2016. In its resolution, the European Parliament made observations regarding budget and

⁶⁰ European Parliament decision of 18 April 2018 on discharge in respect of the implementation of the budget of the SESAR Joint Undertaking for the financial year 2016 (2017/2181(DEC))

financial management, multiannual budget implementation under Horizon FP7, TEN-T and H2020, procurement and recruitment procedures, prevention and management of conflicts of interests, internal control, internal audits, calls for proposals and communication.

These observations were acknowledged by the SESAR JU. A written reply was sent to inform the Parliament of the measures that the SESAR JU has already implemented or intends to implement in order to address the observations made in the context of the discharge⁶¹.

3.10 Data protection

The year 2018 saw the entry into force of the new data protection legal framework through the adoption of two new pieces of legislation relevant for the SESAR JU, namely:

- Regulation (EU) 2016/679, the General Data Protection Regulation⁶² (or GDPR) which entered into force on 25 May 2018; and
- Regulation (EU) 2018/1725, the Internal Data Protection Regulation⁶³ (or IDPR), directly applicable to the SESAR JU, which entered into force on 11 December 2018.

At the end of 2018, the status of Data Protection at the SESAR JU can be summarised as follows:

- The SESAR JU has developed policies such as DP Impact Assessments (DPIA), data breaches and notifications to EDPS, internal rules of the SESAR JU on DP and internal rules on restriction of access to rights from data subjects,
- The system of notifications of processing operation has been transformed into records;
- The SESAR JU has implemented data protection by design and by default in the definition of new services and tasks,
- Thorough assessment and advice is provided on a regular basis to teams responsible for processing operations,
- Dissemination and info sessions have enabled to raise awareness across the SESAR JU teams on Data Protection.

⁶¹ Letter of the Executive Director dated 28 November 2017 with reference SJU D-2017-780

⁶² Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation)

⁶³ Regulation (EU) 2018/1725 of the European Parliament and of the Council of 23 October 2018 on the protection of natural persons with regard to the processing of personal data by the Union institutions, bodies, offices and agencies and on the free movement of such data, and repealing Regulation (EC) No 45/2001 and Decision No 1247/2002/EC

4 Part IIb. External Evaluations

In 2018, the SESAR JU was not subject to any external evaluations. Nevertheless, the SESAR JU worked to implement recommendations related to two previous evaluations.

As reported in the CAAR 2017, the SESAR JU was subject to two evaluations in 2017. One concerned the closure of the SESAR 1 Programme (Final Evaluation of SESAR 1: 2007-2016), while the second focused on the ongoing research activities under the SESAR 2020 Programme (Interim Evaluation of SESAR 2020: 2014-2020). The reports were based on the work of independent experts and the results of a stakeholder consultation. The evaluation reports outline a total of five recommendations on which the future work of SESAR should focus upon. SESAR JU management addressed each of these recommendations in an action plan which was presented to the SESAR JU Administrative Board in May 2018.

Consequently, in 2018, several corrective measures were implemented, for example: the architecture of the Master Plan was strengthened, level 2 and level 3 of the Master Plan were reorganized and links to academia were strengthened.

SESAR JU management considers that the action plan is implemented except for recommendation 5. The implementation of this recommendation is subject to the next MFF perspectives, and has therefore been put on hold.

5 Part III. Assessment of the effectiveness of the internal control systems

5.1 Risk Management

In 2018, the SESAR JU executed its risk management process implementing the SESAR JU Risk Management Policy (SESAR JU/ED/613). According to this process, the SESAR JU risk management focus is on critical risks affecting the achievement of the SESAR JU objectives. A risk should be considered significant if it falls within at least one of the following impact categories:

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

At the end of 2018, the corporate risks and related response actions are:

Risk #	Risk description	Consequences and impacts	Affected 2018 objectives	Risk Owner	Summary of Response Actions
1	The SESAR JU may not be able to take up new challenges due to limited HR capabilities	- Endangers the realisation of objectives outlined in the European ATM Master Plan Provide support to EC on other areas linked to the technological pillar of SESAR JU	Execute the Master Plan Update Campaign Provide support to EC on other areas linked to the technological pillar of SESAR JU	SESAR JU	- Re-assess need for support contracts to get additional expertise during peaks of workload not to endanger the realisation of core business activities
2	The BREXIT may have an impact on SESAR JU objectives	- Endangers the realisation of objectives outlined in the European ATM Master Plan - Results in critical intervention at political level (Commission, Council, Parliament) regarding SESAR JU's performance	Potentially all	SESAR JU	- Close liaison with Commission services to implement any necessary measures

Risk #	Risk description	Consequences and impacts	Affected 2018 objectives	Risk Owner	Summary of Response Actions
3	SESAR is not able to address the airspace capacity challenge	<ul style="list-style-type: none"> - Endangers the realisation of objectives outlined in the European ATM Master Plan - Increase in ATM delays, cancellations and accommodated flights - Negative environmental impact as flight cannot fly their optimal trajectories 	<ul style="list-style-type: none"> Execute the Master Plan Update Campaign Strengthen coordination with relevant Master Plan stakeholders Provide support to EC on other areas linked to the technological pillar of the SES 	SESAR JU	<ul style="list-style-type: none"> - Execute Airspace Architecture study to identify concrete solutions to address the problem structurally - Translate outcome of the Airspace Architecture study into the European ATM Master Plan
4	Delays in the implementation of the Pilot Common Project (PCP)	<ul style="list-style-type: none"> -Insufficient commitment for the deployment phase -Delay/de-synchronization of deployment plans - Performance ambition not met - Negative impact on EU economy, employment, mobility and the environment 	<ul style="list-style-type: none"> Execute the Master Plan Update Campaign Strengthen coordination with relevant Master Plan stakeholders Provide support to EC on other areas linked to the technological pillar of the SES 	SESAR JU, SDM	<ul style="list-style-type: none"> - SESAR JU to deliver delayed solution (IOP) in 2020 - SDM to coordinate deployment to ensure timely and synchronised deployment of the PCP
5	The inability to successfully develop and deploy the right solutions may threaten the safe integration of drones into the airspace	<ul style="list-style-type: none"> - Value at stake from safe drones integration is not realised -Increase in safety and security risks related to drone traffic 	Execute the Master Plan Update Campaign	EC, SESAR JU, EASA	<ul style="list-style-type: none"> - Update European ATM Master Plan to cover all aspects related to the safe integration of drones into all classes of airspace - Secure funding to commit additional R&D activities in support of U3/U4 - To accelerate the development of rules and means of compliance supporting harmonised deployment of U-space services across Europe

Risk #	Risk description	Consequences and impacts	Affected 2018 objectives	Risk Owner	Summary of Response Actions
6	Unaddressed cybersecurity vulnerabilities endanger deployment	<ul style="list-style-type: none"> - Increase of potential cyber threats stemming from intentional or unintentional acts causing service disruption - Delays and potential higher costs during deployment phase 	<ul style="list-style-type: none"> Execute the Master Plan Update Campaign Strengthen coordination with relevant Master Plan stakeholders Provide support to EC on other areas linked to the technological pillar of the SES 	EC, SESAR JU	<ul style="list-style-type: none"> - Ensure efforts on ATM cybersecurity are coordinated, and assess policy options for strengthening cybersecurity and resilience - Continue to address cybersecurity during the development phase and as part of the validations conducted in the SESAR work programme
7	Global interoperability and harmonisation is not ensured	<ul style="list-style-type: none"> - European modernization is not aligned with other global plans - Lack of consideration of common standards may cause reworking resulting in delays in deployment and increased development costs 	<ul style="list-style-type: none"> Execute the Master Plan Update Campaign Strengthen coordination with relevant Master Plan stakeholders 	EC, SESAR JU	<ul style="list-style-type: none"> - work towards global interoperability in the framework of ICA work arrangements (especially on the Global Air Navigation Plan) - continue to strengthen SESAR/NextGen coordination under the EU-US MoC and further develop additional collaboration with other global partners

Table 19: SESAR JU Corporate risks and response plan summary on 31 December 2018

5.2 Effectiveness of the Internal Control Framework

The Corporate Management Team reviews, assesses and monitors its internal control according to the Internal Control Framework introduced by the European Commission in 2017. This is done on a yearly basis, by assessing each of the 50 characteristics of the 17 principles across the five components of the Internal Control Framework⁶⁴, materialised with a rating (3 = full compliance; 2 = partial compliance requiring improvement; 1 = non-compliance requiring action plan).

The figure below summarises this assessment for the 17 principles for the year 2018:

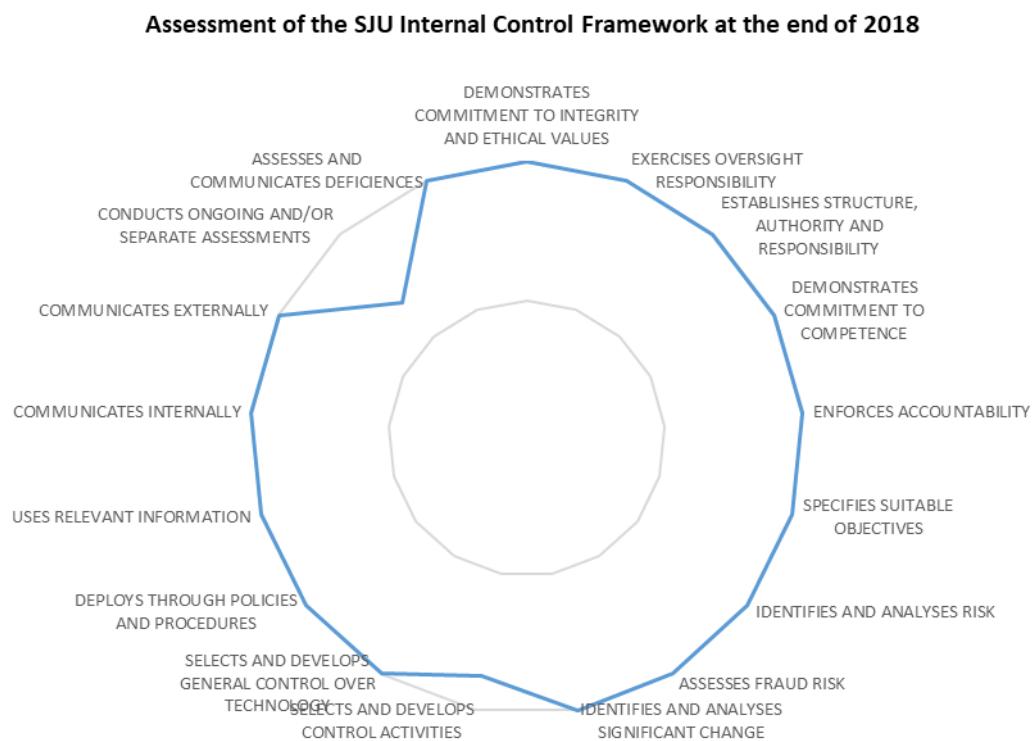


Figure 28: Assessment by the SESAR JU management team against the Internal Control Framework at the end of 2018

As shown in the figure, the SESAR JU implements 15 out of the 17 Principles fully and two others partly.

For the Principle 10 ‘Selects and develops control activities’, the SESAR JU implements all control activities which are required from the key regulations and EC guidance (Financial Regulation and FFR, SESAR JU Regulation, Staff Regulation etc.); these control activities are embedded in the business processes that form part of the Quality Management System. However, a control strategy has not been formalised as such.

For the Principle 16 ‘Conducts ongoing and/or separate assessments’, the SESAR JU relies on building blocks which are the Quality Management System (including all key business processes), the Financial Matrix, the Information and Document Management System, the exception register (since 2018, see above in paragraph 2.6.3) and the data protection register. Through these building blocks, the SESAR JU ensures control of its activities and registration of deficiencies when required. However, due to the

⁶⁴ As per the Internal Control Framework published by the European Commission in 2017: Communication to the Commission from Commissioner Oettinger with reference C(2017) 2373 final on the revision of the Internal Control Framework

limited size of the SESAR JU, no systematic separate assessment of internal control activities is conducted.

A complete report on the assessment of the implementation of the Internal Control Framework is available in annex VII.

5.3 Project Audits

5.3.1 Control results for SESAR1⁶⁵ (audits launched by the SESAR JU)

In 2018 the last audits of SESAR1 (FP7 & TEN-T) were launched, regarding the last payments that took place in 2017. On the basis of the ex-post audit strategy applicable to SESAR1 as adopted by the SESAR JU Administrative Board, the 4th cycle of audits was completed in 2018, consisting of 23 audits in 8 SESAR JU Members. All fieldwork is finalised for all 23 audits, with only 3 reports still at the draft phase, expected to be finalised in the first semester of 2019.

5.3.1.1 Overview

The total amounts of Costs declared in the Interim Financial Statements 2016 (IFS 2016) and Final Financial Statements (FFS) by all 15 Members (excluding EUROCONTROL) of the SESAR JU amounted to EUR 102.477.218.

Based on the methodology described in the SESAR JU Ex-post audit strategy, Batch 8 was composed of cost claims on IFS2016 and it was reinforced by follow-up audits of Cost Breakdown Forms of previous periods, as well as audits for the amounts claimed in the FFS.

5.3.1.2 Coverage

The Interim Financial Statements received by the 8 SESAR JU Members included in Batch 8 – EUR 34 million – were examined at the level of Projects; 122 CBFs were selected, representing EUR 14.6 million (i.e. 14% of the IFSs of the 15 selected Members and 41% of total costs accepted for the 8 Members).

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

1. the cost claims submitted for the IFS2016 of the audited Members, are not any longer affected by systematic errors, and
2. nothing appeared to the attention of the auditors concerning the respect of the principles of regularity and legality of the underlying expenditure and sound financial management.

Furthermore, the SESAR JU Members audited in the course of 2018 demonstrated their willingness to adopt the Project Audit Reports' recommendations and to correct the detected errors.

⁶⁵ The figures and statistics provided in this section were lastly updated with final results by 17th April 2019.

5.3.1.3 Representative Error Rate

Based on 106 cost statements for which the audit is completed (or almost completed as no changes are expected during the contradictory procedure), the results of the finalised audits indicate a representative error rate of 5.6%.

Where systematic errors are detected, audited SESAR JU Members are requested to take immediate actions to correct them and implement recommendations made by the auditors in the audit reports. The errors found mainly concerned the incorrect calculation of labour costs, by using wrong number of productive hours or inclusion of ineligible items in the pool of indirect costs, as well as subcontracting costs without prior notification to the SESAR JU. The amounts to be recovered from the Members were identified and recovery orders are issued.

5.3.1.4 Residual Error Rate

The residual error, defined as the error remaining in the population after the corrections and recoveries are made, for the year 2018 was calculated to 4,27%.

As this figure results from the sample audits of only 8 out of 15 SESAR JU Members (in compliance with the SESAR JU Ex-Post Audit Strategy), it cannot be considered a representative value for the entire Programme's residual error.

5.3.1.5 Cumulative Error Rates

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

Based on a total amount of costs claimed of EUR 986 million, of which 588 cost statements were audited representing all 15 Members amounting to EUR 136 million of (i.e. 14%), after the 2018 audit exercise the **new representative error rate is 5,07%** and the **new residual error rate is 1,29%**.

5.3.1.6 Implementation of audit results

Implementation of the audits which resulted in an adjustment at cost level in favour of the SESAR JU is done through recovery orders issued.

5.3.1.7 Extension of audit findings

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

5.3.1.8 Risk-based audits

No risk-based audit was performed during 2018.

5.3.1.9 Desk Control

One of the representative audits of Batch 4 which was transformed to Desk Control because of the fact that the Member is based in Melbourne-Australia, is finalised and recovery order was issued.

5.3.1.10 Other budget lines

No contracts have been audited on other budget lines.

5.3.1.11 Resources

During 2018, 23 audits were performed under the SESAR JU cascade Framework Contract. The resources devoted to the audits outsourced and those done by the SESAR JU are shown in the table below.

Resources devoted to audits in 2018		
Year	2017	2018
Internal Resources EPA (FTE)	1	1
Cost of outsourced auditing (in EUR)	513.000	529.000

Table 20: Resources for project audits in 2018

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

5.3.2 Control Results for Horizon 2020 (audits launched by the EC's Common Audit Service)

At this stage of the programme lifecycle, cost claims totalling EUR 9 billion of requested funding had been received by the services by the end of 2018. The first Horizon 2020 audits were launched in the middle of 2016 and further audits were launched in 2017 and 2018. Two Common Representative Samples (CRS), Common Risk Samples and Additional Samples⁶⁶ have been selected. In total, by December 2018, 2383 participations had been selected for audit, covering all the services signing grants in Horizon 2020.

In total, the audit of 1.155 participations has been finalised by 31/12/2018 (763 in 2018). This includes 164 out of 303 participations selected in the first 2 CRS. The error rate at 31/12/2018 is:

- Overall Detected Error Rate based on 1155 participations: 1,62%.
- The Detected Error Rate⁶⁷ based on 164 out of 303 participations selected in the first and second CRS is 2.43%. However, if we take into account the draft audit reports, then the expected representative error rate for the full sample will be around 3.32%.
- Residual Error Rate for the Research and Innovation Family: 2,22% expected to rise to around 2,45% when taking into account the draft audit reports.

5.3.2.1 Comments on the control results

As last year, the error rates set out above must still be treated with care. The two first CRS are not yet complete, and so the error rate is not yet fully representative of the expenditure that it covered. In addition, the first CRS was taken at an early stage of the programme in order to provide an early

⁶⁶ This sampling accommodates special needs of certain stakeholders with regard to audit coverage and selection method. In addition, top ups, which are participations of selected beneficiaries which are added to the selected participations, are included in the total participations selected.

⁶⁷ This error rate is not named at this stage common representative error rate as the audits of the first CRS are not yet all finalised.

indication of the error rate and, also, to help assess whether the simplifications introduced in Horizon 2020 had been effective. The nature of expenditure in the first years of the programme may not be totally representative of the expenditure across the whole period of expenditure. And the programme is in any case multi-annual, so the error rates, and especially the residual error rate, must be considered over time. In particular, the cleaning effect of audits over time will tend to increase the difference between the representative/detected error rate and the residual error rate, with the latter finishing at a lower rate.

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

To improve clarity of the rules and compliance with them DG RTD has already taken the following actions:

The Model Grant Agreement, and its accompanying annotations, have already been adjusted to introduce simplifications or clarifications on different points. The results of the first audits were considered in a working group bringing together auditors from the Commission and the Court of Auditors to see where additional simplifications and clarifications may be needed.

Considerable efforts have been made to ensure clear communication of the rules and guidance to participants and their auditors. In 2018, the Common Support Centre has been attending and coordinating 15 events organised by the National Contact Points of EU Member States and associated members with a total of 1.819 participants.

Lump sum funding has already been used for the SME stage 1 calls grants. Trials of lump sum funding for collaborative projects began in 2018 to evaluate if this form of entitlement funding, which would avoid errors of legality and regularity, is appropriate to achieving all the objectives of research policy. These trials will continue in 2019, and include the extension of lump sum funding to the ERCEA Proof of Concept grants.

The Financial Statement accompanying the Commission's proposal to the legislative authority for the Horizon 2020 regulation states: "The Commission considers therefore that, for research spending under Horizon 2020, a risk of error, on an annual basis, within a range between 2-5% is a realistic objective, taking into account the costs of controls, the simplification measures proposed to reduce the complexity of rules and the related inherent risk associated to the reimbursement of costs of the research project. The ultimate aim for the residual level of error at the closure of the programmes after the financial impact of all audits, correction and recovery measures will have been taken into account, is to achieve a level as close as possible to 2%."

The first audit results suggest that the detected (and in future representative) error rate will remain within the established range. Together with the experience in FP7, they also suggest that the objective for the residual error rate will be respected.

In conclusion, DG RTD still considers that the error rate will fall within the range established in the Financial Statement, so it does not consider that a reserve is needed for Horizon 2020 expenditure.

5.3.2.2 Results for the ex-post SESAR-specific audits

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

For the SESAR JU, in 2017 a total amount of EUR 8.077.628 of cost claims has been received and paid. Two snapshots of the population have been taken on 01/03/2017 and 03/07/2017 which resulted in two audit samples drawn from the CAS on a total amount of EUR 5.505.141. The two samples represent 11 beneficiaries, 24 participations and audit coverage of 24% of the H2020 expenditure. By 31/12/2018 nine audit reports in 26 participations were finalised **resulting in a detected error rate of 3,49% with systematic errors of 2,80% and a Residual Error Rate of 1,33%**.

For 2018, where cost claims of the core SESAR activities (IR-VLD) were received and paid, the amount of payments increased significantly to EUR 50.757.590. One snapshot of this population was taken on 28/06/2018, on the amounts paid by that cut-off date (total of EUR 33 million) resulting to a sample of 15 participations in 11 beneficiaries and audit coverage of 22%. The audit results of these audits will be available in 2019.

6 Part IV. Management assurance

6.1 Review of the elements supporting assurance

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

These building blocks are composed of the following elements:

Building block 1 – Assessment by management:

This assessment is provided in section 3.5.

Building block 2 – Register of exceptions:

This assessment is provided in section 3.5.

Building block 3 – Audit results during the reporting period:

Audit results and recommendations are presented in sections 3.7, 3.8 and 3.9.

Building block 4 – Internal Control:

The assessment of the SESAR JU's Internal Control Framework is presented in section 5.2.

6.2 Reservations

No reservation is made on the SESAR JU's activities in 2018.

6.3 Overall conclusions on assurance

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

There are also no reservations on the procedures relating to the selection of participants for SESAR 2020 projects in 2018 and the corresponding underlying financial operations (legal and financial commitments). This is also the case for SESAR JU payments relating to administration and procurement.

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

7 Part V. Declaration of Assurance

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

In my capacity as Authorising Officer,

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

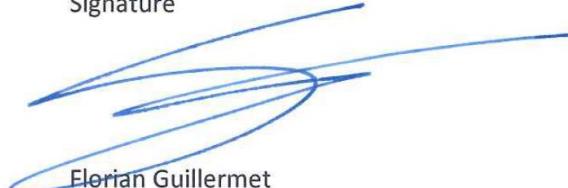
State that I have reasonable assurance that the resources assigned to the activities described in this report have been used for their intended purpose and in accordance with the principles of sound financial management, and that the control procedures put in place give the necessary guarantees concerning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

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

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

Brussels, 27 June 2019

Signature



Florian Guillermet

Executive Director

SESAR Joint Undertaking

8 Annexes

8.1 Annex I. Core business statistics

8.1.1 Annex I.1: Horizon 2020 Scoreboards

The tables below follows the instructions on Annual Activity Reports for Joint Undertakings operating under Horizon 2020:

8.1.1.1 Scoreboard of Horizon 2020 common KPIs

REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU ⁶⁸	Value in 2017	Value in 2018
1	SME - Share of participating SMEs introducing innovations new to the company or the market (covering the period of the project plus three years);(Number of SMEs that have introduced innovations)	Number and % of participating SMEs that have introduced innovations to the company or to the market	N	43 (8,5%)	78 (37,3%)
2	SME - Growth and job creation in participating SMEs (turnover of company, number of employees)	Turnover of company Number of employees	N	Not available	Not available
3	Number of publications in peer-reviewed high impact journals	The percentage of papers published in the top 10% impact ranked journals by subject category	N	66	22
4	Patent applications and patents awarded in the area of the JTI (number of patents awarded)	Number of patent applications by theme Number of awarded patents by theme	N	Number of patent applications: 4 Number of awarded patents: 3	Number of patent applications: 4 Number of awarded patents: 3

⁶⁸ Data not provided by the SESAR JU is provided by beneficiaries through project reporting
Founding Members

REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU ⁶⁸	Value in 2017	Value in 2018
5	Number of prototypes testing activities and clinical trials	Number of prototypes, testing (feasibility/demo) activities, clinical trials	N	Prototypes: 1 Feasibility activities: 11 Clinical trials: n/a	Prototypes: 259 Feasibility activities: 344 Clinical trials: n/a ⁶⁹
6	Number of joint public-private publications in projects	Number and share of joint public-private publications out of all relevant publications.	N	21 ⁷⁰	24 ⁷¹
7	New products, processes, and methods launched into the market	Number of projects with new innovative products, processes, and methods	N	Innovative products: 2 Innovative processes: 3 Innovative methods: 3	Innovative products: 15 Innovative processes: 11 Innovative methods: 12 ⁷²
8	Time to inform (TTI) <u>all applicants</u> of outcome of evaluation	Number and % of information letters sent to applicants within target (153 days) Average TTI (calendar days) Maximum TTI (calendar days)	Y	111 (100%) Average: 109 days Maximum: 124 days ⁷³	N/A

⁶⁹ Cumulative amounts referring to 2016-2018⁷⁰ Cumulative amount referring to 2016-2017⁷¹ Cumulative amount referring to 2016-2018⁷² Cumulative amounts referring to 2016-2018⁷³ Refers to calls H2020-SESAR-2016-1 and H2020-SESAR-2016-2

REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU ⁶⁸	Value in 2017	Value in 2018
9	Redress after evaluation/evaluation review	Number of redressed requested	Y	1,78%	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	Y	19 out of 20 (95%) Average: 210 days Maximum: 342 days ⁷⁴	N/A
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	Y	7 out of 20 (35%) Average 99 days Maximum: 248 days ⁷⁵	N/A
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	Y		

⁷⁴ Refers to calls H2020-SESAR-2016-1 and H2020-SESAR-2016-2⁷⁵ Refers to calls H2020-SESAR-2016-1 and H2020-SESAR-2016-2

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REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU ⁶⁸	Value in 2017	Value in 2018
Number of experts appointed					
13	Vacancy rate (%)	% vacancy rate during the reporting period	Y	10%	5,13% ⁷⁶
14	Budget implementation/execution:	% of CA and PA	Y		
	1. % CA to total budget			92,7%	83,18%
	2. % PA to total budget			75,5%	47,23%
15	Administrative Budget: Number and % of total of late payments	Number of delayed payments	Y	0%	

Table 21: Scoreboard of Horizon 2020 common KPIs

⁷⁶ Incl. one Financial Assistant AST 3 whose selection was finalised in December 2018 (start date: 01/02/2019)

8.1.1.2 Indicators for monitoring cross-cutting issues

REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU ⁷⁷	Value in 2017	Value in 2018
16	Number of nationalities in H2020 applicants & beneficiaries	Nationality of Horizon 2020 applicants & beneficiaries (number of)	N	25 ⁷⁸	N/A
17	Total amount of EU financial contribution by Member State	Nationality of Horizon 2020 beneficiaries and corresponding EU financial contribution	N	Austria: EUR 138.502 Belgium: EUR 1.250.094 Bulgaria: EUR 56.300 Czech Republic: EUR 761.232 Denmark: EUR 954.854 Finland: EUR 562.391 France: EUR 3.630.943 Germany: EUR 2.589.678 Ireland: EUR 181.300 Italy: EUR 3.088.784 Malta: EUR 67.109 Netherlands: EUR 2.600.984 Portugal: EUR 128.125 Slovenia: EUR 141.543 Spain: EUR 2.563.262 Sweden: EUR 113.750	Austria: EUR 7.420.921 Belgium: EUR 8.199.467 Bulgaria: EUR 56.300 Croatia: EUR 919.962 Czech Republic: EUR 3.610.800 Denmark: EUR 2.818.248 Finland: EUR 852.516 France: EUR 106.419.457 Germany: EUR 24.926.126 Greece : EUR 170.000 Hungary: EUR 1.093.162 Ireland: EUR 2.483.707 Italy: EUR 35.722.244

⁷⁷ Data not provided by the SESAR JU is provided by beneficiaries through project reporting

⁷⁸ Refers to calls H2020-SESAR-2016-1 (applicants and beneficiaries) and H2020-SESAR-2016-2 (applicants and beneficiaries)

REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU ⁷⁷	Value in 2017	Value in 2018
			United Kingdom: EUR 4.913.877 ⁷⁹	Lithuania: EUR 1.380.102	
				Luxembourg: EUR 72.000	
				Malta: EUR 185.859	
				Netherlands: EUR 5.080.422	
				Poland: EUR 2.550.531	
				Portugal: EUR 606.800	
				Slovakia: EUR 1.858.361	
				Slovenia: EUR 141.543	
				Spain: EUR 47.422.843	
				Sweden: EUR 8.446.303	
				United Kingdom: EUR 19.623.130 ⁸⁰	
18	Number of nationalities in H2020 applicants & beneficiaries (associated countries)	Nationality of Horizon 2020 applicants & beneficiaries (number of)	N	6 (Armenia, Israel, Norway, Serbia, Switzerland, Turkey) ⁸¹	N/A
19	Total amount of EU financial contribution by associated country	Nationality of Horizon 2020 beneficiaries and corresponding EU financial contribution	N	Israel: EUR 216.661 Norway: EUR 99.988 Serbia: EUR 155.292	Iceland: EUR 26.700 Israel: EUR 591.409 Norway: EUR 4.770.520

⁷⁹ Refers to calls H2020-SESAR-2016-1 and H2020-SESAR-2016-2⁸⁰ Cumulative total amount, refers to calls H2020-SESAR-2015-1, H2020-SESAR-2015-2, H2020-SESAR-2016-1 and H2020-SESAR-2016-2⁸¹ Refers to calls H2020-SESAR-2016-1 and H2020-SESAR-2016-2



REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU ⁷⁷	Value in 2017	Value in 2018
				Switzerland: EUR 22.750 ⁸²	Serbia: EUR 600.859
				Switzerland: EUR 5.560.770	
				Turkey: EUR 373.125 ⁸³	
20	Share of EU financial contribution going to SMEs	Number of Horizon 2020 beneficiaries flagged as SME; % of EU contribution going to beneficiaries flagged as SME	N	7,97% ⁸⁴	9% ⁸⁵
21	Percentage of women in H2020 projects	Gender of participants in Horizon 2020 projects	N	15,4% ⁸⁶	N/A
22	Percentage of women project coordinators in Horizon 2020	Gender of MSC fellows, ERC principle investigators and scientific coordinators in other Horizon 2020 activities	N	12% ⁸⁷	N/A
23	Percentage of women in EC advisory groups, expert groups, evaluation panels, individual experts, etc.	Gender of memberships in advisory groups, panels, etc.	Y	33,3% ⁸⁸	N/A

⁸² Refers to calls H2020-SESAR-2016-1 and H2020-SESAR-2016-2

⁸³ Cumulative total amounts referring to calls H2020-SESAR-2015-1, H2020-SESAR-2015-2, H2020-SESAR-2016-1 and H2020-SESAR-2016-2

⁸⁴ Refers to calls H2020-SESAR-2016-1 and H2020-SESAR-2016-2

⁸⁵ Cumulative amount referring to calls H2020-SESAR-2015-1, H2020-SESAR-2015-2, H2020-SESAR-2016-1 and H2020-SESAR-2016-2

⁸⁶ Refers to calls H2020-SESAR-2016-1 and H2020-SESAR-2016-2

⁸⁷ Refers to calls H2020-SESAR-2016-1 and H2020-SESAR-2016-2

⁸⁸ Refers to calls H2020-SESAR-2016-1 and H2020-SESAR-2016-2

Founding Members



EUROPEAN UNION

EUROCONTROL

REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU ⁷⁷	Value in 2017	Value in 2018
24	Share of third-country participants in Horizon 2020	Nationality of Horizon 2020 beneficiaries	N	0	0
25	Percentage of EU financial contribution attributed to third country participants	Nationality of Horizon 2020 beneficiaries and corresponding EU financial contribution	N	0	0
26	Share of projects and EU financial contribution allocated to Innovation Actions (IAs)	Number of IA proposals and projects properly flagged in the WP; follow up at grant level.	Y	Number of IA projects: g ⁸⁹ % of IA projects out of all projects: 12% IA out of overall EU contribution: 13,9%	Number of IA projects: 14 ⁹⁰ % of IA projects out of all projects: 17,7% IA out of overall EU contribution: 16,6%
27	Within the innovation actions, share of EU financial contribution focussed on demonstration and first-of-a-kind activities	Topics properly flagged in the WP; follow-up at grant level	Y	100% (all IA projects are VLD activities)	100% (all IA projects are VLD activities)
28	Scale of impact of projects (high-technology readiness level)	Number of projects addressing TRL between ... (4-6, 5-7)?	Y	44 projects up to TRL 2 or equivalent operational concept maturity level ('ER') 17 projects from TRL 2 to 6 or equivalent operational concept maturity level 9 projects from TRL 6 to 7 or equivalent operational concept maturity level	45 projects up to TRL 2 or equivalent operational concept maturity level ('ER') 17 projects from TRL 2 to 6 or equivalent operational concept maturity level 14 projects from TRL 6 to 7 or equivalent operational concept maturity level

⁸⁹ Refers to call H2020-SESAR-2016-2⁹⁰ Cumulative amount referring to calls H2020-SESAR-2015-2 and H2020-SESAR-2016-2

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REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU ⁷⁷	Value in 2017	Value in 2018
				3 projects address transversal activities, i.e. non-directly TRL or operational concept-related activities	3 projects address transversal activities, i.e. non-directly TRL or operational concept-related activities
29	Percentage of H2020 beneficiaries from the private for profit sector	Number of and % of the total Horizon 2020 beneficiaries classified by type of activity and legal status	Y	91 out of 160 (56,9%) for PRC ER: 41 out of 92 (44,6%) VLD: 50 out of 68 (73,5%) ⁹¹	578 out of 880 (65,7%) for PRC ER: 92 out of 223 (41,3%) IR: 374 out of 505 (74%) VLD: 112 out of 152 (73,9%) ⁹²
30	Share of EU financial contribution going to private for profit entities (Enabling & industrial tech and Part III of Horizon 2020)	Horizon 2020 beneficiaries classified by type of activity; corresponding EU contribution	Y	EUR 139,2 million out of total 192,4 for PRC (72,4%)	EUR 222.826.790 for PRC out of total EUR 293.984.187 (75%) ⁹³
31	EU financial contribution for PPP (Art 187)	EU contribution to PPP (Art 187)	Y	EUR 283 169 682	EUR 293 984 187 ⁹⁴

⁹¹ Refers to calls H2020-SESAR-2016-1 and H2020-SESAR-2016-2⁹² Cumulative amounts referring to calls H2020-SESAR-2015-1, H2020-SESAR-2015-2, H2020-SESAR-2016-1 and H2020-SESAR-2016-2⁹³ Cumulative amount referring to calls H2020-SESAR-2015-1, H2020-SESAR-2015-2, H2020-SESAR-2016-1 and H2020-SESAR-2016-2⁹⁴ Cumulative amount referring to the signature of grant agreements resulting from the calls H2020-SESAR-2015-1, H2020-SESAR-2015-2, H2020-SESAR-2016-1 and H2020-SESAR-2016-2
Founding Members

REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU ⁷⁷	Value in 2017	Value in 2018
32	PPPs leverage: total amount of funds leveraged through Art. 187 initiatives, including additional activities, divided by the EU contribution	Total funding made by private actors involved in PPPs - in-kind contribution already committed by private members in project selected for funding - additional activities (i.e. research expenditures/investment of industry in the sector, compared to previous year)	Y	See indicator #40	See indicator #40
33	Dissemination and outreach activities other than peer-reviewed publications.	A drop down list allows the choice of the type of dissemination activity. Number of events, funding amount and number of persons reached thanks to the dissemination activities	N		
34	Proposal evaluators by country	Nationality of proposal evaluators	Y	Turkish: 1 Austrian: 2 Cypriot: 2 Finnish: 1 French: 4 German: 4 Greek: 4 Hungarian: 1	N/A

REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU ⁷⁷	Value in 2017	Value in 2018
				Italian: 4 Dutch: 3 Portuguese: 2 Romanian: 3 Slovenian: 2 Spanish: 3 Swedish: 1 UK: 5 +SESAR JU staff involved in the evaluation: Spanish: 2 French: 1 UK: 2 Dutch: 1 Turkish: 1	
35	Proposal evaluators by organisations' type of activity	Type of activity of evaluators' organisations	Y	Higher Education: 4 Research organisation: 2 Non-research public body: 4 Non-research private body: 4 Other: 6	N/A
36	Participation of RTOs and Universities in PPPs	Number of participations of RTOs to funded projects and % of the total		117 out of 383 (17%) for RTOs and Universities (HES and REC) ER: 83 out of 162 (51%)	199 (REC) out of 1201 (all entity types) – 16,6%

REF	Name of H2020 Key Performance Indicator	Definition	Data provided by SESAR JU ⁷⁷	Value in 2017	Value in 2018
		Number of participations of Universities to funded projects and % of the total % of budget allocated to RTOs and to Universities	IR: 18 out of 119 (15%) VLD: 16 out of 102 (16%) ⁹⁵	98 (HES) out of 1201 (all entity types) – 8,2%	Budget allocated to RTOs and to Universities: 15% ⁹⁶
37	The objective is ensuring that research projects funded are compliant with provisions on ethics efficiently	% of proposals not granted because non-compliance with ethical rules/proposals invited to grant (target 0%); time to ethics clearance (target 45 days)	Y	0%	0%
38	Error rate (for H2020 grants)	% of representative error % residual error	Y	2,82% ⁹⁷ 2,24%	3,49% 1,33% (see section 5.3.2.2)
39	Implementation of ex-post audit results for H2020 projects	Number of cases implemented in total €million of cases implemented/total cases	Y	N/A	87% (EUR 26.420 / EUR 30.366) ⁹⁸

Table 22: Indicators for monitoring cross-cutting issues

⁹⁵ Cumulated amount of grant EU contributions signed up to end 2017. Refers to calls H2020-SESAR-2015-1, H2020-SESAR-2015-2, H2020-SESAR-2016-1, H2020-SESAR-2016-2⁹⁶ Cumulated amounts and percentages referring to beneficiaries and third party participants of the calls H2020-SESAR-2015-1, H2020-SESAR-2015-2, H2020-SESAR-2016-1, H2020-SESAR-2016-2⁹⁷ The values reported in "Value in 2017" refer to 2017 audit targets and those reported in "Values in 2018" refer to 2018 audit targets, as agreed with the CAS⁹⁸ Cumulative amount referring to 2017 and 2018

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8.1.2 Annex I.2: Scoreboard of KPIs specific to SESAR JU

The tables below provide an overview of KPIs specific to the SESAR JU:

REF	Name of H2020 Key Performance Indicator	Definition	Value in 2017	Value in 2018	Target by 2024
40	PPP – Leverage: In –kind contributions committed by private members in SESAR 2020 projects selected for funding	Private funding balancing public funding in all project types (see section 2.6.5 for explanations)	N/A (new method applied as from CAAR 2018, see section 2.6.5)	Forecasted leverage at the end of the programme: Method 1 (Interim Evaluation): 1,22 Method 2 (refined Interim Evaluation): 1,26 Method 3 (Horizon 2020): 2,26 Partnership leverage: 1,74	Programme target: Method 1 (Interim Evaluation): 1,40 Method 2 (Union Body leverage): 1,44 Method 3 (Horizon 2020): 2,44 Partnership leverage: 1,95
41	Completion of SESAR 2020 Programme	Actual v Planned % complete per project as of the end of the reporting period	3 calls for proposals completed + 2 ongoing out of the 8 planned at the end of 2017 1 grant completed + 1 terminated 77 grants in execution 4 grants in preparation	3 calls for proposals completed + 2 ongoing out of the 8 planned at the end of 2017 1 grant completed + 1 terminated 77 grants in execution 4 grants in preparation	100%

REF	Name of H2020 Key Performance Indicator	Definition	Value in 2017	Value in 2018	Target by 2024
42	Delivery of SESAR 2020 Solutions	Number of solutions ready for pre-industrialisation vs. plan	n/a (planned for Release 9)	n/a (planned for Release 9)	70% ⁹⁹

Table 23: KPIs specific to the SESAR JU – 2017 and 2018

The European ATM Master Plan defines the Performance Ambitions that the Single European Sky should achieve through the full implementation of its vision within the 2035 timeframe, provided that deployment would be achieved in an optimal and timely manner. The table below provides an overview of the SES Performance Scheme, composed of the list of key performance areas (KPAs), the related key performance indicators (KPIs) and the related Performance Ambitions:

REF	ATM Master Plan SES Performance Ambition KPA	KPI	ATM Master Plan overall SESAR 2020 Performance Ambition (vs. baseline 2012)
43	Cost efficiency	PA1	30-40% reduction in ANS costs per flight
		PA2	3-6% reduction in flight time
44	Operational efficiency	PA3	5-10% reduction in fuel burn
		PA4	Arrival predictability: 2 minute time window for 70% of flights actually arriving at gate
45	Capacity	PA5	10-30% reduction in departure delays
		PA6	5-10% additional flights at congested airports
46	Environment	PA7	System able to handle 80-100% more traffic
		PA8	5-10% reduction in CO2 emissions
47	Safety	PA9	Safety improvement by a factor 3-4
48	Security	PA10	No increase in ATM related security incidents resulting in traffic disruptions

Table 24: Single European Sky Performance Scheme as per the European ATM Master Plan

⁹⁹ Approximate target. The estimated number of solutions will be refined by the end of 2019 as it will be determined by proposals to the call IR-VLD Wave 2 currently open.

The SESAR Programme is expected to achieve a significant portion of the SES Performance Scheme. That portion is defined in the SESAR Performance Framework, composed of key performance areas (SESAR KPs and KPIs, linked with SES KPs and KPIs) and the overall SESAR 2020 Ambition, which was updated in 2017 to recognise the achievements of the SESAR 1 Programme and to set the objectives for the SESAR 2020 Programme.

In 2018, in continuation of the activities conducted in 2017, in collaboration with its Members with the support of project PJ.19, the SESAR JU assessed the performance benefits expected to result from the candidate solutions according to the KPs. A consolidation exercise was conducted in 2018, in continuation of the work initiated in 2017. The table below provides the results of that assessment:

KPA	Overall SESAR 2020 Ambition	SESAR2020 VT starting point ¹⁰⁰	Units	SESAR 2020 Wave 1 expected achievement (V3)	SESAR 2020 Wave 2 target achievement (V3)	Cumulated SESAR 2020 Wave 1 + Wave 2 V3 achievements
SAFETY	factor 3-4	not yet defined	not yet defined	Not yet available due to project's lack of maturity	Not yet available due to project's lack of maturity	Not yet available due to project's lack of maturity
Airport Capacity (CAP3)	10%	7%	% increase peak hour throughput	6,00%	0,32%	6,32%
TMA Capacity (CAP1)	47%	26%	% increase in peak hour throughput	10,02%	15,83%	25,85%
En-Route Capacity (CAP2)	49%	16%	% increase in peak hour throughput	2,97%	14,67%	17,64%
Punctuality (PUN1)	7%	7%	Increase in proportion of flights departing within +/- 3 minutes of SOBT	0,67%	6,06%	6,73%
Predictability (PRD1)	96%	62%	Reduction in variance of block-to-block flight time	9,94%	42,44%	52,37%

¹⁰⁰ SESAR 2020 VT starting point represents the portion of the overall SESAR 2020 Ambition which is expected from the SESAR 2020 programme, i.e. building on the V3 achievements of the SESAR 1 programme Founding Members

KPA	Overall SESAR 2020 Ambition	SESAR2020 VT starting point ¹⁰⁰	Units	SESAR 2020 Wave 1 expected achievement (V3)	SESAR 2020 Wave 2 target achievement (V3)	Cumulated SESAR 2020 Wave 1 + Wave 2 V3 achievements
Environment/Fuel Efficiency (FEFF1)	500	340	saving kg/flight	74,56	180,08	254,64
ATCO Productivity (CEF2)	52%	40%	% increase in ATCO productivity	10,07%	35,07%	45,14%
Technology Cost (CEF3)	22%	16%	% reduction in technology cost per flight	3,49%	12,51%	16,00%

Table 25: Performance ambitions, Validation target starting point and SESAR 2020 Initial Performance assessment results (expectations)

The expected achievements in the table above will be validated in the context of the Release 9 ending at the end of 2019 for those Solutions reaching the V3-TRL6 level of maturity only, not including performance results from candidate Solutions not yet in V3-TRL6 level of maturity.

8.1.3 Annex I.3: Procurement activity in 2018

In order to manage the timely implementation of its procurement activities supporting the implementation of the SESAR JU objectives for 2018, SESAR JU used a contract action planning where all the procurement/contract activities are recorded over 2018. This file is updated on a weekly basis in concertation with OIA and Corporate Management team. This planning is a repository of all the procurement activities planned in the SPD as well as unforeseen activities at the time of the SPD adoption upon validation of the Corporate Management team and details the timeline for implementation of these activities on the basis of SESAR JU needs and applicable rules. In particular, the SESAR JU launched and finalised the following procurement activities in 2018.

SAoO	Type of Procedure	Title	Total Budget (Est.)	Type of Contract	Signed
5	Framework Contract	Events	98.168 €	Specific Contract	20-02-2018
5	Framework Contract	communications support for Strategic communication	63.233 €	Specific Contract	13-02-2018
6	Open call	Assessment management functions	10.000 €	EC Framework Contract	13-02-2018
6	Specific Contract	Assurance des biens et des personnes	0 €	EC Framework Contract	16-02-2018
5	Negotiated Procedure	3PRM - Professional Staff Organisations - IFATCA	200.000 €	Framework service	07-03-2018
5	Negotiated Procedure	3PRM - Professional Staff Organisations - ECA	200.000 €	Framework service	07-03-2018
5	Negotiated Procedure	3PRM - Professional Staff Organisations - IFATSEA	200.000 €	Framework service	07-03-2018
5	Framework Contract	3PRM - Airspace Users, Lot 3	72.400 €	Specific Contract	01-03-2018
6	n.a.	Cleaning services	6.368 €	Amendment	12-03-2018

SAoO	Type of Procedure	Title	Total Budget (Est.)	Type of Contract	Signed
1	Framework Contract	Strategic advice	401.444 €	Specific Contract	19-03-2018
1	Framework Contract	Airspace architecture Study	399.391 €	Specific Contract	19-03-2018
5	open call	Web support	488.000 €	Framework Contract	28-03-2018
5	Negotiated Procedure	3PRM - Professional Staff Organisations	200.000 €	Framework service	23-03-2018
5	Negotiated Procedure	3PRM - Professional Staff Organisations	200.000 €	Framework service	16-03-2018
6	Specific Contract	Microsoft high level services for quality management	169.470 €	EC FWC	19-04-2018
6	Specific Contract	Microsoft high level services for quality management	69.360 €	EC FWC	10-04-2018
5	Framework Contract	Digital Communications	41.238 €	Specific Contract	14-04-2018
1	Amendment	SDSS Amendment	0 €	Direct service	23-05-2018
1	Amendment	Strategic advice	401.444 €	Specific Contract	29-06-2018
5	Framework Contract	3PRM - Airspace Users, Lot 1 2017 Amendment	459.980 €	Specific Contract	22-05-2018
5	Framework Contract	3PRM - Airspace Users, Lot 1 2018 SC2	822.410 €	Specific Contract	22-05-2018
6	Framework Contract	Project Audit - Ernst & Young Réviseurs d'Entreprises	386.616 €	Specific Contract	16-05-2018
5	Framework Contract	Events	31.963 €	Specific Contract	03-05-2018
5	Framework Contract	Events	31.963 €	Specific Contract	01-08-2018

SAoO	Type of Procedure	Title	Total Budget (Est.)	Type of Contract	Signed
1	Negotiated Procedure	Provision of technical advice for European Architecture	57.000 €	Service Contract	18-06-2018
5	Framework Contract	3PRM - Airspace Users, Lot 2 2017 Amendment	207.955 €	Specific Contract	19-06-2018
5	Framework Contract	3PRM - Airspace Users, Lot 4 2017 amendment	176.400 €	Specific Contract	21-06-2018
5	Framework Contract	3PRM - Airspace Users, Lot 3 2018 SC2	203.000 €	Specific Contract	27-06-2018
5	Framework Contract	3PRM - Airspace Users, Lot 2 2018 SC2	348.250 €	Specific Contract	19-06-2018
6	Framework Contract	Microsoft licencing 1 CO Scenario CO	15.160 €	Order Form	27-06-2018
6	Framework Contract	Microsoft NV/SA	0 €	Order Form	28-06-2018
6	Framework Contract	Cleaning services, Facilities improvement & Maintenance	180.000 €	Service Contract	01-06-2018
6	Framework Contract	Audit of IFS 2016 &FFS -PKF Littlejohn LLP	138.000 €	Specific Contract	10-07-2018
5	Framework Contract	3PRM - Airspace Users, Lot 4 2018 SC2	164.800 €	Specific Contract	17-07-2018
6	Framework Contract	Telecom S.A.	42.000 €	Specific Contract	01-08-2018
6	Open call	Cleaning services, Facilities improvement & Maintenance	100.000 €	Direct service	06-08-2018
6	Amendment	Microsoft	0 €	Amendment	21-08-2018
6	Amendment	Microsoft	0 €	Amendment	23-08-2018

SAoO	Type of Procedure	Title	Total Budget (Est.)	Type of Contract	Signed
5	Amendment to FWC	Organisation of events	20.000 €	Framework Contract	31-08-2018
5	Amendment to FWC	Organisation of events	28.000 €	Framework Contract	31-08-2018
5	Amendment to FWC	Organisation of events	42.000 €	Framework Contract	31-08-2018
1	Negotiated Procedure	Programme Management Support	144.000 €	Framework service	30-08-2018
1	Framework Contract	Programme Management Support	39.600 €	Specific Contract	30-08-2018
6	Framework Contract	Comparex Nederland B.V.	7.746 €	Specific Contract	11-09-2018
6	Negotiated Procedure	Col Audit	25.000 €	Direct service	17-09-2018
6	Framework Contract	Adobe licences - DI 7360	7.800 €	Specific Contract	11-09-2018
6	Framework Contract	Audit of accounts	36.850 €	Specific Contract	26-09-2018
5	Amendment to Specific Contract	Digital Communications Lot 2	-3.143 €	Specific Contract	20-09-2018
5	Amendment to Specific Contract	Event Communications Lot 3	0 €	Specific Contract	25-09-2018
6	Framework Contract	Comparex Nederland B.V.	4.417 €	Specific Contract	26-09-2018
5	Framework Contract	Event Comms - Lot 3		Specific Contract	25-08-2018
6	Specific Contract	VMWare licences - DI 7360	4.462 €	EC Framework Contract	14-09-2018
5	Framework Contract	3PRM - Airspace Users, Lot 1	580.416 €	Specific Contract	03-10-2018
5	Framework Contract	Organisation of events	83.115 €	Specific Contract	15-10-2018

SAoO	Type of Procedure	Title	Total Budget (Est.)	Type of Contract	Signed
6	Direct Service Contract	Security related services - Lot 1	0 €	Amendment	22-10-2018
5	Low value negotiated procedure	Regulatory and legal advice	55.000 €	Direct service contract	23-10-2018
5	Framework Contract	Communication services, Lot 1	32.827 €	Specific Contract	26-11-2018
5	Amendment to FWC	Communication services, Lot 1	0 €	Amendment	26-11-2018
5	Framework service	3PRM - Professional Staff Organisations - Lot1 - ATCEUC	85.500 €	Specific Contract	28-12-2018
5	Framework service	3PRM - Professional Staff Organisations - Lot3 - ETF	80.700 €	Specific Contract	20-12-2018
5	Framework service	3PRM - Professional Staff Organisations - Lot5 - IFATSEA	78.500 €	Specific Contract	20-12-2018

Table 26: Main procurement activities launched and completed in 2018

8.2 Annex II. Statistics on financial management

Statistics on financial management are provided in part IIa section 3.3.

8.3 Annex III. Organisation chart

On 31 December 2018, the organisation chart was as follows:

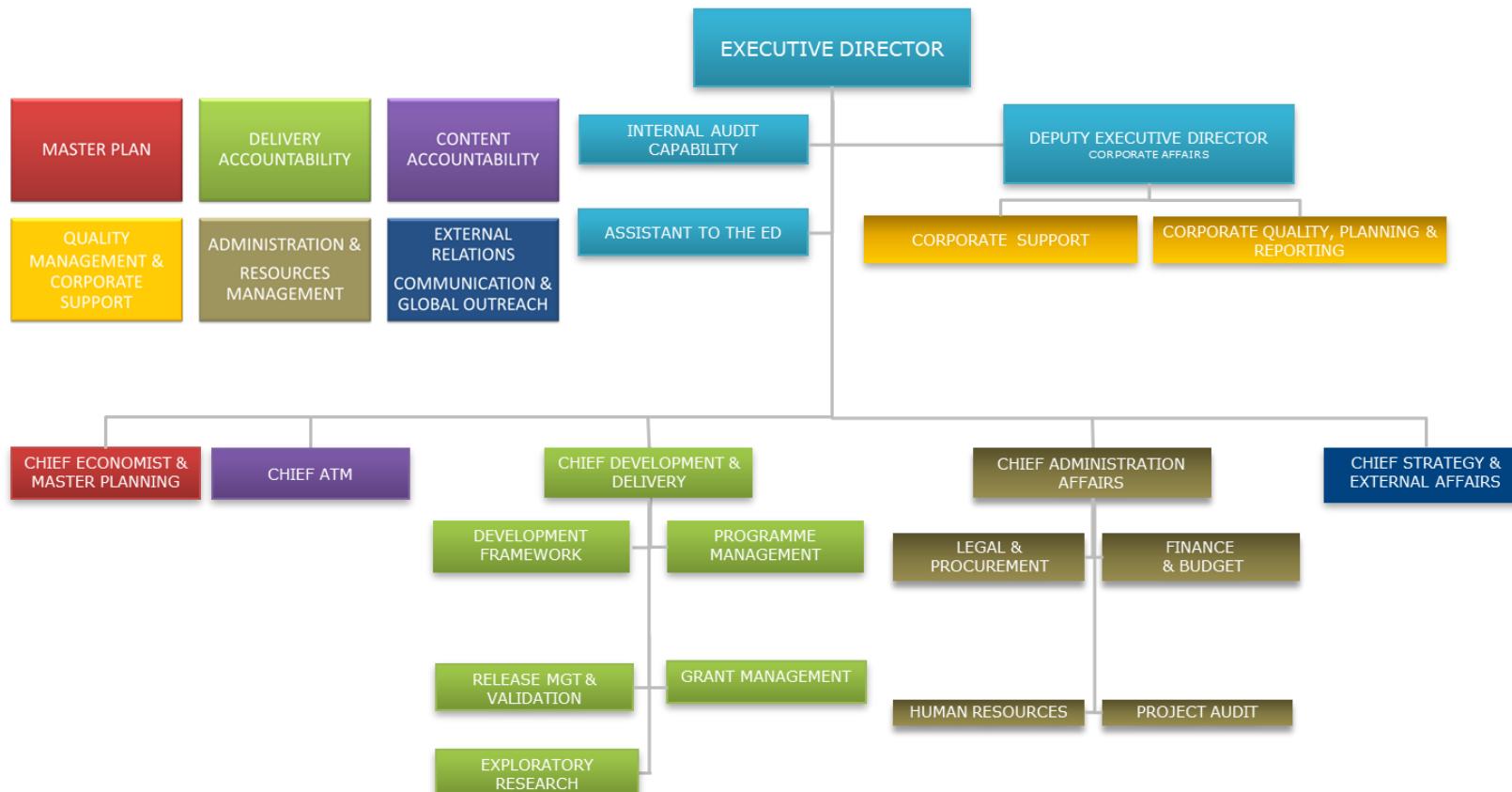


Figure 29: Organisation chart of the SESAR JU as at 31 December 2018

8.4 Annex IV. Establishment plan

Table of 39 positions per area and activity at 31 December 2018:

Activity	Function / Job title
Executive Director	Executive Director
TBD	TBD
Audit	Internal Audit Capability
Executive secretariat	Assistant to the Executive Director*
Corporate Affairs including corporate support and corporate quality, planning and reporting	Deputy Executive Director Corporate Affairs*
	Head of Corporate Support*
	Administrative Assistant – Facility Coordinator*
	Head of Corporate Quality, Planning & Reporting
	Planning & programming Officer
Strategies and relations with ICAO, follow up of MoC with third countries and communication	Chief Strategies & External Relations*
	Head of International Affairs
Relations with different stakeholders and coordination of ED activities	Head of Stakeholders and Institutional Relations
Communication internal/external, media	Senior Communications & Media Relations Officer
Implementation of the day-to-day communication strategy	Communications & Events Officer
Development & delivery, Release and validation	Head of Release Management & Validation
Development & delivery, grant management and development framework	Call Coordinator
	Grant Manager
	Grant Manager
	Grant Manager
ATM	ATM Architecture Framework Expert
	Chief ATM
	ATM Expert – Architecture & Systems Engineering
	ATM Expert - Airport & Airspace User Operations

Activity	Function / Job title
	ATM Expert - TMA, en-route & network operations
AU relations, business case, Master Planning	Chief Economist & Master Planning*
Digital transformation and innovation	Manager Digital Transformation & Innovation
General administration, Finance, legal and HR	Chief Administration Affairs
Project Audit	Project Auditor
Finance and Budget Coordination and responsibility for the follow up of the SESAR JU Budget	Head of Finance & Budget
Financial administration and budget	Financial Officer
	Financial Officer
	Financial Assistant
	Financial Assistant
Legal Affairs and Contract	Head of Legal Affairs and Procurement*
Procurement procedures, personal data protection, day-to-day legal issues	Legal & Procurement Officer, Data Protection Officer
	Legal & Procurement Officer
	Legal & Procurement Officer**
HR Legal matters	HR Legal Officer**
Recruitment, HR Administration, staff development	HR Officer*

Table 27: List of the 39 SESAR JU positions (31 December 2018)

(*) Staff member eligible to Transitional Provisions Article 2 of Council Regulation (EC) 1361/2008 (8 staff).

(**) Positions currently covered by a CA contract. These staff members are not additional to the 39 posts included in the Staff Establishment Plan approved by the Administrative Board of the SESAR JU, but they are contractual forms used provisionally by the SESAR JU to fill in specific TA positions taking into consideration the needs (including covering the position while the call for vacant is launched), or specific expertise required.

8.5 Annex V. Human and financial resources by activity

Human and financial resources allocation by activity is provided in part IIa section 3.3.4 and 3.4.

8.6 Annex VI. Specific annexes related to part II

Not applicable for 2018.

8.7 Annex VII. Specific annexes related to part III

Components	#	Principle	Description	Characteristics	Y - 1 SESAR JU's compliance	Principle avg	Comments / Actions plan
I. Control environment	1	Demonstrates commitment to integrity and ethical values	The Commission demonstrates a commitment to integrity and ethical values	Tone at the top. The Administrative Board and all management levels respect integrity and ethical values in their instructions, actions and behaviour.	3	3	
				Standards of conduct. The SESAR JU's expectations on integrity and ethical values are set out in standards of conduct and understood at all levels of the organisation, as well as by entrusted bodies, outsourced service providers and beneficiaries.	3		
				Alignment with standards. Processes are in place to assess whether individuals and departments are aligned with the SESAR JU's expected standards of conduct and to address deviations in a timely manner.	3		
	2	Exercises oversight responsibility	The College of Commissioners demonstrates independence from management and exercises oversight of the development and performance of internal control	The Administrative Board oversees the SESAR JU's governance, risk management and internal control practices and takes overall political responsibility for management carried out by the Executive Director. This happens through the use of appropriate working arrangements and communication channels between SESAR JU Areas.	3	3	
				Executive Director oversees the internal control systems within their Directorate-General. Executive Director oversees the development and performance of internal control. They are supported in this task by the Chief(s) in charge of risk management and internal control.	3		

Components	#	Principle	Description	Characteristics	Y - 1 SESAR JU's compliance	Principle avg	Comments / Actions plan
				<p>In their capacity as Authorising Officer, Executive Director provides a Declaration of Assurance on the appropriate allocation of resources and their use for their intended purpose and in accordance with the principles of sound financial management, as well as on the adequacy of the control procedures in place (see Appendix 2).</p> <p>The Chief(s) in charge of risk management and internal control plays a key role by coordinating the preparation of the SESAR JU's Consolidated Annual Activity Report. In this context, they sign a declaration taking responsibility for the completeness and reliability of management reporting (see Appendix 3). This declaration covers both the state of internal control in the SESAR JU and the robustness of reporting on operational performance. However, responsibility for achieving operational objectives remains with the relevant directorate and unit.</p>	3		
	3	Establishes structure, authority and responsibility	Management establishes, with political oversight, structures, reporting lines, and appropriate authorities and responsibilities in the pursuit of objectives	Management structures are comprehensive. The design and implementation of management and supervision structures cover all policies, programmes and activities. In particular for spending programmes, they cover all management modes, expenditure types, delivery mechanisms and entities in charge of budget implementation (i.e. both SESAR JU Areas and entrusted external entities) to support the achievement of policy, operational and control objectives	3	3	

Components	#	Principle	Description	Characteristics	Y - 1 SESAR JU's compliance	Principle avg	Comments / Actions plan
				Authorities and responsibilities. The SESAR JU and the Executive Director, as appropriate, delegate authority and use appropriate processes and technology to assign responsibility and segregate duties as necessary at the various levels of the SESAR JU.	3		
				Reporting lines. The Executive Director designs and evaluates reporting lines within departments and with entrusted entities to enable the execution of authority, fulfilment of responsibilities, and flow of information.	3		
4	Demonstrates commitment to competence	The Commission demonstrates a commitment to attract, develop, and retain competent individuals in alignment with objectives		Competence framework. The Chiefs defines the competences necessary to support the achievement of objectives and regularly evaluate them across the SESAR JU, taking action to address shortcomings where necessary.	3	3	
				Professional development. SESAR JU Areas provide the training and coaching needed to attract, develop, and retain a sufficient number of competent staff.	3		
				Mobility. SESAR JU Areas promote and plan staff mobility so as to strike the right balance between continuity and renewal.	3		
				Succession planning and deputising arrangements for operational activities and financial transactions are in place to ensure continuity of operations.	3		
				Enforcing accountability. The SESAR JU defines clear roles and responsibilities and holds individuals and entrusted entities accountable for the performance of internal control responsibilities across the	3		
5	Enforces accountability	The Commission holds individuals accountable for their internal control				3	

Components	#	Principle	Description	Characteristics	Y - 1 SESAR JU's compliance	Principle avg	Comments / Actions plan
			responsibilities in the pursuit of objectives	organisation and for the implementation of corrective action as necessary.			
				Staff appraisal. Staff efficiency, abilities and conduct in the service are assessed annually against expected standards of conduct and set objectives. Cases of underperformance are appropriately addressed.	3		
				Staff promotion. Promotion is decided after consideration of the comparative merits of eligible staff taking into account, in particular, their appraisal reports.	3		
II. Risk assessment	6	Specifies suitable objectives	The Commission specifies objectives with sufficient clarity to enable the identification and assessment of risks relating to objectives	Mission. The SESAR JU Areas and Sections have up-to-date mission statements that are aligned across all hierarchical levels, down to the tasks and objectives assigned to individual staff members. Mission statements are aligned with the SESAR JU's responsibilities under the Treaties and the policy objectives set in the legal base.	3	3	
				Objectives are set at every level. The SESAR JU's objectives are clearly set and updated when necessary (e.g. significant changes in priorities, activities and/or the organigram). They are consistently filtered down from the SESAR JU level to the various levels of the organisation, and are communicated and understood by management and staff.	3		

Components	#	Principle	Description	Characteristics	Y - 1 SESAR JU's compliance	Principle avg	Comments / Actions plan
				<p>Objectives are set for the most significant activities. Objectives and indicators cover the SESAR JU's most significant activities contributing to the delivery of SESAR JU priorities or other priorities relating to the core business, as well as operational management.</p> <p>Objectives must be SMART (specific, measurable, achievable, relevant and time-framed). Indicators must be RACER (relevant, accepted, credible, easy to monitor and robust).</p>	3		
				<p>Objectives form the basis for committing resources. Management uses the objectives set as a basis for allocating available resources as needed to achieve policy, operational and financial performance goals.</p>	3		
				<p>Financial reporting objectives. Financial reporting objectives are consistent with the accounting principles applicable in the SESAR JU.</p>	3		
				<p>Non-financial reporting objectives. Non-financial reporting provides management with accurate and complete information needed to manage the organisation at SESAR JU, SESAR JU Area and Sector level.</p>	3		
				<p>Risk tolerance and materiality. When setting objectives, management defines the acceptable levels of variation relative to their achievement (tolerance for risk) as well as the appropriate level of materiality for reporting purposes, taking into account cost-effectiveness.</p>	3		

Components	#	Principle	Description	Characteristics	Y - 1 SESAR JU's compliance	Principle avg	Comments / Actions plan
7				Monitoring. Setting objectives and performance indicators make it possible to monitor progress towards their achievement.	3	3	
		Identifies and analyses risk	The Commission identifies risks to the achievement of its objectives across the organisation and analyses risks as a basis for determining how the risks should be managed	Risk identification. The SESAR JU identifies and assesses risks at the various organisational levels (SESAR JU, SESAR JU Area, Section, cross-cutting across SESAR JU Areas) and those related to entrusted entities, analysing internal and external factors. Management and staff are involved in the process at the appropriate level.	3		
				Risk assessment. The SESAR JU estimates the significance of the risks identified and determines how to respond to significant risks considering how each one should be managed and whether to accept, avoid, reduce or share the risk. The intensity of mitigating controls is proportional to the significance of the risk.	3		
				Risk identification and risk assessment are integrated into the annual activity planning and are regularly monitored.	3		
	8	Assesses fraud risk	The Commission considers the potential for fraud in assessing risks to the achievement of objectives	Risk of fraud. The risk identification and assessment procedures (see principle 7) consider possible incentives, pressures, opportunities and attitudes which may lead to any type of fraud, notably fraudulent reporting, loss of assets, disclosure of sensitive information and corruption.	3	3	

Components	#	Principle	Description	Characteristics	Y - 1 SESAR JU's compliance	Principle avg	Comments / Actions plan
				Anti-fraud strategy. The SESAR JU sets up and implements measures to counter fraud and any illegal activities affecting the financial interests of the EU. They do this by putting in place a sound anti-fraud strategy to improve the prevention, detection and conditions for investigating fraud, and to set out reparation and deterrence measures, with proportionate and dissuasive sanctions.	3	3	
				Assess changes. The risk identification process considers changes in the internal and external environment, in policies and operational priorities, as well as in management's attitude towards the internal control system.			
III. Control activities	10	Selects and develops control activities	The Commission selects and develops control activities that contribute to the mitigation of risks to the achievement of objectives to acceptable levels	Control activities are performed to mitigate the identified risks and are cost-effective. They are tailored to the specific activities and risks of the SESAR JU and their intensity is proportional to the underlying risks.	3	2,75	The SESAR JU implements all control activities which are required from the key regulations and EC guidance (Financial Regulation and FFR, SESAR JU Regulation, Staff Regulation etc.)
				Control activities are integrated in a control strategy. The control strategy includes a variety of checks, including supervision arrangements, and where appropriate, should include a balance of approaches to mitigate risks, considering manual and automated controls, and preventive and detective controls.	2		Control activities must be defined in the context of the new Internal Control Framework

Components	#	Principle	Description	Characteristics	Y - 1 SESAR JU's compliance	Principle avg	Comments / Actions plan
				Segregation of duties. When putting in place control measures, management considers whether duties are correctly divided between staff members to reduce risks of error and inappropriate or fraudulent actions.	3		
				Business continuity plans based on a business impact analysis following corporate guidance are in place, up-to-date and used by trained staff to ensure that the Commission is able to continue working to the extent possible in case of a major disruption. Where necessary, business continuity plans must include coordinated and agreed disaster recovery plans for time-sensitive supporting infrastructure (e.g. IT systems).	3		
11	Selects and develops general control over technology	The Commission selects and develops general control activities over technology to support the achievement of objectives		Control over technology. In order to ensure that technology used in business processes, including automated controls, is reliable, and taking into account the overall corporate processes, the SESAR JU selects and develops control activities over the acquisition, development and maintenance of technology and related infrastructure.	3	3	
				Security of IT systems. The SESAR JU applies appropriate controls to ensure the security of the IT systems of which they are the system owners. They do so in accordance with the IT security governance principles, in particular as regards data protection, professional secrecy, availability, confidentiality and integrity.	3		

Components	#	Principle	Description	Characteristics	Y - 1 SESAR JU's compliance	Principle avg	Comments / Actions plan
12	Deploy through policies and procedures	The Commission deploys control activities through corporate policies that establish what is expected and in procedures that put policies into action		Appropriate control procedures ensure that objectives are achieved. The control procedures assign responsibility for control activities to the department or individual responsible for the risk in question. The staff member(s) put in charge perform the control activities in a timely manner and with due diligence, taking corrective action where needed. Management periodically reassesses the control procedures to ensure that they remain relevant.	3	3	
				Exception reporting is one of the management tools used to draw conclusions about the effectiveness of internal control and/or the changes needed in the internal control system. A system is in place to ensure that all instances of overriding controls or deviations from established processes and procedures are documented in exception reports. All instances must be justified and approved before action is taken, and logged centrally.	3		
				The impact assessment and evaluation of expenditure programmes, legislation and other non-spending activities are performed in accordance with the guiding principles of the Commission's better regulation guidelines, to assess the performance of EU interventions and analyse options and related impacts on new initiatives.	3		

Components	#	Principle	Description	Characteristics	Y - 1 SESAR JU's compliance	Principle avg	Comments / Actions plan
IV. Information and communication	13	Uses relevant information	The Commission obtains or generates and uses relevant quality information to support the functioning of internal control	Information and document management. SESAR JU identifies the information required to support the functioning of the internal control system and the achievement of its objectives. Information systems process relevant data, captured from both internal and external sources, to obtain the required and expected quality information, in compliance with applicable security, document management and data protection rules. This information is produced in a timely manner, and is reliable, current, accurate, complete, accessible, protected, verifiable, filed and preserved. It is shared within the organisation in line with prevailing guidelines.	3	3	
	14	Communicates internally	The Commission internally communicates information, including objectives and responsibilities for internal control, necessary to support the functioning of internal control	Internal communication. The SESAR JU communicates internally about their objectives, challenges, actions taken and results achieved, including but not limited to the objectives and responsibilities of internal control. Separate communication lines, such as whistleblowing hotlines, are in place at the SESAR JU level to ensure information flow when normal channels are ineffective.	3	3	

Components	#	Principle	Description	Characteristics	Y - 1 SESAR JU's compliance	Principle avg	Comments / Actions plan
	15	Communicates externally	The Commission communicates with external parties about matters affecting the functioning of internal control	External communication. SESAR JU ensure that their external communication is consistent, relevant to the audience being targeted, and cost-effective. The SESAR JU establishes clear responsibilities to align its Areas communication activities with the SESAR JU's political priorities and narrative of the institution.	3	3	
				Communication on internal control. The SESAR JU communicates with external parties on the functioning of the components of internal control. Relevant and timely information is communicated externally, taking into account the timing, audience, and nature of the communication, as well as legal, regulatory, and fiduciary requirements.	3		
V. Monitoring activities	16	Conducts ongoing and/or separate assessments	The Commission selects, develops, and performs ongoing and/or separate assessments to ascertain whether the components of internal control are present and functioning	Continuous and specific assessments. The SESAR JU continuously monitors the performance of the internal control system with tools that make it possible to identify internal control deficiencies, register and assess the results of controls, and control deviations and exceptions. In addition, when necessary, the Directorate General carries out specific assessments, taking into account changes in the control environment. Ongoing assessments are built into business processes and adjusted to changing conditions. Both kinds of assessment must be based on the general principles set out in Appendix 1.	2	2,33	Control activities must be assessed in the context of the new Internal Control Framework

Components	#	Principle	Description	Characteristics	Y - 1 SESAR JU's compliance	Principle avg	Comments / Actions plan
				Sufficient knowledge and information. Staff performing ongoing or separate assessments has sufficient knowledge and information to do this, specifically on the scope and completeness of the results of controls, control deviations and exceptions.	2		Control activities must be assessed in the context of the new Internal Control Framework
				Risk-based and periodical assessments. The SESAR JU varies the scope and frequency of specific assessments depending on the identified risks. Specific assessments are performed periodically to provide objective feedback.	3		Control activities must be assessed in the context of the new Internal Control Framework

Components	#	Principle	Description	Characteristics	Y - 1 SESAR JU's compliance	Principle avg	Comments / Actions plan
17		Assesses and communicates deficiencies	<p>The Commission assesses and communicates internal control deficiencies in a timely manner to those parties responsible for taking corrective action, including senior management and the College of Commissioners, as appropriate</p>	Deficiencies. With the support of the Chief(s) in charge of risk management and internal control, the SESAR JU considers the results of the assessments of how the internal control system is functioning within the SESAR JU. Deficiencies are communicated to management and to the departments responsible for taking corrective action. They are reported in the Annual Activity Reports and to the responsible Administrative Board, as appropriate. The term 'internal control deficiency' means a shortcoming in a component or components and relevant principle(s) that reduces the likelihood of a SESAR JU achieving its objectives. There is a major deficiency in the internal control system if management determines that a component and one or more relevant principles are not present or functioning or that components are not working together. When a major deficiency exists, the SESAR JU cannot conclude that it has met the requirements of an effective system of internal control. To classify the severity of internal control deficiencies, management has to use judgment based on relevant criteria contained in regulations, rules or external standards.	3	3	
				Remedial action. Corrective action is taken in a timely manner by the staff member(s) in charge of the processes concerned, under the supervision of their management. With the support of the Chief(s) in charge of risk management and internal control, the Executive Director monitors and takes responsibility for the timely implementation of corrective action.			

Table 28: Assessment of the SESAR JU's Internal Control Framework at the end of 2018



Founding Members



EUROPEAN UNION

EUROCONTROL

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8.8 Annex VIII. Final Annual Accounts

Final Annual Accounts are provided in a separate document entitled “*Final annual accounts of the SESAR Joint Undertaking Financial year 2018*”.

The main information in relation with the Final Financial Accounts for 2018 is the following:

Balance sheet:

	Note	31.12.2018	31.12.2017	EUR '000
NON-CURRENT ASSETS				
<i>Intangible assets</i>	2.1	4	4	
<i>Property, plant and equipment</i>	2.2	174	187	
<i>Pre-financing</i>	2.3	10 928	71 330	
		11 106	71 522	
CURRENT ASSETS				
<i>Pre-financing</i>	2.3	60 902	10 937	
<i>Exchange receivables and non-exchange recoverables</i>	2.4	77 852	61 336	
<i>Cash and cash equivalents</i>	2.5	1	7	
		138 755	72 280	
TOTAL ASSETS		149 861	143 802	
CURRENT LIABILITIES				
<i>Payables and other liabilities</i>	2.6	(123 368)	(101 458)	
<i>Accrued charges and deferred income</i>	2.7	(93 990)	(75 947)	
		(217 359)	(177 404)	
TOTAL LIABILITIES		(217 359)	(177 404)	
NET ASSETS		(67 498)	(33 603)	
<i>Contribution from Members</i>	2.8	2 083 381	1 873 397	
<i>Accumulated deficit</i>		(1 906 999)	(1 743 330)	
<i>Economic result of the year</i>		(243 879)	(163 670)	
NET ASSETS		(67 498)	(33 603)	

Statement of financial performance:

	Note	2018	2017	EUR '000
REVENUE				
		–	–	
Revenue from exchange transactions				
<i>Financial income</i>		–	0	
<i>Other exchange revenue</i>	3.1	0	43	
Total revenue		0	43	
EXPENSES				
<i>Operating costs</i>	3.2	(235 341)	(156 065)	
<i>Staff costs</i>	3.3	(4 824)	(4 022)	
<i>Finance costs</i>		(5)	(5)	
<i>Other expenses</i>	3.4	(3 709)	(3 620)	
Total expenses		(243 879)	(163 713)	
ECONOMIC RESULT OF THE YEAR		(243 879)	(163 670)	

Cash flow statement:

	Note	2018	2017
		EUR '000	
<i>Economic result of the year</i>		(243 879)	(163 670)
Operating activities			
<i>Depreciation and amortization</i>		71	85
<i>(Increase)/decrease in pre-financing</i>		10 438	(5 457)
<i>(Increase)/decrease in exchange receivables and non-exchange recoverables</i>		(16 515)	(7 087)
<i>Increase/(decrease) in payables</i>		21 910	(122 881)
<i>Increase/(decrease) in accrued charges</i>		18 044	57 572
<i>Increase/(decrease) in cash contributions</i>		95 920	132 099
<i>Increase/(decrease) in in-kind contributions</i>		114 064	109 505
<i>Other non-cash movements</i>			(40)
Investing activities			
<i>(Increase)/decrease in intangible assets and property, plant and equipment</i>		(57)	(138)
NET CASHFLOW		(5)	(10)
<i>Net increase/(decrease) in cash and cash equivalents</i>		(5)	(10)
<i>Cash and cash equivalents at the beginning of the year</i>	2.5	7	17
<i>Cash and cash equivalents at year-end</i>	2.5	1	7

Result of the implementation of the budget:

	Title	2018	2017
		EUR '000	
Revenue		97 887	162 523
<i>of which:</i>			
<i>Contribution From The European Union</i>	1	88 185	113 147
<i>Contribution From Eurocontrol</i>	2	5 189	32 605
<i>Contribution From Other Members</i>	3	2 546	0
<i>Other Revenue</i>	4	1 967	16 770
Expenditure		(78 626)	(144 785)
<i>of which:</i>			
<i>Staff expenditure</i>	A-1	(5 220)	(5 048)
<i>Admin expenditure</i>	A-2	(4 220)	(3 321)
<i>Operational expenditure</i>	B0-3	(69 186)	(136 416)
Exchange rate differences		0	0
Budget result		19 262	17 738

8.9 Annex IX. Other annexes

8.9.1 IX.1 List of acronyms and definitions

Acronym	Long Name / Definition
ABSR	Assistance Based Speech Recognition
ACAS	Airborne Collision Avoidance System
ACC	Area Control Centres
A-CDM	Airport Collaborative Decision Making
ADS-B	Automatic Dependence Surveillance-Broadcast
ADS-C	Automatic Dependence Surveillance-Contract
AFs	ATM Functionalities
AIM	Aeronautical Information Management
AIRM	ATM Information Reference Model
AMAN	Arrival Manager
ANC	Air Navigation Conference
ANS	Air Navigation Services
ANSP	Air Navigation Service Provider
AOP	Airport Operation Plan
ASBUs	Aviation System Block Upgrades
ATC	Air Traffic Control
ATFCM	Air Traffic Flow and Capacity Management
ATM	Air Traffic Management
ATCO	Air Traffic Control Officer
ATSU	Air Traffic Services Unit
AU	Airspace Users (Civil)
BVLOS/VLOS	Beyond Visual Line Of Sight/Visual Line Of Sight
CA	Contract Agent
CAP	Collaborative Advanced Planning
CCTV	Closed Circuit Television

Acronym	Long Name / Definition
CDM	Collaborative Decision Making
CEF	The Connecting Europe Facility Programme
CNS	Communication, Navigation, Surveillance
CONOPS	Concept of Operations
CP2	Common Project 2
CRS	Common Representative Samples
CWP	Controller Working Position
DAC	Dynamic Airspace Configurations
DART	Data-driven Aircraft Trajectory
DCB	Demand and Capacity Balancing
DMAN	Departure Manager
DME	Distance Measuring Equipment
DMSC	Delivery Management Sub-Committees
DPO	Data Protection Officer
EAP	Extended ATC Planning
EASA	The European Aviation Safety Agency
EASCG	The European Air Traffic Management Standards Coordination Group
EATMA	The European Air Traffic Management Architecture portal
EC	The European Commission
ECTRL	EUROCONTROL
EDA	The European Defence Agency
EDPS	The European Data Protection Supervisor
EFVS	Enhanced Flight Vision Systems
EGNOS	European Geostationary Navigation Overlay Service
ELTA	The Hellenic Post S.A.
EPP	Extended Projected Profile
EUROCAE	European Organisation for Civil Aviation Equipment
EUSCG	The European UAS Standards Coordination Group

Acronym	Long Name / Definition
ER	Exploratory Research
EU	European Union
FAA	Federal Aviation Administration
FCI	Future Communication Infrastructure
FFS	Final Financial Statements
FIS-B	Flight Information System-Broadcast
FMP	Flow Management Positions
FP7	7th Framework Programme of the European Union
FRA	Free Route Airspace
FRD	Functional Requirements Definition
GA	General Aviation
GA/R	General Aviation & Rotorcraft
GANP	Global Air Navigation Plan (from ICAO)
GBAS	Ground Based Augmentation System
GDPR/IDPR	General Data Protection Regulation/Internal Data Protection Regulation
GNSS	Global Navigation Satellite System
GPS	The Global Positioning System
H2020	Horizon 2020, the Framework Programme for Research and Innovation (2014-2020)
HES	Higher or Secondary Education Organisation
HMI	Human Machine Interface
IA	Innovation Action
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
INS	Inertial Navigation System
IOP	Inter-operability
IR	Industrial Research & Validation
KPAs	Key Performance Areas
KTN	Knowledge Transfer Network

Acronym	Long Name / Definition
LDACS	L-band Digital Aeronautical Communication System
LIDAR	Light Detection and Ranging
MAWP	SESAR 2020 Multi-Annual Work Programme
MET	Meteorological
MLAT	Multilateration
MoC	Memorandum of Cooperation
MoU	Memorandum of Understanding
MPC	The Master Planning Committee
MUAC	Maastricht Upper Area Control
NM	Network Manager
NOP	Network Operation Plan
OAT	Operational Air Traffic
OE _s	Operational Environments
OSED	Operational Service and Environment Definition
PA	Payment Appropriations
PBN	Performance-Based Navigation
PC	Programme Committee
PCP	Pilot Common Project
PKF	PKF Littlejohn LLP
PMP	Program Management Plan
PPP	Public Private Partnership
PRC	Private for Profit Organisation
R&D	Research and Development
REC	Research Organisation
R&I	Research & Innovation
RNP	Required Navigation Performance
RPAS	Remotely Piloted Aircraft System
RSP	Required Surveillance Performance

Acronym	Long Name / Definition
RTCA	Radio Technical Commission for Aeronautics
RTOs	Research and Technology Organisations
RTS	Real Time Simulation
RVR	Runway Visual Range
SAoO	SESAR JU Strategic Area of Operation
SATCOM	Satellite Communications
SBT/RBT	Shared Business Trajectory/Reference Business Trajectory
SC	Scientific Committee
SDM	SESAR Deployment Manager
SE-DMF	System Engineering Data Management Framework
SES	Single European Sky
SESAR	Single European Sky ATM Research is the SESAR research and innovation programme (called SESAR 1 for the period covering 2008 to 2016, and SESAR 2020 starting in 2015 with a maximum period for award of grants ending in December 2020)
SESAR 1	The SESAR 1 research and innovation programme, also referred to as the SESAR 1 Programme or SESAR 1 R&I Programme, is the coordinated set of activities undertaken by the Members other than the Union and managed by the SESAR JU over the period from 2008 through to 2016
SESAR 2020	The SESAR 2020 research and innovation programme, also referred to as the SESAR 2020 Programme or SESAR 2020 R&I Programme, is the coordinated set of activities described in this document and being undertaken by the Members other than the Union and managed by the SESAR JU, starting in 2015 with a maximum period for award of grants ending in December 2020
SESAR JU	SESAR Joint Undertaking
SIDs	SESAR Innovation Days
SMEs	Micro, small and medium-sized enterprises
SNE	Seconded National Expert
SRIA	Strategic Research and Innovation Agenda
STAM	Short Term ATFCM Measures
SWIM	System Wide Information Management
SWIM-TI	System Wide Information Management Technical Infrastructure
TBO	Trajectory Based Operations
TMA	Terminal Control Area

Acronym	Long Name / Definition
TRA	The EU Transport Research Arena
TRL	Technology Readiness Level
TTA	Target Time Arrival
TTG	Time to Grant (H2020 Grant Lifecycle)
TTI	Time to Inform (H2020 Grant Lifecycle)
TTS	Time to Sign (H2020 Grant Lifecycle)
UAS	Unmanned Aerial System
UDPP	User Driven Prioritisation Process
UTM	UAS Traffic Management
VAC	Vigilance and Attention Controller
VALP	Validation Plan
VFR	Visual Flight Rules
VLD	Very Large-Scale Demonstration
VLL	Very Low-Level
WAM	Wide Area Multilateration
WOC	Wing Operations Centre
WP	Work Programme
WVE	Wake Vortex Encounter
YSA	SESAR Young Scientist Award

Table 29: List of acronyms and definitions

8.9.2 IX.2 Composition of the Administrative Board as at 31 December 2018

SESAR JU Founding Members		Member	Alternate
European Union	Mr Henrik Hololei (Chair), European Commission	Mr Filip Cornelis	
EUROCONTROL	Mr Eamonn Brennan (Deputy Chair), EUROCONTROL Agency	Mr Philippe Merlo	
SESAR JU Members		Member	Alternate
Airbus	Mr Bruno Darboux	Mr Hugues de Beco	
AT-One consortium	Prof. Dr.-Ing. Dirk Kügler	Dr Helmut Többen	
B4-consortium	Mr Maciej Rodak	Mr Lubos Hlinovsky	
COOPANS	Ms Susanne Isaksen	Mr Steen Erichsen	
Dassault Aviation	Mr Frédéric Falchetti	Ms Catherine Champagne	
DFS	Mr Robert Schickling	Mr Ralf Bertsch	
DSNA	Mr Maurice Georges	Mr Philippe Barnola	
ENAIRe	Mr Angel Luis Arias	Ms Mariluz de Mateo	
ENAV	Mr Iacopo Prissinotti	Mr Cristiano Cantoni	
Leonardo (formerly "FINMECANICCA")	Mr Stefano Porfiri	Mr Fabio Ruta	
Frequentis	Mr Hermann Mattanovich	Mr Michael Holzbauer	
Honeywell	Mr George Papageorgiou	Mr Sander Roosendaal	
INDRA	Mr Rafael Gallego Carbonell	Mr Ramon Tarrech	
NATMIG	Mr Trond Runar Hagen	Mr Trond Bakken	
NATS	Mr Jonathan Astill	Mr Dave Curtis	
SEAC	Mr Gérard Batistella	Mr Frank Pötsch	
Skyguide	Mr Thomas Buchanan	Mr Pascal Latron	
Thales LAS France SAS	Mr Luc Lallouette	Mr Todd Donovan	
Thales AVS France SAS	Mr Philippe Benquet	Mr Pascal Combe	
Stakeholder Representatives		Member	Alternate
Military	Air Commodore (ret.) Chris Lorraine, MAB Mr Jorge Domecq, European Defence Agency	Mr Per Coulet Mr Roland Van Reybroek	
Civil users of airspace	Mr Giancarlo Buono	Mr Robert Baltus	

	Ms Sylviane Lust (permanent observer)	
Air Navigation Service Providers	Ms Tanja Grobotek	Mr Edouardo Garcia Gonzalez
Equipment manufacturers	Mr Vincent de Vroey, ASD	Mr Yoann Viaouet
Airports	Mr Olivier Jankovec, Airports Council International	Mr Aidan Flanagan
Staff in the ATM sector	Mr Michele Altieri, ENAV	Mr Theodore Kyritsis
Scientific community	Mr Peter Hecker, Technische Universität Carolo-Wilhelmina zu Braunschweig	Mr Jacco Hoekstra
Permanent Observers	Member	Alternate
European Commission – Directorate General for Research and Innovation	Ms Clara de la Torre	n/a
European Commission – Directorate General for Research and innovation	Mr Sebastiano Fumero	n/a
Permanent Representatives	Member	Alternate
SESAR JU Executive Director	Mr Florian Guillermet	n/a
SESAR JU Deputy Executive Director	Mr Peter Hotham	n/a
SESAR JU Chief Administration Affairs	Mr José Calvo Fresno	n/a
SESAR JU Internal Audit	Ms Véronique Haarsma	n/a
Secretary of the Board	Ms Ilaria Vazzoler	n/a

Table 30: Composition of the SESAR JU Administrative Board as at 31 December 2018



Members

AIRBUS



ENAIRe



FREQUENTIS SESAR PARTNERS



Honeywell



LEONARDO



NATS



THALES

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