CONSOLIDATED ANNUAL ACTIVITY REPORT 2015

SESAR
JOINT UNDERTAKING

SESAR JOINT UNDERTAKING (SJU)

In accordance with Article [16, 17, 20 and 22] of the Statutes of the SESAR JU annexed to Council Regulation (EU) No 219/2007 as amended by Regulation (EU) No 721/2014, and with Article 46 of the Financial Rules of the SJU.

The consolidated annual activity report will be made publicly available after its approval by the Administrative Board.

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FACTSHEET[1]

Name	SESAR Joint Undertaking (SJU)
Objectives	The SJU is responsible for the modernisation of the European Air Traffic Management (ATM) system by coordinating, rationalising and concentrating all relevant research and development efforts in the EU.
Founding Legal Act	The SESAR Joint Undertaking (SJU) was established under Council Regulation (EC) 219/2007 of 27 February 2007 (as modified by Council Regulation (EC) 1361 / 2008 (SJU Regulation) and last amended by the Council Regulation (EU) 721/2014).
Executive Director	Florian Guillermet

Administrative Board Members

SJU Founding Members	Member	Alternate
European Union	Mr Henrik Hololei (Chair) European Commission	Mr Margus Rahuoja
EUROCONTROL	Mr Frank Brenner (Deputy Chair) EUROCONTROL Agency	Mr Philippe Merlo
SJU Members	**Member**	**Alternate**
Airbus	Mr Bruno Darboux	Mr Bruno Ley
ALENIA Aermacchi	Mr Marco Protti	Mr Fabio Ruta
DFS	Mr Robert Schickling	Mr Ralf Bertsch
DSNA	Mr Maurice Georges	Mr Philippe Barnola
ENAIRE	Mr Ignacio González Sánchez	Ms Mariluz de Mateo
ENAV	Mr Iacopo Prissinotti	Mr Cristiano Baldoni
Frequentis	Mr Christian Pegritz	Mr Michael Holzbauer
Honeywell	Mr Jean-Luc Derouineau	Mr Sander Roosendaal
INDRA	Mr Rafael Gallego Carbonell	Mr Ramon Tarrech
NATMIG	Mr Aage Thunem	Mr Magnus Lindegren
NATS	Mr Simon Hocquard	Mr Peter Whysall
NORACON	(vacant)	Mr Niclas Gustavsson
SEAC	Mr Giovanni Russo	Mr Gérard Battistella
SELEX E.S.	Mr Stefano Porfiri	Mr Giuliano d'Auria

[1] As of 31 December 2015

	Thales Group	Mr Jean-Marc Alias	Mr Luc Lallouette
	Stakeholder Representatives	**Member**	**Alternate**
	Military	Air Commodore (retd) Chris Lorraine (MAB) Mr Jorge Domecq (EDA)	Mr Per Coulet Mr Roland Van Reybroek
	Civil users of airspace	Mr Simon McNamara (IATA)	Mr Giancarlo Buono
	Air Navigation Service Providers	Mr Guenter Martis (CANSO)	Mr Thomas Buchanan
	Equipment manufacturers	Mr Vincent de Vroey (ASD)	Mr Kyle Martin
	Airports	Mr Olivier Jankovec (ACI)	Mr Panos Spiliotis
	Staff in the ATM sector	Mr Michele Altieri (ENAV)	Mr Theodore Kiritsis
	Scientific community	Mr Peter Hecker (Technische Universität Carolo-Wilhelmina zu Braunschweig)	Mr J.A. Mulder
	Permanent Representatives	**Member**	**Alternate**
	SJU Executive Director	Mr Florian Guillermet	n/a
	SJU Deputy Executive Director	Mr Peter Hotham	n/a
	SJU Chief Administration Affairs	Mr José Calvo Fresno	n/a
	SJU Accounting Officer	Mr Marcel Dedic	n/a
	SJU Internal Audit	Mrs Véronique Haarsma	n/a
	Secretary of the Board	Mrs Ilaria Vazzoler	n/a
Other Governance Bodies	The Programme Committee (PC), The Scientific Committee (SC), The SESAR Performance Partnership (SPP).		

Staff, Secondees, Trainees and Contractors

Staff Type	Number of Staff
Temporary Agents AD (SJU)	33
Temporary Agents AST (SJU)	6
Seconded National Experts (SJU)	3
EUROCONTROL Seconded Staff	20
External Service Provision for Reception Services	1
SJU Trainees (SJU)	*4*
ICT Coordinator (contractor)	*1*
IT Support & Helpdesk (contractors)	*2*
Industrial Support Team (contractors)	*3*
Programme Support (contractors)	*6*
Other contractors	*7*
TOTAL	**86**

2015 Budget	Title 1 (staff expenditure): **5 980 000 EUR** Title 2 (infrastructure and operating expenditure): **3 258 500 EUR** Title 3 (operational expenditure): **72 461 274 EUR (**of which **51 470 000 EUR** is SESAR2020 Budget)
2015 Budget implementation	Title 1: **5 954 705 EUR** (99.6% commitment) Title 2: **3 231 138 EUR** (99.2% commitment) Title 3: **72 461 274 EUR** (100.0% commitment) (of which **51 470 000** SESAR2020 Budget)
Grants	No grants were signed during the 2015 reporting period.
Strategic Research Agenda	SESAR 2020 Multi-annual work programme http://www.sesarju.eu/newsroom/brochures-publications/sesar-2020-multi-annual-work-programme
Call implementation	Number of calls launched in 2015: 3 (i) Call for SESAR2020 Exploratory Research, (ii) Call for SESAR2020 Transversal , IR&V and VLD activities (Wave 1) and (iii) Call for Final Membership Application Membership. For (i) - Number of proposals submitted: 128 Number of eligible proposals: 123 Number of proposals funded: 28 Global project portfolio (since the setting up): 370 + 28 (398) Number and value of procurement procedures: 13 procedures with an approximate value of EUR 76,700,000
Participation, including SMEs	SESAR 1 participation remained static during 2015, involving all SJU Members, their Affiliates, Associates and subcontractors as well as engagement of 3rd parties (airspace users, Military, Staff Associations, ACI) and Associates of the SJU through earlier procurement arrangements of the SJU. The evaluation of the 1st SESAR2020 ER call has been completed but no grant agreements were signed by 31 December 2015.

FOREWORD

A Year of Preparations, Plans and Progress

2015 saw the SESAR Joint Undertaking together with our members and partners push the limits of our collective abilities by moving forward not just one but two research and innovation programmes following two very different approaches and funding arrangements.

The year was marked by a number of major milestones, not least with regard the ramp-up towards SESAR 2020, within the framework of Horizon 2020. Following months of intensive work, a multi-annual programme was drawn up and adopted detailing the industrial research activities required to deliver SESAR 2020. At the same time, the SESAR JU also launched a first call for SESAR 2020 exploratory research projects and continued with the membership accession process. In parallel, the partnership moved full speed ahead with delivering the remaining SESAR 1 R&I activities, reaching the expected 80% programme target as planned by the end of 2015. Throughout this transition year, the SJU continued therefore to deliver very tangible results, while securing the buy-in and commitment of its stakeholders. This achievement is particularly important in the context of the start of the SESAR deployment activities to ensure continued involvement of the various investors and smooth transition from Research & Innovation to implementation.

During 2015 special attention was also paid to the articulation and dependencies between the outcome of SESAR 1 and the corresponding activities of SESAR2020 to secure an efficient and effective handover of the relevant results and continuity of technical operations.

2015 was also the year in which the European Master Plan was revisited, reviewed and revised in strong collaboration with the SESAR JU members and all aviation stakeholders. We believe that this latest edition, which came hot on the heels of the European Commission's aviation strategy, will give further impetus to the competitiveness of the European aviation industry. The Plan will also facilitate continued collaboration with the FAA and the NextGen initiative, and more generally allow the European voice to be better heard globally through ICAO.

In addition to the core programme, the 12 months saw the completion of a number of important deliverables, such as the R&I definition phase for remotely-piloted aircraft systems (RPAS), and studies on ATM cyber-security and datalink capacity for air-ground communications.

All in all, despite some operational difficulties faced in executing the management and transition of two very differently administered programmes, this has overall been a truly productive year, which further demonstrates the SESAR JU's winning formula of pooling public and private knowledge and resources for ATM modernisation.

Enjoy the read.

Florian Guillermet

Executive Director

SESAR Joint Undertaking

INTRODUCTION

The SESAR Joint Undertaking (SJU) was established under Council Regulation (EC) 219/2007 of 27 February 2007 (as modified by Council Regulation (EC) 1361 / 2008 (SJU Regulation) and last amended by the Council Regulation (EU) 721/2014). Under this establishing Regulation, the SJU is responsible for the modernisation of the European Air Traffic Management (ATM) system by coordinating, rationalising and concentrating all relevant research and development efforts in the EU.

The form of the SJUs main planning and reporting documents are changing in order to align to applicable Commission Decisions. In particular, as a European Union body, the SJU is required by Article 46 of the SJU's Financial Rules[2] to produce a Consolidated Annual Activity Report (CAAR) for the preceding year, that must be submitted by the Executive Director to the Administrative Board to be forwarded to the relevant budgetary authorities by 1 July (n +1) of each year. This CAAR has been prepared in accordance with Article 66 (9) of the EU's Framework Financial Regulation, Article 7 (para 5h) of the statutes of the SJU and Article 47 of the SJU's Financial Rules

This CAAR has several purposes. It provides evidence of progress toward achieving the SJU's key objectives as defined in the 2015 Annual Work Programme[3], taking into account resources used during the reporting period. It also outlines the management and oversight systems in place at the SJU, including reference to the European Commission's Internal Control Standards. Lastly, the CAAR also includes a declaration of assurance in which the Executive Director, in his role as Authorising Officer, provides assurance as regards the true and fair view given by the report and pertaining to the legality and regularity and the sound financial management of all financial transactions under his responsibility.

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 SJU was created 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 4 long-term strategic objectives set by the Single European Sky initiative: safety improvement, capacity increase, a reduction of environmental impact and a reduction of service costs and the SJU 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 any initiatives that demonstrate a high level of interdependency with SESAR project objectives.

Research, development and deployment elements of the SESAR project are closely linked. The SJU defines and develops SESAR Solutions in preparation for deployment, validating solutions within a given timeframe in order to establish their readiness for deployment. In this way, R&D activities overseen by the SJU enter into the deployment pipeline (see s1.8.3 for more about SJU's links to Deployment).

[2] Adopted by the SJU's Administrative Board on 25 June 2015 (Decision ADB (D) 08-2015).

[3] For the definition, see Article 16(1)(b) of SESAR JU Statutes annexed to Council Regulation (EC) No 219/2007 as amended. This term corresponds to the term "work plan" defined in Article 2(1)(22) of Regulation (EU) No 1290/2013 of the European Parliament and of the Council of 11 December 2013 laying down the rules for participation and dissemination in "Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)" (OJ L 347, 20.12.2013 p.81): "the document similar to the Commission work programme adopted by funding bodies entrusted with part of the implementation of Horizon 2020 in accordance with Article 9(2) of Regulation (EU) No 1291/2013".

The way in which the SJU executes its mission is significantly changed in the context of its extension and of the set-up of the SESAR 2020 programme (While the SESAR1 programme was funded through FP7, TEN-T and EUROCONTROL, SESAR 2020 is funded through the Horizon 2020 Framework Programme. The introduction of H2020 grants in 2015 within SJU has necessitated a change not only in funding but also fundamental adjustments in organisational structure and ways of working[4]. In adapting to the H2020 operating framework, the SJU has been faced with a number of difficulties or challenges beyond its direct control and leading to a significant volume of work in addition to that planned and described in its annual work programme. The measures taken in 2015 to ensure this significant evolution and the set-up of new external dependencies or interfaces are further detailed in the document. Overall this major transition was managed successfully thanks to the outstanding commitment and dedication of the SJU' staff and the strong commitment of the SJU's Members.

[4] Council Regulation (EU) No 721/2014 amending Regulation (EC) No 219/2007 entered into force on 1 January 2014 but the introduction of H2020 grants in SJU did not begin until 2015.

EXECUTIVE SUMMARY

2015 was a significant year for the SJU, being the first year of transition between SESAR1 and SESAR2020. During this important year, the SESAR Joint Undertaking planning focused on achieving 5 core objectives that were endorsed by the Administrative Board:

- The preparation of the launch of SESAR 2020 Programme and the first steps of transition;
- The execution of Release 5 under SESAR 1, including components relating to the Pilot Common Project;
- The completion of at least 80% of the SESAR 1 Programme;
- The execution of specific mandates in relation to Data-Communication (VDL/2 Data-Link) and Remotely Piloted Aircraft Systems;
- The update of the European ATM Master Plan (Edition 2015).

Following the call for expressions of interest for the SJU Membership that was launched in 2014 and the selection of 19 candidate members, in 2015 the SJU undertook in-depth preparation of the technical activities to be delivered in SESAR2020. This intensive preparatory work led to the successful definition and adoption by the Administrative Board of the SESAR 2020 Multi-annual Work Programme. The multi-annual programming document serves as the "global work programme of the Joint Undertaking" and details the various operational, technical and transversal activities required to deliver SESAR 2020. This document was developed in parallel with the campaign to update of the European ATM Master Plan and its content is fully aligned with the priorities established in the ATM Master Plan (2015 Edition). The SESAR 2020 Multi-annual Work Programme also formed the basis for the last stage of the membership accession process that was initiated in November 2015 with the publication of the final Call for Membership.

From an administrative point of view, during 2015 the SJU continued to analyse and began to adapt its technical, legal and financial procedures to ensure compliance with Horizon 2020's legal, financial and administrative framework. An intensive training plan was progressively rolled out to ensure that SJU staff involved in the first calls under the Horizon 2020 regime became fully acquainted with the relevant tools and procedures that would be used. Within this context, the SJU successfully met the objective of launching the first two calls for proposals under H2020 (Exploratory Research Call and SESAR2020 Transversal Activities, Industrial Research and Validation and Very Large Demonstrations Call for Wave 1 (full details of call management in 2015 are included in section 1.4).

Despite the planning, training and resource commitment made by the SJU to support the first call under SESAR2020 it proved impossible to award all grants within the 8 months' time to grant target used under H2020. This was due in part to issues with the IT tools, delays in information being transferred from the evaluation to grant preparation for the SJU and significant changes to the provided IT tool configuration, all impacting on the grant preparation timescale. All of these factors were outside of SJU control and equated to around 2 months of delay, where in some cases no advanced warning of change was provided to the SJU.

In parallel, SESAR1 execution continued at full speed during the course of 2015. Following the dissemination of Release 4 results, the delivery process continued with the execution of Release 5 which constitutes the last scheduled release under SESAR1. Significant progress was made in the delivery of Pilot Common Project solutions as well on key concept of operations components like initial 4D, System Wide Information Management and Satellite Based landing technology. The SJU further strengthened its effort to disseminate its results through various forms of media communication (newsletters, website, press articles etc.), in addition to organising and participating in a number of workshops and other dedicated events. Overall, the SESAR 1 Programme continued to deliver its results and the completion rate of the programme reached the 80% target set in the 2015 work programme before the end of 2015. Special attention was also paid to the description, and dependencies between the results, of SESAR 1 (planned to be delivered by the end of 2016) and the corresponding activities of SESAR2020. The objective was to ensure a smooth transition and the handover of the relevant results between the two programmes.

In addition to the execution of its core technical programme, the SJU successfully delivered the work mandated by the European Commission concerning the Remotely Piloted Aircraft Systems (RPAS) Definition phase. Along with the wider Aviation industry, the SJU agreed on several prerequisites for the safe integration of drones into civilian air space. These pre-requisites allowed for the identification of key R&D activities encompassing the areas of detect & avoid, data-link capabilities, security, human factors etc. This allowed for the capture of a first set of RPAS-relevant R&D activities that have been partially reflected in future SESAR 2020 projects within the limits of existing budget constraints. Secondly, a study on defining the ATM research and development needs to ensure adequate coverage of cyber security was also completed in 2015. The study set out the elements needed to introduce a holistic approach to cyber-security and the means of developing a comprehensive response to cyber threats, which included a roadmap for increasing the maturity of cyber-security and cyber-resilience processes within the SJU's research and innovation programme in preparation for SESAR 2020. Finally, work that started in 2014 supporting the European Commission on the datalink issue continued into 2015 with the launch of a dedicated VDL/2 ATN datalink study in February that included an in-flight testing campaign and the finalisation of the VDL/2 datalink capacity study, which delivered its final report in mid-2015.

The campaign for the update of the ATM Master Plan was another highlight of 2015. Launched officially through a kick-off event in December 2014 which set clear and ambitious targets for the process, work continued throughout 2015 and involved Airspace Users, Air Navigation Service Providers, Airports manufacturers and all other major stakeholders (including EC, EUROCONTROL, EASA, EDA, the Network Manager, and the SESAR Deployment Manager). This campaign concluded with the adoption by the SJU Administrative Board of the Master Plan (2015 Edition) at its December 2015 meeting. The conclusion of this work and the formal adoption of the Master Plan was a major achievement for the SJU and for the SESAR project as a whole: having gained further

importance through explicit references in Regulation (EU) No 409/2013[5], the Master Plan is recognised by the aviation community as the *"roadmap driving the modernisation of the European ATM system and connecting SESAR research and development with deployment*". The document further details the link between performance improvement and technology and confirms the role of ATM modernisation in contributing to reaching EU-wide performance targets of the Single European Sky performance scheme. Particular efforts were made as well throughout the campaign to ensure that this new edition of the Master Plan covered the entire lifecycle of SESAR development as well as deployment. A SESAR vision for 2035+ was also developed that set aspirational performance ambitions and a high-level preliminary business view. The campaign also aimed at highlighting R&D priorities under SESAR 2020, focusing on performance delivery and the connection with technology upgrades. The successful outcome of this campaign allows the SJU to ramp up SESAR 2020 within the framework of a sound and robust roadmap with a long-term vision, supported and endorsed by the European ATM community as a whole. It will also facilitate collaboration with the FAA and the NextGen initiative and more generally allow the European point of view to be better articulated on a global level, e.g. through ICAO.

Beyond these key objectives, the SJU continued to run its administrative activities in full compliance with the principles of sound financial management, ensuring that the requirements of legality and regularity of transactions are complied with in full.

The process of assessing the Members' Interim Financial Statements 2014 was performed in 2015. Due to late or incomplete submissions, the SJU was however not in a position to finalise the assessment of the interim financial statements of 2014 for two Members by the end of 2015.

During 2015, fifteen audit exercises were scheduled and several remaining audits from previous reporting periods were finalised. These audits were planned to cover five Members in accordance with the Audit Strategy adopted by the Administrative Board. Twelve of these audits were finalised in 2015, while the remaining three are in the pre-final stage and are expected to be finished in the first quarter of 2016.

Finally regarding its organisation and human resources, the SJU put into operation in 2015 its new organisational structure that reflects its core business objectives through clear accountabilities and staff assignment. In June 2015, the Administration Board authorised through the MSPP 2016-2018 the strengthening of the legal and financial capabilities of the SJU through the recruitment of two additional contractual agents for a 2 year period in order to support the transition from SESAR 1 to SESAR 2020.

In terms of financial management of the SESAR 1 programme, the € 700 Million contribution from the EU to the SESAR development phase under the EU financial framework 2007-2013 has been fully committed and is being used to co-finance the research activities of the SJU's Members and Associates, in addition to supporting flight demonstrations involving airlines, airports, national supervisory authorities and a broad range of other European companies and industries.

The SESAR 1 programme includes SESAR members but also a significant number of other organisations (up to 80) working with the SJU. Among those, there are more than 10 universities from 5 EU Member States and a number of Small-Medium Size Enterprises (SMEs). This means that there is significant diversity in the type and size of organisation that is contributing to and benefiting from the SESAR programme.

[5] EU Regulation 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

Valuable technical elements required for the success of the SESAR programme have been obtained from these activities as well as a number of other direct benefits, including:

- The successful execution of 359 validation activities which have engaged the equivalent of more than 1800 full-time jobs in the aviation industry and has developed a wider network of technical and operational expertise across Member States' ATM industries.
- The delivery of close to 95 industry prototypes has set the new standards for the future evolution of systems both on the ground and in the air.
- The performance of flight trials which address all flight phases and demonstrate the maturity as well as technical and economic validity of a number of SESAR concepts. These flight trials are used to show that investing in new technologies has the potential to provide a return on investment. Performed in real-life environments involving a wide range of operational experts, from airports, air traffic control centres, airlines, and also military, business and general aviation, they have already resulted in increased network performance. For example, between 2012 and 2014, the SJU co-financed a total of 18 Demonstration Activities (amounting to over 30.000 individual flight trials) that demonstrated the readiness of SESAR Solutions for wider scale deployment.
- From an environmental point of view, specific demonstration activities have confirmed that SESAR solutions, once industrialised, can result in significant reductions in CO_2 emissions and noise. These projects were run in collaboration with global partners such as the USA and Canada, under the Atlantic Interoperability Initiative to Reduce Emissions (AIRE). On CO_2 emissions alone, a total of 16,568 flight trials have been conducted involving more than 100 stakeholders. Their results forecast savings ranging from 20 to 1,000 kg fuel per flight (consequently 63 to 3,150 kg of CO_2). More than 8,000 tonnes of fuel and 25,000 tonnes of CO_2 have been already saved during these demonstrations.

The above points show that the execution of SESAR development phase has provided and will continue to provide significant benefits to the European economy and wider society.

Some specific examples of the economic and societal benefits that have resulted from SESAR research activities are outlined below:

- Remote Tower Services to provide access to remote regions and boost regional economies. Sweden has celebrated the entry into operations of the first one early in 2015, and plans the deployment of another 12 remote towers in the next years. Germany has planned for implementation investments, and Ireland and several others have declared their interest.
- The Free Routing concept, enabling more efficient planning and execution of flights and fuel emission reductions, is being implemented in a significant number of Air Traffic Control Centres[6].
- The world's first flight in four dimensions (4D = 3 spatial dimensions + time), to enhance flight predictability and therefore punctuality and efficiency. 4D flying is one of the most promising concepts of the SESAR project, likely to trigger a

[6] At the end of 2014, Free Route Airspace has been partially and/or fully implemented in the following ACCs: Beograd ACC, Brest ACC, Brindisi ACC, Bordeaux ACC, Bucuresti ACC, Chisinau ACC, Karlsruhe UAC, Kobenhavn ACC, Lisboa ACC, London ACC, Ljubljana ACC, Maastricht UAC, Madrid ACC (SAN and ASI sectors), Malmo ACC, Malta ACC, Marseille ACC, Milano ACC, Padova ACC, Praha ACC, Prestwick ACC, Reims ACC, Roma ACC, Shannon ACC, Skopje ACC, Sofia ACC, Stockholm ACC, Tampere ACC, Warsaw ACC, Wien ACC and Zagreb ACC.

paradigm shift in air navigation services provision. It is a key priority under the SESAR 2020 programme.

In 2015 the SESAR SJU reached full maturity, becoming a key contributor toward delivering the Single European Sky and its High-level goals. Its implementation has already provided a return on the original EU investment, generating employment in research and stimulating activity across the entire aviation sector, including within academia. There are already a number of demonstrable benefits delivered, with more than 8,000 Tons of fuel and 25,000 tonnes of CO_2 saved. Building on these initial successes, the Pilot Common Project will deliver by 2030 cumulated net benefits by a total amount of about 8.3 Billion Euros, primarily in terms of fuel savings. The deployment of the SESAR project can generate for the aviation community annual recurring benefits ranging potentially from 8 Billion Euros to 15 Billion Euros per year in 2035 compared to the baseline. Overall, the benefits expected from SESAR for EU economy and society can be described qualitatively in terms of facilitating EU industrial leadership in ATM and aviation, increasing the competitiveness of EU aviation industry, an increase of connectivity and mobility with a lower environmental impact, a significant contribution to EU GDP together with significant job creation, and allowing the elaboration of high-performing standards.

The introduction and transition to SESAR 2020 during 2015 is designed to further secure these benefits as well as building upon and delivering greater benefits and economic advantage for SES and Europe. In terms of financial commitments made towards this aim, the SJU has, under the EU financial framework 2014-2020 (Horizon2020) already committed 20.6MEuro and this is being used to support exploratory research in ATM, engaging a wide range of universities and other research organisations across 28 projects whose grants will be awarded in 2016.

1. IMPLEMENTATION OF THE ANNUAL WORK PROGRAMME 2015

SESAR1 project execution continued on schedule during the course of 2015. Following the dissemination of Release 4 results, the delivery process continued with Release 5, which constitutes the last scheduled release under SESAR1.

During 2015 the SJU also began its transition to SESAR2020 and to launch and execute projects within the framework of SESAR2020. To facilitate this, the SESAR multi-annual work programme was adopted in July 2015. It presented the activities for the period 2016-2019 (and provided a further outlook to 2021). Further, 2 calls for proposals were published under SESAR2020 during 2015 (the 1st SESAR2020 Exploratory Research Call in Q1 2015 and a SESAR2020 Transversal Activities, Industrial Research & Validation and Very Large Demonstrations Call (Wave 1) in Q4 2015). The SJU continues to adapt its procedures to ensure compliance with Horizon 2020's legal framework, fully implementing the required changes for the Exploratory Research call and making significant progress in Industrial Research and Validation.

Additionally, the move to the H2020 environment has necessitated adjustments in organisational structure and ways of working. In particular, as the SJU has continued the transition to H2020 in 2015[7] it has been necessary for SJU to look in detail at the scope of application of the Horizon 2020 Regulation and Rules for participation in relation to the SJU's activities and their applicability to all phases of research, validation & demonstration under the responsibility of the SJU. Analysis was conducted to understand the impact on existing decisions and approved processes and procedures, the implication of changes needed to be undertaken and the order of priorities. SJU staff also started attending H2020 training sessions and also participated in a number of H2020 coordination groups. More details on these activities are outlined in section 1.3.

1.1. Key objectives 2015 and associated risks

1.1.1. Key Objectives During 2015

This section seeks to highlight progress toward completion of the SJU's main objectives in 2015.Outlined in more detail in the table below, these were to progress towards closure and completion of SESAR1, validate the content and deliver the material for the PCP and to ramp up SESAR 2020. To do this the SJU, in conjunction with its Members, continued to deliver progressively mature results for deployment activities so that the improvements in operational, safety, environment and cost efficiency domains delivered by SESAR Solutions would reaffirm ATM stakeholders' intent to adopt and deploy them.

The effective allocation of both staff and financial resources also remained a priority for the SJU during 2015. Efforts were focused on the professional and career development of its staff, in addition to ensuring that allocated financial resources are used in the most economic, efficient and effective way. In 2015, the SJU staff consisted of 42 positions, as per the Multi-Annual Staff Policy Plan 2014 – 2016. Additionally, the 2015 accounts in Annex 10 provide a more complete description of the financial resources expended by the SJU to execute its mandate during the reporting period.

[7] Council Regulation (EU) No 721/2014 amending Regulation (EC) No 219/2007 and the corresponding H2020 legal framework became applicable to SJU's activities in relation to H2020 funding and grants relating to SESAR2020.

The drafting and implementation of the Annual Work Programme 2015 was driven by the SJU medium term vision. Reflecting its mandate, the vision set by the SJU's management for the period 2015/2016 and endorsed by the Administrative Board is as follows:

High Performing Aviation in Europe

The SESAR Joint Undertaking for Research and Innovation is delivering solutions to modernise air traffic management, enabling high-performing aviation in Europe and worldwide.

This vision has been further refined into a number of strategic objectives related to both the closure of SESAR 1 and providing a solid basis for the SESAR 2020 launch. These objectives also serve as stepping stones to delivery of the SJU's overall mandate as defined within the ATM Master Plan.

The table below outlines the objectives for 2015 and provides a description of the results achieved for these headline targets. During the year the SJU continued to provide regular information to the Administrative Board about their implementation and the performance of the Joint Undertaking.

#	*Description of 2015 Objective*	*2015 AWP Target Indicator(s)*	*2015 AWP Target(s) Met?*[8]	*Mitigation?*
1	Execute Release 5 & additional validation exercises related to PCP components in the following ATM functionalities: • Extended Arrival Management & Performance Based Navigation in High Density Manoeuvring Areas; • Airport Integration & Throughput • Flexible Airspace Management & Free Route; • Network Collaborative Management; • Initial System Wide Information Management; • Initial Trajectory Information Sharing.	75% of the total Release 5 exercises to be completed by the end of Q4 2015		30% completed 20% on track 50% re-scheduled to Q1&Q2 2016
2	Launch SESAR 2020 & prepare SESAR 1 handover	Complete Membership Accession Process by Q3 and sign related Membership Agreements by Q4; Complete Exploratory Research grant procedure by Q4; Five S2020 Projects started by end of Q4; Agreed SESAR 1 closure and handover plan by Q1		Final stage of Membership accession moved to Q1 2016, in accordance with the implementation of the relevant ADB decision
3	Update the ATM Master Plan	Master Plan presented to the SJU Administrative Board by Q2; Master Plan approval by Q4		n/a
4	Execute the following specific mandates: • Datalink recovery actions assigned to SJU on time; • Complete RPAS definition phase	Datalink study launched by Q1 2015; 2015 Datalink milestones achieved by the end of Q4; Finalise the work on the Definition Phase of the RPAS integration in the non-segregated airspace by end of Q3		n/a
5	Actual completion of the SESAR1 Programme	Complete 80% of the last approved baseline for the full programme by the end of Q4		n/a

[8] from the presentation on the status of the SESAR1 Programme given at the ADB meeting in December 2015.

1.1.2. Operational Risks, Mitigation and Prevention:

Within the context of the overall internal control framework outlined in section 4.7, throughout 2015 the SJU reviewed, managed and mitigated corporate and R & D risks through the adoption of a multi-faceted approach. This comprised regular and detailed discussions at management level, the setup of a corporate risk register and dedicated action plans and mitigation measures designed to address identified risks.

A risk should be considered significant and reported in the Annual Activity Report if it falls within one of the following impact categories:

- jeopardises the achievement of strategic goals or effective implementation of the mandate of SJU;
- causes serious damage to SJU's stakeholders or partners;
- results in critical intervention at political level (e.g. Council/Parliament) regarding the SJU'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.

As part of the overall risk framework, SJU undertakes an annual risk review exercise covering the JU's operational and administrative activity areas with the aim of identifying possible critical risks, assessing their likelihood and impact on SJU's operations and objectives and determining the response in order to mitigate/reduce/eliminate them to the extent feasible.

In May 2015, the management team formally reviewed the entire risk register composed of 31 risks and 83 related mitigation actions. The risks which were considered to have both a high probability of occurrence and a potential significant impact on the Joint Undertaking achieving its objectives as well as impacting Master Plan execution were identified and mitigation actions were initiated. In addition, a broader review of the risks and actions related to the MP execution has been made with the contribution of all stakeholders in the context of the Master Plan update campaign.

REF	*Risk Description*	*Type of Risk*	*Criticality (x/10) [May 2015]*	*Risk Owner?*	*Summary of Mitigation/Response Actions in 2015*
RD02	The R&D Programme does not deliver solutions that are ready for the preparation of deployment	ATM Master Plan execution	6	SJU	-Ensure consistency between the expectations outlined in the ATM Master Plan and the delivery of SESAR solutions in time and scope. -Deliver and publish SESAR Solutions Packs to prepare for the deployment of first SESAR R&D results.
RD03	Ineffective bridging between development and deployment activities may put industrialisation at risk and delay deployment	ATM Master Plan execution	6	EC, SJU, SDM, Standardisation Bodies	-Launch first wave of SESAR Very Large Scale Demonstration activities to bridge R5D with Deployment in the context of SESAR 2020. -Strengthen cooperation arrangements with Standardisation bodies to ensure alignment of their respective work programmes with the needs identified in the ATM Master Plan. -Strengthen current engagement of the regulatory authorities in the development phase to prepare for deployment.

REF	*Risk Description*	*Type of Risk*	*Criticality (x/10) [May 2015]*	*Risk Owner?*	*Summary of Mitigation/Response Actions in 2015*
RD18	The transition from SESAR 1 to SESAR 2020 causes delays and discontinuation of R&D activities.	ATM Master Plan execution	6	SJU	-Implementation of the DMS project. -Ensure a good transition plan from SESAR 1 to SESAR 2020 in order to guarantee the seamless continuation of all activities required for the modernisation of European ATM. -Ensure the adequate documentation of all relevant R&D output and the identification and storage of all results, necessary to ensure continuity of ATM Research and Development and deployment planning activities supporting the execution of the ATM Master Plan.
WSS02	Governance Structure is not capable of ensuring successful Deployment	ATM Master Plan execution	6	EC, SDM, SJU, All Stakeholders	-Define and implement an appropriate Deployment Governance mechanism and efficient interaction of all parties involved in order to ensure an effective execution of the Deployment Programme consistently with the ATM Master Plan and the Network Strategy Plan. -Governance has to ensure that the required resources are available for the timely local and synchronised deployment.
WSS05	Failure to manage Human Performance (Human Factors, Competency and Change Management) issues in the development and implementation of the ATM Target Concept	ATM Master Plan execution	6	SJU, All Stakeholders	-Ensure that operational staffs are included in development and validation activities. -Issue regular recommendations and activity plans for Human Performance in the area of R&D, regulation, standards, and management at industry level. -Monitor all SESAR oriented R&D and validation phases regarding Human Performance standards, methods and requirements. -Examine staff implications of all deployment activities for all groups of operational aviation staff and publish results and related recommendations. -Ensure appropriate coordination between all stakeholders concerned to ensure consistency between initiatives related to Human Factors, Competency and Social Dialogue.
WSS06	Delays in the implementation of the Pilot Common Project (PCP)	ATM Master Plan execution	6	EC, SDM, All Stakeholders	- Coordinate deployment to ensure timely and synchronized deployment of the PCP. -Synchronisation and coordination by SDM. -Ensure a strong promotion of the Deployment Programme. -Identify, stabilise and ensure implementation of elements that are prerequisite for SESAR deployment and/or essential for contributing to the performance ambition. -Implement the pre-SESAR changes and the PCP precursors according to Stakeholder roadmaps.

REF	*Risk Description*	*Type of Risk*	*Criticality (x/10) [May 2015]*	*Risk Owner?*	*Summary of Mitigation/Response Actions in 2015*
WSS12	Interoperability and global harmonisation are not ensured	ATM Master Plan execution	6	EC, SJU	-Work towards global interoperability in the framework of ICAO working arrangements. -Continue to strengthen SESAR/NextGen coordination under the EU/US MoC with a particular focus on securing further alignment between the ATM Master Plan and the NextGen Implementation Plan.
WSS16	Deployment of SESAR Solutions leads to unaddressed cyber-security vulnerabilities	ATM Master Plan execution	New	EC,SJU	-Ensure efforts on ATM cyber-security are coordinated, and assess policy options for strengthening cyber-security and resilience. -Establish principles and processes for ensuring cyber-security and resilience appropriately within the work programme.
WSS17	Investments to support deployment beyond 2020 is not secured	ATM Master Plan execution	New	EC,SJU, SDM	-Prepare for the deployment of SESAR R&D results (business cases, impact assessments, future Common projects when appropriate). -Ensure that financial and operational incentive mechanism are defined and implemented in a timely manner in order to facilitate the deployment of SESAR. -Ensure consistency between the stakeholder's roadmaps in the ATM Master Plan and stakeholders' investment plans.
ADM02	Lack of available required competences due to key staff turnover and/or inability to attract skilled resources or inability to offer compelling career development perspectives	ADM	9	SJU	-Develop the workplace to include facilities and procedures.
ADM03	Large amount of both external and internal upcoming changes affects effectiveness and quality of the work performed	ADM	9	SJU	-Appropriate change/transformation management framework and processes within SJU to ensure a smooth transition to H2020; -Support of external contracts identifying change path and priorities.

1.2. Research & Innovation activities

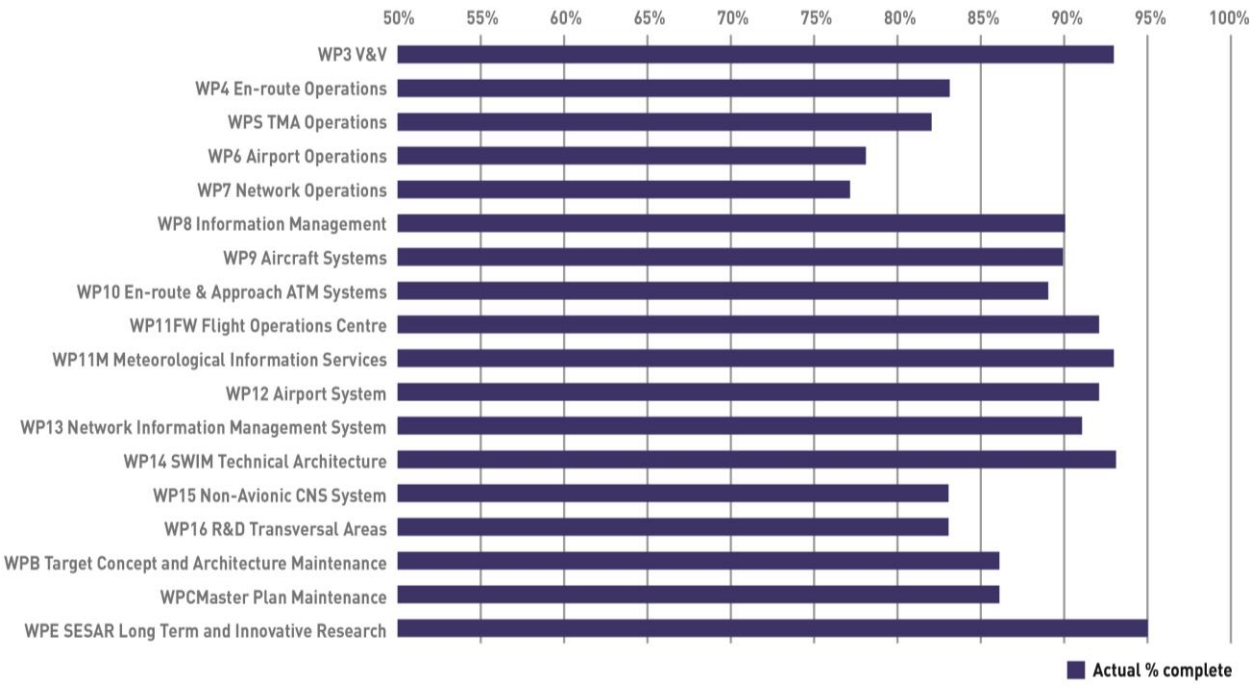
1.2.1. Evolution of SESAR1 Work Packages during 2015

In order to ensure the adequate functioning and supervision of activities, the work breakdown structure of SESAR1 constitutes a number of work packages that provide the framework for the effective delivery of SESAR1. These work packages are broadly split into four separate elements:

- Operational considerations (addressed under work packages 4, 5, 6 and 7)
- System considerations (addressed within work packages 9, 10, 11, 12, 13 and 15);
- System Wide Information Management (SWIM) considerations (addressed under WPs 8 and 14);
- 'Transversal' activities, such as validation infrastructure, development of safety, security, environment and human performance cases, European ATM Master Plan etc. are covered under a number of other work packages (B, C, 3 and 16);
- Exploratory Research (WPE).

The graph below provides an update of the status of the implementation of each work package as of 31 December 2015. Activity within each of the work packages is regularly monitored against plan and reported into the SJU's formal governance structures, notably the Programme Committee, which provides oversight of SESAR1 in terms of progress, risks and issues, and provides timely and appropriate corrective action as required.

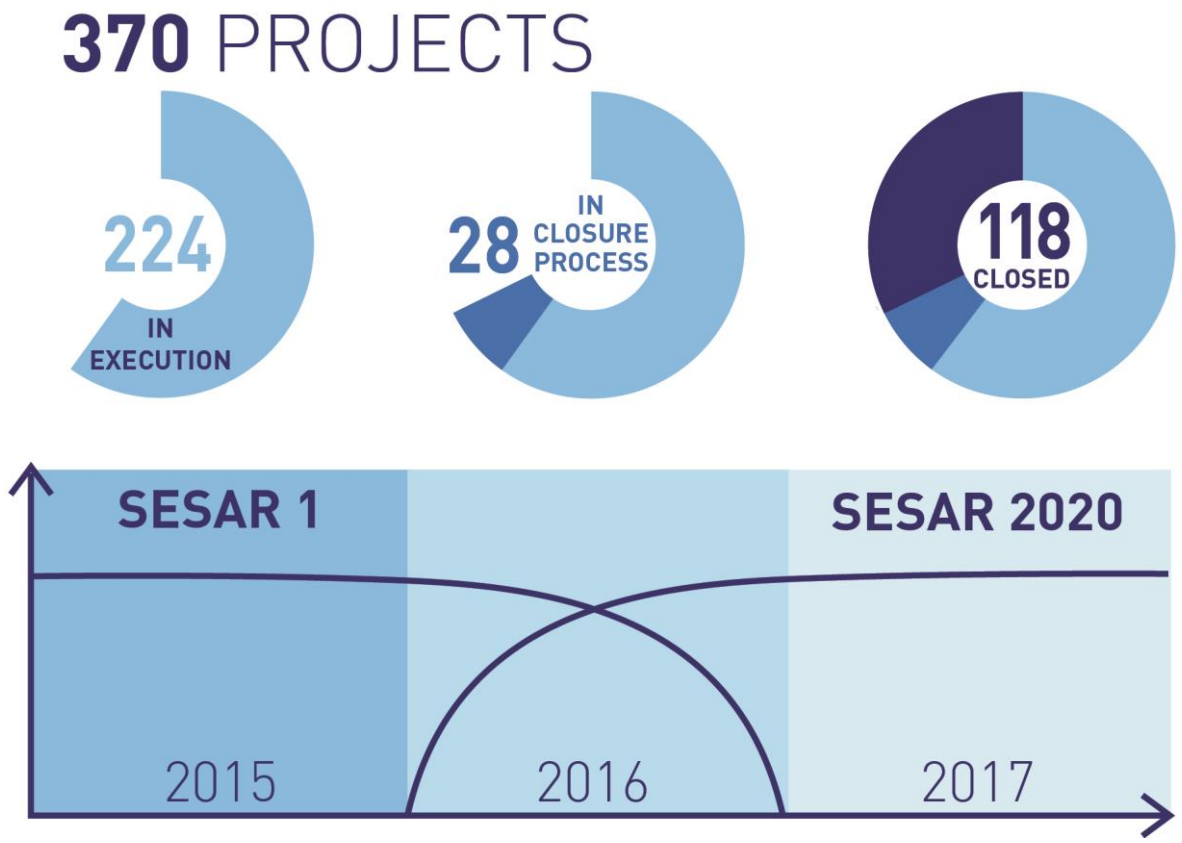
SESAR1 Activity Completion per Work as of 31 December 2015



It must be noted that, at Programme level, the 80% completion target by the end of 2015 was reached, with a completion rate of 86% achieved in December 2015. Annex 6 provides a more detailed update of the scope and progress of each SESAR1 work package during the course of 2015.

1.2.2. Closure status of SESAR1 Work Packages by end 2015

Of the 370 projects awarded under SESAR 1 all must close by December 31 2016. This closure plan is being actively managed by a plan agreed with the SJU Programme Committee and its status regularly reported upon to ensure any risks are managed appropriately. The status at the end of 2015 for project closure is shown in the diagram below:



1.2.3. Demonstration Activities in 2015:

There were 15 SESAR large scale demonstration (LSD) activities ongoing during the course of 2015. The following table summarises the LSD activity that took place during the reporting period:

PROJECT NAME	*LOCATION*	*LSD ACTIVITY IN 2015*
iStream	 France Switzerland	Further to the project kick-off in October 2014, a number of actions were taken in early 2015 to strengthen the project management on iStream. The team participated in the elaboration of the target time management concept in the wider SESAR programme. Live trials at Zurich – addressing an improved arrival sequence for the peak period after the night curfew – are under way. The development of tools (notably iAMAN) and platforms is progressing for the Paris arrivals part of the project; with a view to have live trials in 2016. The project closure meeting is planned for 30 November 2016.
EVA (Electronic Visibility via ADS-B)	 United Kingdom	The demonstration exercises are taking place in the four real world scenarios for GA flight operations within the vicinity of a small UK airport, medium UK airport, UK cross country and medium airport within Continental Europe. The Low Powered ADS-B Transceiver (LPAT) prototypes have been successfully verified in ground and flight tests, noting that LPAT provides the minimum functionality needed to see and be seen by other traffic. So far the project has achieved CAA's approval for the flight test procedures to execute the trials. The LPAT verification trials are complete and the Project has commenced concept validation flights. The Traffic Awareness Beacon System (TABS) & Traffic Situational Awareness with Alerts System (TSAA) devices are ready for installation, pending the regulatory process for installation. These allow the pilot to receive audio alerts about the traffic in their vicinity via ADS-B in. Additionally, the UK CAA has developed a mature draft of the technical standard for portable, low power, non-transponding Electronic Conspicuity devices. This standard will enable devices such as LPAT to be marketed within the UK.

PROJECT NAME	*LOCATION*	*LSD ACTIVITY IN 2015*
Augmented Approaches to Land (AAL):	 Switzerland, Czech Republic & France	The project spent 2015 planning their demonstration activities and started executing flight trials with both experimental aircraft and revenue flights at the end of the year in Switzerland, Czech Republic and France. The trials focused on advanced approach procedures enabled by SBAS and GBAS, precision approaches supported by Synthetic Vision Guidance System (SVGS) and Enhanced Flight Vision System (EFVS) as well as enhanced flight planning and advanced information for airspace users without flight operations centre.
European Connected Regional Airports (ECRA):	 France	The project spent 2015 planning their demonstration activities at Bordeaux airport, France. In particular, the E-CRA Consortium Members developed scenarios allowing them to test different operational situations during the demonstrations. They also adapted their airport operations management gaming platform to the Project needs and they integrated it with the operational systems at the airport.
Remote Airport Concept of Operation (RACOON):	 Italy	The project spent 2015 planning their demonstration activities at Milan Malpensa and Linate airports, Italy. A lot of effort was spent on planning and executing a real time simulation of the remote tower procedures and system in order to prepare 2016's flight trials. The technical developments in order to design develop and integrate the remote tower systems were the other main activity in the project.
Remote Towers:	 Ireland	The project spent 2015 planning their demonstration activities at Dublin, Cork and Shannon airports, Ireland. Most of the effort was spent on refining the different exercises to be performed, preparing the safety assessment and designing, developing and integrating the remote tower systems
Remote Tower Operations (RTO):	 Sweden, Germany & The Netherlands	The project spent 2015 planning their demonstration activities in Sweden, Germany and The Netherlands. Demonstration flight trials with revenue flights were successfully executed in Sweden, showing positive initial results on the performance of remote tower operations for a single low density aerodrome and providing valuable inputs to the German and Dutch parts of the projects.
Free solutions	 Italy, Malta, France, Germany	The project aimed at demonstrating that direct routes and initial free routing operations are possible in Europe helping to reduce flight time, congestion and positively impacting on the environment.
ODP	 FABEC	The project aimed at demonstrating that designing and validating cross-border arrival management procedures using Optimised and Continuous Descent Operations (CDO). In 2015, all work packages have been launched and initial results available are the Aircraft Profiles Studies Report, the CDO procedures catalogue and the Safety Plan.

PROJECT NAME	LOCATION	LSD ACTIVITY IN 2015
PEGASE	 Western Europe	The project aimed at analysing the performance of Extended Projected Profile (EPP) information from multiple live trials involving aircrafts equipped with prototype of the next generation flight management system (FMS) and data link communication systems. So far, 11 ferry flights have been performed and 9 flights on MSN 1 development aircraft have been performed. On all flights EPP has been valid 76.32% of the time.
Budapest 2.0	 Hungary	The project aimed at showing that SESAR solutions can improve operational efficiency at small and medium sized airports. In particular the design and the preparation for Remote Tower operations in Budapest airport have been finalised, as well as the design of new CDO procedures and enhancement tool, and the design of RNP based operations.
PROuD	 Switzerland, Norway	The project aimed at demonstrating how the use of satellite-based procedures can enhance helicopters operations, particularly for search and rescue and medical emergencies in Europe. RNP-APCH PinS approach with LPV minima and PinS departure operations have been designed and validated as effective solution to overcome existing limitations in terms of safety and accessibility to challenging areas such as Swiss airports (Samedan and Church) and Norvegian Heliports (Lorenskog and Olso Ulleval).
RISE	 France, Portugal, Greece & Cyprus	The project aimed at validating several PBN/RNP (Performance Based Navigation/Required Navigation Performance) procedures on ten European small and medium-sized airports. All preparatory activities (i.e. before the first trial) have been performed for all airports.
Toplink L1	 France, Austria, Belgium, Croatia, Germany, Finland	The project aims at demonstrating the benefits of the deployment of System Wide Information Management (SWIM) based services, including MET, aeronautical, network and flight information services
Toplink L2	 France, Austria, Belgium, Croatia, Germany, Finland	The project aims at conducting a total of 130 flight trials to demonstrate cost innovative solutions for the provision to general aviation users of network business to business information services, including MET services, air traffic control and aeronautical information management services.

In addition to the above, seven of nine Remotely Piloted Aircraft Systems (RPAS) demonstration projects were concluded during the course of 2015 (two projects were extended to 2016 due to unforeseen tasks related to regulatory changes). These projects were designed to capture best practice, experience and data through RPAS demonstration activities and the relevant outcomes and recommendations will help shape SESAR 2020 activities on RPAS.

PROJECT NAME	*PROJECT STATUS AS OF 31/12/2015*
DEMORPAS – Demonstration Activities for Integration of RPAS in SESAR	Project completed in December 2015. DEMORPAS followed a stepwise approach during two different live trial exercises in order to progressively increase the complexity of the demonstration. This demonstration project, executed in Spain, aimed at demonstrating how to integrate RPAS into non-segregated airspace (manned and unmanned multi-aircraft flight environment), carrying out both operational and emergency scenarios.
INSuRE - RPAS Integration into non-segregated ATM	Project completed in December 2015. Real time simulations and live trials were conducted on a RPAS piloted from a fixed station on the ground using CPDLC, ADS-B and TCAS technology to assess technological and operational procedures. One airport in the Czech Republican was simulated and the live trials were carried out in Italy.
RAID – RPAS ATM Integration Demonstration	Extended until April 2016. RAID project covers real time simulations and live trials initially planned for Malta. During 2015 for several reasons the trial location was changed to Italy. The project already conducted and disseminated via a workshop the simulations results. Live trials to be performed in March 2016.
MedALE - Mediterranean ATM Live Exercise	Project completed in September 2015. MedALE consisted of real time simulations and live trials considering different levels of complexity. For the RTS a multi RPAS interaction / operation within the ATM environment, including Beyond Radio Line of Sight (BRLOS) operations was conducted and for the live trial a single RPAS was performed in a surrogated non-segregated airspace in Italy.
TEMPAERIS - Testing Emergency Procedures in Approach and En Route Integration Simulation	Project completed in October 2015. TEMPAERIS consisted of real time simulations and live trials in Bordeaux-Mérignac airport. For the simulations the main objective was to evaluate whether current ATC operational procedures are applicable both in nominal and non-nominal modes; for the live trial to demonstrate that RPAS can be interfaced with standard civil ATC and be processed as other commercial aircraft by civil operator and test the acceptance by ATC of current RPAS procedures.
ODREA – Operational Demonstration of RPAS in European Airspace	Project completed in June 2015. The project covered fast time simulations to validate the behaviour and performance of the detect and avoid algorithms, real time simulations to assist in the definition and validation of the operational procedures managing RPAS with representative controlled traffic, and live trials to demonstrate that RPAS can be interfaced with standard civil ATC and exchange data to be managed as any other commercial aircraft by civil operators. The flight demonstrations have included non-segregated operations from and back from Muret-Lherm, insertions in the traffic of Toulouse-Blagnac, as well as assessments of Detect & Avoid (D&A) technology and Command & Control (C2) lost link procedures.
CLAIRE - CiviL Airspace Integration of RPAS in Europe	Project completed in December 2015. CLAIRE consisted of simulation exercises exploring integration challenges at the airfield and in the TMA; and live trials from West Wales Airport in civil controlled airspace using normal ATM operating procedures made possible by the development of a comprehensive Safety Case.
AIRICA - ATM Innovative RPAS Integration for Coastguard Applications	Project completed in December 2015. AIRICA consisted of a live trial for coastguard activities in non-segregated airspace to set up The AIRICA demonstrations have been set up to demonstrate on-board Detect and Avoid capability, the connection with ATC and the simultaneous Non-Interfering (SNI) Approach procedures.
ARIADNA - Activities on RPAS Integration Assistance and Demonstration for operations in Non-segregated Airspace	Project extended until March 2016. The project covers live trials and simulations using a satellite-based augmentation system (SBAS) approach and landing at an aerodrome; and concepts for RPAS Ground-Based Situational Awareness System (GBSAS).

In addition, in 2015 the SJU also continued to assist its stakeholders on a number of areas relating to the contribution of the SES technological pillar in other areas of the Single European Sky initiative. This included continued technical assistance to SESAR policy makers on specific tasks such as the Datalink initiative, cyber-security, RPAS and SPI, details of which are outlined below.

1.2.4. Remotely Piloted Aircraft Systems (RPAS):

1.2.4.1. Results from the RPAS Demonstration projects in 2015

Listed in section 1.2.3 above and established as a preliminary fact-finding initiative, in 2013 the SJU selected nine RPAS SESAR Demonstration Activities for co-financing (50%), with a budget of EUR 4.2 million over a two year period. These activities brought together operators, manufacturers, air navigation service providers (ANSP) and regulatory authorities in order to assess the feasibility of RPAS integration in non-segregated airspace. By the end of 2015 seven out of the nine projects had completed their activities, providing valuable conclusions and recommendations to inform future R&D activities in SESAR 2020. Complete public reports will be made available on the SJU website (www.sesar.eu) as soon as they become available.

The main aim of the demonstrations was to see what level of RPAS demonstration and operation was possible to achieve using available technology within the current regulatory and operating environment. Such demonstrations would be used to highlight areas where additional research and development would be needed, as well as providing valuable insight into the practical difficulties of flying this new and potentially disruptive technology.

Overall, apart from lower than expected performance of some RPAS types, these projects registered no significant difference in the behaviour of RPAS compared to small general aviation aircraft when operating in the air traffic control (ATC) environment. However, the projects did identify several technical, operational, safety and security matters that need to be addressed before integration could be considered, specifically:

- A harmonised and well-established civil certification system by the required certification authorities;
- policies and procedures on how ATC should interact with RPAS to ensure efficient operations and to meet safety-level requirements;
- specific training and licensing for RPAS pilots; and
- a detect & avoid (D&A) capability and compliance with European aircraft equipage requirements.

The main conclusions and recommendations from the seven projects completed in 2015 are presented below:

Executing trials and obtaining authorisation

Demonstrations are an effective mechanism to increase stakeholder awareness and to gain the trust and buy-in of aviation authorities. However, the current process for obtaining the necessary approval from the authorities is burdensome and time-consuming. One recommendation would be to define national-specific RPAS test flight zones with simplified procedures to obtain flight permits. To ensure legal compliance, an initial package for small RPAS could be defined, comprising a simple and efficient navigation system, a permanent positon reporting system and geo-fencing capabilities.

For test areas, segregation is a prerequisite until a suitable D&A system is available and accepted by the authorities. The use of temporary danger areas to protect uncontrolled airspace is not sustainable for routine operations since this approach does not meet the principles of equivalence and transparency.

For live trials, RPAS pilot-to-pilot communications (in case of VLOS or E-VLOS operations, foreseeing a safety pilot and a pilot in command) could, in some cases, be briefly performed using the operational frequency to communicate short messages to the tower about repetitive activities, without congesting the voice link. This approach would be dependent on the intensity of operations at the test site.

Another important challenge is to insure these systems effectively since insurance rates are currently significantly higher than manned aviation and thus may hamper the business case for RPAS operations. As RPAS operations become more common and the safety and security risks identified are addressed, there is an expectation that the cost of insurance should significantly diminish.

Adapting ATC and airspace procedures

It has become clear that although RPAS could be operated much like conventional aircraft from an ATC perspective, their variety in size and performance means that there would be a need to define new RPAS-specific procedures. These could be published and shared as per conventional equivalent procedures.

All actors should have a high situational awareness at all times, so procedures on how to share information and how to proceed in non-nominal conditions should be researched and published and any standardisation requirements should be incorporated. RPAS missions are likely to vary widely in nature, so research is required into the best method of defining mission profiles to enable smooth management and execution of each mission. Specific procedures should cover the launch and recovery methods for aerodromes and different procedures for emergency and/or non-nominal conditions for all RPAS typologies. Existing separation standards may also need to be reviewed and potentially altered.

Regarding aerodrome access, RPAS operating characteristics should be compatible with the aerodrome in question in order to maintain runway capacity at realistic levels. High-performance RPAS operations could be integrated into busier medium-sized airports, while lower performance RPAS could be operated from aerodromes with lower traffic levels or with traffic operating at similar speeds. Alternatively, it may be possible to maintain airport throughput by new RPAS-specific procedures.

Detect and avoid (D&A)

A 'detect and avoid' (D&A) system is essential to allow RPAS integration in non-controlled, non-segregated airspace to ensure collision avoidance. Continuing research into this important topic is essential to cover both collision avoidance and traffic avoidance.

Recommendations for the implementation of D&A are as follows:

- Relying only on ADS-B data could be sufficient in cases when all aircraft were equipped, and the underlying ATM operating environment allowed it, however additional primary radar data could also be used to provide increased traffic information if not all systems were cooperative;
- There is a need for appropriate electro-optical technology (ex: HD cameras + communication architecture) to secure the use of procedures currently dependent on the human eye, such as the "line-up behind and hold" procedure and also the "see and avoid" capability;
- Future work to define and standardise a D&A automatic capability for RPAS is considered the key for real integration of RPAS in ATM.

Spectrum, C2 requirements, datalink

For the more technical aspects required for ensuring safety, several needs in terms of definition and possible standardisation were identified. Contingency procedures for radio failure, C2 loss, GPS failure, and emergency landing should be investigated and possibly standardised and made homogeneous at the ICAO level.

To allow for the loss of control links between the pilot and the RPAS, some form of backup communication is considered desirable, possibly based upon ground or mobile telecoms infrastructure. It is also recommended to produce procedures and to train the RPAS team and pilot in command on those procedures associated with emergency at the operational site, specifically on:

- Expected reaction time;
- Expected communication and responses between the involved actors; and
- The method of providing back-up communications in the event of a communication link failure.

The lack of available spectrum and frequencies for civil operations use was also identified as an ongoing issue. The exploitation of different existing link technologies, or the development new RPAS-specific links (e.g. C-band) may be instrumental to allow the use of larger RPAS and this should be researched

further. For projects to have adequate C2 frequencies for more than one RPA flying at the same time in the same volume implies additional electromagnetic compatibility studies (additional trials, certification, and new equipment) as there is currently no implementation of dedicated RPAS C2 bands.

Air vehicle performance issues

The lower performance of RPAS could result in an increase in en-route and TMA ATCO workload as a result of lower speeds and different climb/descent/turn profiles. The practice of blocking out large altitude bands of airspace for a manned aircraft to enable RPAS to climb or descend could result in non-optimised trajectories for other airspace users. Standardised methods must be established for how to pass RPAS performance characteristics and mission information to the Network Manager and to ATCOs and procedures and mitigations need to be devised.

Sometimes specific performance (like the ability to do steeper descents) can be of benefit so RPAS should not necessarily follow all the RNAV trajectories for manned aircraft; specific new RPAS procedures could be designed to take advantage of different operating characteristics.

Remote pilot considerations

Suitable qualification for the RPAS pilots is needed in order to achieve live unmanned flight in non-segregated airspace. The qualification and licensing requirements for RPAS pilots should be researched including pilot/controller phraseology to include additional terminology to reflect unique RPAS conditions, such as for example the loss of C2 link and the concept of lost link routes. Trials have shown, based mainly on pilot feedback, that piloting two RPAS at the same time in a crowded environment could be very demanding for an RPAS pilot and so research is needed into the feasibility of allowing one remote pilot to control more than one RPAS at the same time.

Future research

A research and development roadmap that is line with regulatory activities and SESAR solutions for small RPAS flying in very low level (VLL) should be prioritised. In particular, the projects recommend the following to be used in demonstrations:

- Multiple RPAS demonstrations to extend the RPAS traffic and to validate the operational procedures related to their control and to the coordination with more than one RPAS pilot;
- demonstrations to have larger European scope covering hand-over of control (between different control stations and ATC agencies) for extending the mission areas beyond the data link and area limits;
- SWIM services for the ground-ground exchange of RPAS information to be implemented and validated for RPAS to share data with ATC and other airspace users;
- demonstrations should focus not only on the systems that are working in normal conditions, but address the emergency and contingency scenarios, verifying if the recovery system and emergency procedures are correctly working and compatible with ATM.

1.2.4.2. EU RPAS Roadmap

The EU RPAS Roadmap, handed over by the RPAS stakeholders to the European Commission in 2013, outlined a roadmap for the safe integration of RPAS into non-segregated ATM environments in Europe. Since not all the key technologies required for RPAS to fly in non-segregated ATM environments are currently standardised and mature, the need for further Research and Development was identified in the SJU internal initiative called the RPAS Definition Phase.

Approved by the Commission, the R&D needs identified can be summarised as follows:

- The balanced integration of RPAS activities into the scope of the SESAR 2020 work programme (with a budgetary ceiling of EUR 40 million);
- to consider the enlargement of the scope of Exploratory Research and Very Large Scale Demonstrations to RPAS;

- to assess possible mitigation actions to ensure that all R&D RPAS activities of the Definition Phase can be covered including the support to smaller actors and;
- to fully exploit all the potential synergies with other RPAS R&D programmes such as the ones managed by EDA, ESA, EMSA and JRC.

In addition to the RPAS Definition Phase and related work described above, an overall RPAS framework and supporting role of ATM (regulatory and service provision framework) upon which to satisfy the future operations in the European Aviation System is also needed. This framework must be captured and properly reflected in the European ATM Master Plan in order to implement the required top-down research and development activities. This requirement was addressed through a dedicated study so-called "Drones Outlook Study" that kicked-off in early December 2015 (and is scheduled to be completed by June 2016), which will cover 3 main areas:

- the establishment of the RPAS prospects for RPAS integration into non-segregated airspace and to further develop an understanding of the RPAS value chain. The understanding of high level strategic and business objectives will be translated into categories of operations, typology of trajectories and various high level requirements to access the European Airspace;
- undertake a gap analysis between the R&D Roadmap and the approach for SESAR 2020 in order to establish formal links between SESAR and other on-going activities (such as those managed by EDA, ESA, EMSA, EASA and JRC) or to identify clear needs for additional budget and;
- update the RPAS Roadmap, similar to the ones existing for other enablers (e.g. Surveillance or Communication) that would provide elements to update the existing EU RPAS Roadmap and subsequently either complement or supplement it.

It is intended that the "Drones Outlook Study" will form the basis for the proper coverage of RPAS activities in the European ATM Master Plan (detailing "why we need to act", "what needs to be done" and "when" - including closing gaps, exploring synergies with other programmes and providing linkages with the outcomes of the RPAS definition phase etc.)

1.2.5. Cyber-Security

The future European ATM System must be secure and resilient in order to support EU goals of modernisation of the ATM sector in line with the growth projections in European air traffic. In 2015 the focus continued to be on creating an effective security shield in a SWIM-enabled environment with critical infrastructure requiring the adoption of cyber-security management, enabled to secure information and protect ATM against cyber-threats.

Technical responses to cyber-threats are already being addressed within SESAR1 for the most critical components as part of the SESAR Solutions. However, to be fully effective, cyber-response schemes also have to be considered as part of the overall future ATM System of Systems architecture. In order to address this need and introduce a more comprehensive approach to cyber-security, a "SESAR Strategy and Management framework study for Information Cyber-Security" was delivered in mid-2015. This details a holistic approach to ATM information cybersecurity that takes into consideration guiding frameworks, the experience of industry actors, leading edge consultancies and the cybersecurity strategy of the European Union.

The results of the study are being applied to support the SESAR 2020 Programme (in particular SWIM) and could provide the foundation of a cybersecurity strategy aiming at adequately managing information cyber-security aspects in new ATM systems. This strategy should be seen as a major contributor to the effective deployment of new ATM systems and to their interoperability.

However, though mainly focusing on SWIM, its scope must be extended to all ATM technological enablers (e.g. GNSS). Moreover, while cybersecurity is essential to ATM, it has to be integrated consistently into the aviation security framework as a whole. Furthermore, cybersecurity is inherently a cross sector domain and therefore aviation cybersecurity should also be linked to broader national and European cyber-security institutional and regulatory frameworks, such as for example the EASA initiative for an EU Aviation Cybersecurity Roadmap.

1.2.6. Datalink

The Commission Regulation that stipulated requirements for data link services (DLS) for the Single European Sky entered into force in February 2009. This Regulation lays down the requirements for the coordinated introduction of DLS based on air-ground point-to-point data communications. Following some performance issues concerning the VDL/2 link and a subsequent EASA investigation into the issue, the Commission asked SJU to progress the first steps of the 10-point action plan that resulted from the investigation. During 2015 the SJU made progress with this work, in particular with the launch of the VDL/2 ATN datalink study (ELSA) in February and the finalisation of the VDL/2 datalink capacity study, which delivered its final report. A datalink advisory group was established in Q3 2015 to provide a forum for the SJU to share results and agree required actions on the subject of datalink with the Commission, EASA, SDM and Eurocontrol.

1.2.7. Surveillance Performance and Interoperability (SPI)

The SJU supported the EC in organising a stakeholder workshop in April 2015 concerning the Surveillance Performance and Interoperability (SPI) Implementing Rule. Subsequent to this workshop, EASA has been tasked with developing a revised regulatory proposal that includes the need for a wider set of aircraft to carry an ADS-B capable transponder. The SJU has supported informal discussions with EASA on the way forward for the SPI regulation including the identification of issues to be addressed by any revised SPI regulation.

1.2.8. The European ATM Master Plan

2015 was a crucial year for the campaign for the update of the Master Plan. The twelve month campaign was initiated officially with a kick-off event on 16 December 2014 and ended on 15 December 2015 with the approval of the 2015 Edition of the European ATM Master Plan by the SESAR JU Administrative Board.

When approving the Edition 2015 of the Master Plan in December, the SJU Administrative Board simultaneously approved its three (fully aligned and coherent) levels: Level 1, the Executive Level, submitted for Board approval following the establishment of each Member's formal position; Level 2, the planning level materialised by Dataset 14 (in which all Operational Improvements and Enablers had been aligned with the content of Level 1) and Level 3, the implementation level, also known as the "ESSIP Plan", which was further aligned with the components of the Pilot Common Project and the mature elements identified in Levels 1 and 2.

The SJU drove the MP update delivery through the leadership of the "Campaign Steering Group" (new compared to previous campaign) with SJU Programme Committee and SPP representatives, established to steer activities from a "top-down perspective" against expectations, ensuring stakeholders' engagement with the overall objective to "de-risk" the outcomes for the broader ATM community to the greatest extent possible. In addition, the Campaign Steering Group monitored that the Master Planning Group draft output goes in the direction of the expected results and ensure the implementation of the Tiger Team recommendations for Edition 2015.

The supporting Master Planning Group (MPG) was kept, where experts from Eurocontrol and all other stakeholders formulated the structure and oversaw the drafting of the Level 1 of the Master Plan. Within the context of 'Work Package C', the SJU also prepared the relevant standardisation and regulatory roadmaps for the update campaign as well as defining the principles for financial incentives in order to ensure relevant technology could be deployed in timely and structured manner.

Beyond this exceptional campaign which was one of the success milestones of 2015, the SJU also carried out its yearly task of maintaining Levels 2 and 3 of the Master Plan. These tasks were fully coordinated with the campaign to update Level 1, which, as described above, allowed for the simultaneous approval by the SJU Administrative Board of all three levels on 15 December 2015.

The campaign has allowed SJU to successfully ramp up SESAR 2020 with a long-term vision but also short term implementation objectives which are supported and endorsed by the European ATM community

as a whole. This development will also facilitate collaboration with the FAA and the NextGen initiative and more generally allow the European point of view to be more clearly articulated at a global level, e.g. through ICAO.

Some of the most important tasks in 2016 and beyond will now be to ensure the continued coherence between all three levels of the Master Plan, through the setting up of an ongoing Master Plan governance structure, which will take the form of a Master Planning Committee. This Committee, chaired by SJU, will bring together all key ATM stakeholders to advise the Executive Director and the Board to ensure coherent, timely, effective and efficient implementation of the Master Plan. This will imply, inter alia, monitoring and controlling any "significant modification" at Level 2 that may impact Level 1, which should be brought at Board level for review and decision. It will also be important to strengthen relationships with the Deployment Programme and the reporting structures of the SESAR Deployment Manager.

1.3. SESAR 2020 Preparation in 2015

In 2015 the focus of the organisation was on both the timely closure of SESAR1 and enabling the successful ramp-up of SESAR 2020. Under this programme the SJU will continue to be responsible for managing research and innovation delivered by its renewed membership, in addition to managing open calls for proposals, all under Horizon 2020 rules. In terms of programme delivery, it is envisaged that SESAR2020 will build further upon the work undertaken in SESAR1 and concentrate its effort around the key features outlined within the European ATM Master Plan (2015 edition).

As stated above, SESAR1 will conclude with Release 5. Assessments concerning the maturity of the remaining SESAR1 Solutions to be validated in Release 5 will be undertaken and those that are deemed ready for pre-industrialisation will be published as part of the SESAR1 final outcomes report. It is important to note that in accordance with existing planning, a number of SESAR1 Solutions will undertake further validation as part of the SESAR 2020 Programme.

The definition phase of the SESAR 2020 Programme was carried out in parallel with the definition of Release 5 content and was finalised when Release 5 was in its early execution phase in 2015. This parallel approach has enabled the SJU and candidate members to maintain an accurate view of the maturation of SESAR solutions and to reflect this in regular updates of the Release Strategy. As a result, Solutions considered as not sufficiently mature at the end of SESAR1 were included in the SESAR 2020 projects definition in order to complete their validation.

The ATM Master Plan campaign also took advantage of the Release Strategy updates. In particular, the Master Plan Level 1 in its Operational View identified and described the SESAR Solutions as defined in the SESAR 2020 Programme. In a similar way, Level 2 of the Master Plan was updated to reflect SESAR1 progress and also SESAR 2020 expectations in terms of planning and architecture. As a result, a consistent transition between SESAR1 and SESAR2020 has been ensured through establishing coherence between the Release Strategy, the SESAR 2020 Programme and the ATM Master Plan. In addition to that, a clear reference to SESAR 1 deliverables has been made in the SESAR 2020 project descriptions. The aim is to ensure that the SESAR 2020 programme will continue to build on the foundations of the SESAR 1 validation activities.

A number of issues identified during the course of 2015 will need to be resolved before the closure of SESAR1. In particular, the validation of Free Route operations in high and very high operational complexity environments and across different Air Traffic Service Centres will be partly validated at the end of SESAR 1 programme. It is expected therefore that SESAR 2020 project PJ06 and the VLD PJ23 will complete the validation in order to cope with the first Deployment Common Project (PCP) deadline.

Similarly, issues identified on the development of interfaces for exchange of information between heterogeneous ground systems (Interoperability - IOP) have been addressed within SJU Governance structures at Programme Committee level. An IOP roadmap has been agreed aiming at clearly delivering an initial IOP SESAR Solution as an outcome of the SESAR1 programme and at planning the sequence of

the main activities to be performed in SESAR 2020 in order to cover adequately the full scope of the IOP solution as described in the PCP.

The transition to the H2020 environment will also result in significant changes to the financial and legal framework within which the SJU operates. This has necessitated some adjustments in organisational structure and ways of working during 2015 in order to be compliant with the new funding regime. In particular, as the SJU has continued the transition to H2020 in 2015[9] it has been necessary for SJU to look in detail at the scope of application of the Horizon 2020 Regulation and Rules for participation in relation to SJU's activities and their applicability to the exploratory research activities and applied research, pre-industrial development and large-scale demonstrations that the SJU manages. An external analysis was conducted to refine the areas of work and the relevant changes to be undertaken in addition to determining the order of priorities.

In 2015 SJU staff started attending H2020 trainings covering the following areas: work programme and call management; experts' management; submission and evaluation of proposals; grant agreement preparation, reporting and payments; validation of legal entities.

The SJU also participated in the following H2020 coordination group: H2020 Common Support Centre Executive Meeting; H2020 Network of Lawyers; H2020 Single Point of Contact meetings; H2020 Participant Portal committee; H2020 Dissemination and Exploitation Practitioners Platform (DiEPP); H2020 Coordination of audits in the Research family (CAR); H2020 Fraud and Irregularity in Research Committee (FAIR).

Despite significant successes, some issues have presented themselves during the reporting period, specifically around the availability, integration and use of H2020 IT systems and their dependent systems necessary for awarding grants. In particular technical issues with SEP transfer to COMPASS, COMPASS itself, SyGMA and ABAC along with a number of unannounced H2020 system upgrades complicated and delayed the grant preparation process for the Exploratory Research call, not helped by the need for the SJU to be the coordinator across the relevant Commission Helpdesks in order to resolve certain integration issues. There were also some delays in the legal and financial validation of grant beneficiaries too. The SJU workload associated with all of the new approach and its issues also exposed a limitation of the available and suitably trained staff within SJU to prepare the grants within the relevant H2020 IT systems and target time as no additional resources were available to be engaged to try and recover the delays.

The overall impact of these delays has meant that the SJU has not been able to meet the 'Time to Grant' KPI[10] for all grants in 2015 but the SJU is confident that such teething problems will gradually be resolved and the situation will improve for future calls.

1.4. Calls for proposals and grant information

While Horizon 2020, the Framework programme for research and innovation, emphasises innovation to a greater extent than the previous framework programme (FP7), innovative action already formed the core of SJU's SESAR2020 activity in 2015 for SESAR 1. Under Horizon2020 funding, two Calls for Proposals were launched in 2015 covering two types of action; primarily Research and Innovation actions (RIAs) but also Innovation Actions. The former action captures the majority of activities in the area of Air Traffic Management that aim to research, develop and validate operational and technological innovation with large scale demonstration activities using Innovation Actions.

In addition, some content of the calls for proposals launched in 2015 aimed to provide coordination and guidance across SESAR, assimilating ideas from Exploratory Research results and providing a critical

[9] Council Regulation (EU) No 721/2014 amending Regulation (EC) No 219/2007 and the corresponding H2020 legal framework became applicable to SJU's activities in relation to H2020 funding and grants relating to SESAR2020.

[10] As described in Article 20, (EU) No 1290/2013 of 11 December 2013, laying down the rules for participation and dissemination in "Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)."

integration role across phases of research and the key features of SESAR. These transversal activities use a third type of action, the CSA. These are used to cover activities relating to the maintenance of the European Master Plan and the design & integration of new operational infrastructure but also to activities concerning standardisation definition and coordination and support to validation and demonstration activities.

The following calls for proposals were launched by the SJU in 2015:

- H2020-SESAR-2015-1 (1st SESAR2020 Exploratory Research Call and;
- H2020-SESAR-2015-2 (SESAR2020 Transversal Activities, Industrial Research & Validation and Very Large Scale Demonstration Call.

Twenty eight topics were presented within the calls according to the above type of action required. The proposals received will be evaluated on the basis of excellence, impact and the quality & efficiency of implementation. Below is a short outline of the content of each call.

1.4.1. SESAR2020 Exploratory Research Call 1

The objectives pursued by the SESAR 2020 Exploratory Research Programme seek to address unresolved problems across the ATM Research domain and to transfer the results of past research and apply them to new applications and/or novel technologies in search of innovative and ground-breaking results. Therefore the purpose of this first call for proposals, launched in March 2015, was to ensure the continuity of Exploratory Research activities in SESAR2020 by building upon and ensuring transition of similar work undertaken under Work Package-E of SESAR1 (see Annex 6); the content of the call further built on past recommendations from the Scientific Committee and focused on exploratory research projects in two ER Work Areas:

a) ATM Excellent Science and Outreach, aiming at bridging ATM research with the wider research community and at providing the necessary scientific support to ATM change, either directly or through connection to other funded research areas in other disciplines or sectors; and

b) ATM application-oriented research, aiming at supporting new concepts for ATM beyond those identified in the ATM master plan as well as at supporting the maturation of emerging technologies and methods to the level required to feed the applied research conducted in the SESAR JU.

The 'ATM Excellent Science and Outreach' topics in this call were the following:

REF	Title of Topic	Short Topic Description	Type of Action
1	Automation in ATM	Proposals to study the application of Automation that could provide the key to significant performance improvements across many aspects of ATM, which today rely on high levels of automation	RIA
2	Data Science in ATM	Proposals to study the potential application of the rapidly maturing techniques in complexity science and data science for the ATM domain.	RIA
3	Information Management in ATM	Proposals to study the management and distribution of all types of information in ATM systems, including flight deck and cabin, with particular attention to scalability, stability and error promulgation that relate to the inherent conflict between consistency, availability and partition tolerance in a distributed computer based global ATM system.	RIA
4	Environment & Meteorology in ATM	Research activities that will aim to better understand the impact of aviation on the environment and the ways in which ATM can reduce these effects.	RIA

REF	Title of Topic	Short Topic Description	Type of Action
5	Economics & Legal Change in ATM	Proposals to study the economics and legal changes in ATM. These may originate from evolving market pressures, the emergence of new market entrants, innovation in business models or they may be a consequence of regulation.	RIA

The 'ATM Application Oriented' topics in this call were the following:

REF	Title of Topic	Short Topic Description	Type of Action
6	High Performing Airport Operations	Proposals to study the improved visualisation and awareness for airport operations. Research activities will address new ways of displaying and presenting data on aircraft, vehicles and infrastructure in a manned airport visual control room.	RIA
7	Separation Management and Separation Standards	Proposals to study the aspects of separation management and separation standards, given the emerging SESAR environment, in order to make best use of available airspace resources.	RIA
8	CNS	Proposals to study the use, or adaptation, of new technologies being developed outside ATM to support ATM CNS needs including analysis of the safety, performance and security implications for the ATM system.	RIA
9	Trajectory Based Operations (TBO)	Proposals to study a number of fundamental questions related to TBO (this is a key element of future ATM operating concepts. It is expected to provide the flexibility needed by airspace users to optimise their operations while simultaneously ensuring the predictability needed at ATM network level for maximum overall performance).	RIA
10	ATM Architecture	Proposals to study innovative approaches to analysing ATM architecture. Research activities are expected to help better understanding and modelling how architectural and design choices influence the ATM system and its various behaviours.	RIA
11	ATM Performance	Studies analysing new effective methodologies and tools for micro and macro modelling of performance in ATM, capable of capturing the interdependencies between different Key Performance Areas (KPAs).	RIA

The call closed on 25 June 2015. A total of 128 proposals were received, of which 5 were ineligible. The remaining 123 proposals were evaluated by independent experts between July and October 2015 and the evaluation report completed (see section 1.4.2 for further details of the evaluation elements of this call). Grant preparation and award were expected to be completed in Q1 2016 and will therefore be reported within the 2016 Annual Activity Report.

1.4.2. SESAR2020 Industrial Research, Validation & Very Large Demonstrations Call

Published in October 2015 and restricted to the candidate Members of the SJU, this call was designed to meet the requirements of the 2015 ATM Master Plan's Key Features as reflected within the SESAR multi-annual work programme (MAWP) adopted by SJU's Administrative Board in July 2015.

The MAWP itself is split into two waves; Wave 1 (2016 to 2019) and Wave 2 (2019 to 2021), with this Call for Proposals covering Wave 1 projects only. 28 interdependent projects designed to deliver SESAR solutions for Wave 1 were included in the call.

The activities of this call were organised into three separate Work Areas (SESAR2020 Transversal Activities, Industrial Research and Validation and Very Large Scale Demonstration Activities). Each work area is broken down into one of the 28 topics. Below is a short outline of the content of the call:

The 'Work Area A – SESAR2020 Transversal Activities' topics in this call were the following:

REF	Title of Topic	Short Topic Description	Type of Action
1	Content Integration	"Content Integration" (CI) activities will aim to coordinate and integrate operational and technical solutions, and as such to support and guide the processes to ensure their completeness, consistency and coherency from a holistic perspective as expressed in the SESAR CONOPS.	CSA
2	Master Plan Maintenance	The ATM-MP has three levels (Executive, Planning and Implementation) that require synchronised monitoring and alignment. The work shall consist in maintaining, updating and publishing as and when necessary the ATM-MP. It shall also consist in managing the ATM-MP update campaigns.	CSA
3	Validation & Demonstration Engineering	Development of the Validation & Verification Infrastructures (V&VI) and Platforms (V&VP) development required for supporting SESAR Validation Exercises.	CSA

The 'Work Area B – Industrial Research & Validation Activities' topics in this call were the following:

REF	Title of Topic	Short Topic Description	2015 Master Plan Key Feature	Type of Action
4	Increased Runway & Airport Throughput	Enabling enhanced runway throughput to improve efficiency and resilience of arrival and departure operations.	High Performing Airport Operations	RIA
5	Integrated Surface Management	Further integration of ATC tools through Surface Management with other systems to enhance abilities to deliver, plan and improve the use of airport resource allocation.	High Performing Airport Operations	RIA
6	Airport Safety Nets	Addressing further improvements in SESAR2020 to reduce the number of runway incursions prevent collisions on the apron and taxiway with traffic and fixed obstacles.	High Performing Airport Operations	RIA
7	Total Airport Management	Development of performance-based ATM system as the cornerstone of future airport concept, foreseeing an integrated airport management framework.	High Performing Airport Operations	RIA

REF	Title of Topic	Short Topic Description	2015 Master Plan Key Feature	Type of Action
8	Remote Tower for Multiple Airports	Validation of concept that effective provision of ATS to multiple remote sites is possible, and is at least as safe as current methods of service provision.	High Performing Airport Operations	RIA
9	Optimised Airspace Users Operations	Evolving ATM environment through SESAR towards a Trajectory Based environment in order to improve Airports and ATM Network performance	Optimised ATM Network Services	RIA
10	Advanced Airspace Management	Address the definition and refinement of relevant interfaces between Advanced Airspace Management and other processes such as DCB, FRA, NOP, flight planning.	Optimised ATM Network Services	RIA
11	Advanced Demand Capacity Balancing (DCB)	Provide building blocks to complement Network Management with Network Intelligence based on shared situation awareness, a common set of values and rules and highly interconnected local network management functions.	Optimised ATM Network Services	RIA
12	Enhanced Arrivals and Departures	Addresses interaction between Traffic Synchronisation and DCB within the extended horizon. Potential information integration needs and balancing mechanisms to be investigated and developed.	Advanced Air Traffic Services	RIA
13	Trajectory Based Free Routing	Realising the objective of airspace users to plan flight trajectories without reference to a fixed route network or published directs within high & very high-complexity environments.	Advanced Air Traffic Services	RIA
14	Separation Management En-route & TMA	Looks at the tactical layer of separation management (for resolution advisory purposes demand and capacity balancing considerations will be taken into account if feasible, but main objective is aiming at the provision of separation between aircraft).	Advanced Air Traffic Services	RIA
15	Enhanced Air & Ground Safety Nets	Current Airborne Collision Avoidance System (ACAS) performance requirements will need to be adapted for the future operations identified by the SESAR Concept. This topic looks at the adaptation of ACAS to new separation modes and to new categories of airspace users.	Advanced Air Traffic Services	RIA
16	Air Vehicle Systems	Facilitate integration of Remotely Piloted Aircraft Systems (RPAS), General Aviation (GA) and Rotorcraft with the Commercial Aviation through cross-fertilisation of technical solutions between RPAS and GA/R.	Enabling Aviation Infrastructure	RIA

REF	Title of Topic	Short Topic Description	2015 Master Plan Key Feature	Type of Action
17	Communications, Navigation and Surveillance (CNS)	Enforce new CNS technical capabilities to meet operational requirements and needs, taking into account the newly emerging CNS technologies. GA/R and Remotely Piloted Aircraft Systems (RPAS) needs will also be integrated within CNS solutions development.	Enabling Aviation Infrastructure	RIA
18	Common Services	This topic will develop solutions that are expected to enhance the benefit of operational solutions, especially their cost effectiveness, by identifying opportunities to provide them through alternative organisational arrangements. This is achieved through the discovery, definition and validation of common services and their enabling elements in the operational solutions.	Enabling Aviation Infrastructure	RIA
19	CWP – HMI	Looking at automation and new tools to assist Airport ATS, TMA and En-Route Controllers.	Enabling Aviation Infrastructure	RIA
20	SWIM Infrastructures	Further mature and validate SWIM A/G solutions for advisory services and for safety critical services, federated identity management, a common runtime registry & civil-military interoperability.	Enabling Aviation Infrastructure	RIA
21	4D Trajectory Management	Sharing trajectories between ATM actors including Airspace Users through an iterative process to take into account more accurate data once available (e.g. intentions, MET forecast, current traffic, airspace management).	Enabling Aviation Infrastructure	RIA

The 'Work Area C – Very Large Scale Demonstrations Activities' topics in this call were the following:

REF	Title of Topic	Short Topic Description	2015 Master Plan Key Feature	Type of Action
22	Integrated Airport Operations (incl. TBS)	Demonstrations focussed on functionalities that enhance airport Integration and throughput.	High Performing Airport Operations	IA
23	Network Collaborative Management	Demonstrations that improve the European ATM network performance, notably capacity and flight efficiency through exchange, modification and management of trajectory information.	Optimised ATM Network Services	IA
24	Flexible Airspace Management and Free Route	Demonstrations covering combined demonstration of Flexible Airspace Management and Free Route that will enable airspace users to fly as closely as possible to their preferred trajectory.	Advanced Air Traffic Services	IA

REF	Title of Topic	Short Topic Description	2015 Master Plan Key Feature	Type of Action
25	Arrival Management extended to en-route Airspace	Demonstrations showing extended Arrival Management to en-route Airspace (AMAN horizon extended from 100-120 nautical miles to 180-200 nautical miles from the arrival airport).	Advanced Air Traffic Services	IA
26	Enhanced Terminal Airspace using RNP-Based Operations	Demonstration of environmental friendly procedures for arrival / departure and approach using PBN in high-density TMAs.	Advanced Air Traffic Services	IA
27	Initial Trajectory Information	Demonstrate initial Trajectory Information Sharing (i4D) consisting of the improved use of target times and trajectory information, including where available the use of on-board 4D trajectory data by the ground ATC system & Network Manager Systems.	Enabling Aviation Infrastructure	IA
28	Flight Information Exchange	Demonstrate Flight information exchange during the pre-tactical and tactical phases by ATC systems and Network Manager.	Enabling Aviation Infrastructure	IA

The call opened in December 2015 and is scheduled to close on 20 April 2016. As a result, no participant or evaluation data is available for inclusion in the 2015 CAAR and this will be included in the 2016 annual activity report.

1.5. Ad-hoc Procedure for Membership Accession Call:

In addition to the above H2020 calls, the process to select new members continued in parallel throughout 2015. Following the closure of the pre-selection phase in October 2014, the second phase of Membership Accession, dealing with the technical dialogue required to finalise SESAR2020 content, ran until September 2015. The participants in this second accession phase were the SJU, EUROCONTROL and the Candidate Members.

This Phase aimed to define the technical means to achieve the objectives of the ATM Master Plan (this included amongst other to further refining the technical content of the draft SESAR 2020 R&I Programme, agreeing the programme management framework and confirming the skills required to cover the scope of the refined Programme) and to present the legal and financial make-up of the SESAR 2020 Programme, review the H2020 model contractual documentation and the evolution and outcomes of the above mentioned technical dialogue. This phase was running in parallel with the ATM Master Plan campaign and aligned priorities with those of the Master Plan Edition 2015.

Once the principles of the SESAR 2020 work programme had been substantially agreed with the candidate Members and EUROCONTROL through the dialogue phase, the SJU drafted the Final Call for Membership and a draft Membership Agreement to reflect all aspects of the extended SESAR development phase. At this stage, the SJU declared that discussions with the candidate Members were closed and the relevant documentation was sent to the Administrative Board for adoption.

Following the conclusion of the dialogue phase (as formalised by a decision of its Administrative Board), the SJU commenced the third phase of the Membership Accession Process through the publication of two parallel procedures: an ad-hoc Call for Final Membership Applications, leading to the selection of SJU Members and the signature of a Membership Agreement (MA); and the restricted H2020 Call for Proposals described in section 1.4.2 above, leading to the signature of grants using the Commission provided Model Grant Agreement (MGA) approved for use by the SJU.

1.6. Progress against KPIs / Statistics (Annexes 8, 9, 10 and 13)

A performance dashboard specific for the SJU's operations and mandate has been created for this CAAR, in addition to incorporating indicators for Joint Undertakings which are applicable to all H2020 funded activity. These indicators are broken down into the following:

- Horizon2020 key performance indicators common to all JTIs and JUs (annex 8);
- Indicators for monitoring H2020 cross-cutting issues common to all JTIs and JUs (annex 9);
- Indicators specific to the SJU and its operations (annex 10).

As the first SESAR call funded by H2020 has not concluded the Grant Agreement Preparation phase at the end of December 2015, this Annual Activity Report will only include those indicators for which data was available as of 31 December 2015 (i.e. those indicators related the proposal evaluation process). The SJU has also defined a number of key performance indicators specific to its mandate in order to monitor progress of SESAR 2020 until 2024 and of the SJU in managing the SESAR 2020 programme.

It is also important to measure the improvements delivered as a result of SESAR and to quantify to stakeholders the expected operational improvements to be delivered once SESAR Solutions are validated and deployed as per the defined Master Plan roadmaps. In order to do this, the benefit of OFA and OIs (Operational Focus Areas and Operational Improvement Steps) of validated solutions are analysed and the resulting performance information then applied to those key performance areas (KPAs) as defined in the 2015 edition of the Master Plan. The consolidation of the annual results of individual metrics relating to each KPA will allow an integrated view of the performance impacts at ECAC [European Civil Aviation Conference] level, demonstrating gradual progress toward the 2035 performance ambitions of the Master Plan. For the safety related KPIs, targets are set concerning the safety requirements that must be fully implemented, to ensure that design hurdles are met. The performance data below illustrates the performance benefits stemming from all SESAR solutions validated until 2015 relative to the 2005 baseline "without SESAR". The metrics highlight that compared to the 2014 analysis, performance has improved in 2015 in all Key Performance Areas except Airport capacity, where it slightly decreased[11]. These KPIs also outline performance data compared with the 2015 validation targets, which are used to steer the R&D work in line with the Single European Sky High Level Goals.

Additionally, the SJU's work programme will continue to provide an overview of objectives and activities to be carried out by the SJU on an annual basis with the aim of outlining in detail its current goals and associated annual objectives and outcomes. The SJU's annual work programmes will continue to be in compliance with the SJU's financial rules that outline the following requirements to ensure its validity - '*the annual work programme of [SJU] shall comprise detailed objectives and expected results including performance indicators. It shall also contain a description of the action(s) to be financed and an indication of the amount of financial and human resource allocated to each action*.'

1.6.1. Evaluation: procedures and global evaluation outcome, redress and statistics

As outlined in section 1.4 there were two calls for proposals launched by the SJU in 2015:

1. 1st SESAR2020 Exploratory Research Call;
2. SESAR2020 Transversal Activities, Industrial Research and Validation and Very Large Demonstrations Call (Wave 1).

1.6.1.1. Exploratory Research - H2020-SESAR-2015-1

The first ER call, H2020-SESAR-2015-1, was published in the Participant Portal on 19 March 2015 with a deadline of 25 June 2015. It had a total budget envelope of EUR 20.6 million and comprised a single type

[11] This was due to the fact that significant additional validation results became available that indicated a lower potential improvement of peak runway throughput than expected.

of action (Research and Innovation) in two work areas (ATM Excellent Science & Outreach research – ATM Applications oriented research) with a total of 11 topics.

A total of 128 proposals were submitted to the call.

The evaluation of proposals was carried out between July and October 2015 by independent and SJU experts providing 3 to 5 expert readings per proposal. In selecting experts, the primary objective was to ensure a high level of skills, experience and knowledge in the areas of the call (including innovation, exploitation, dissemination and communication). Under these conditions, specific attention was given to ensure the appropriate balance of experience, geographical dispersion, knowledge and diversity.

As a result of the evaluation, 5 proposals were deemed inadmissible; of the 123 eligible proposals, 103 passed all thresholds and were eligible for funding. The individual thresholds within this call were set at 60 for the "Excellence" criteria, 20 for the "Impact" and 20 for "Excellence and quality of implementation" respectively.

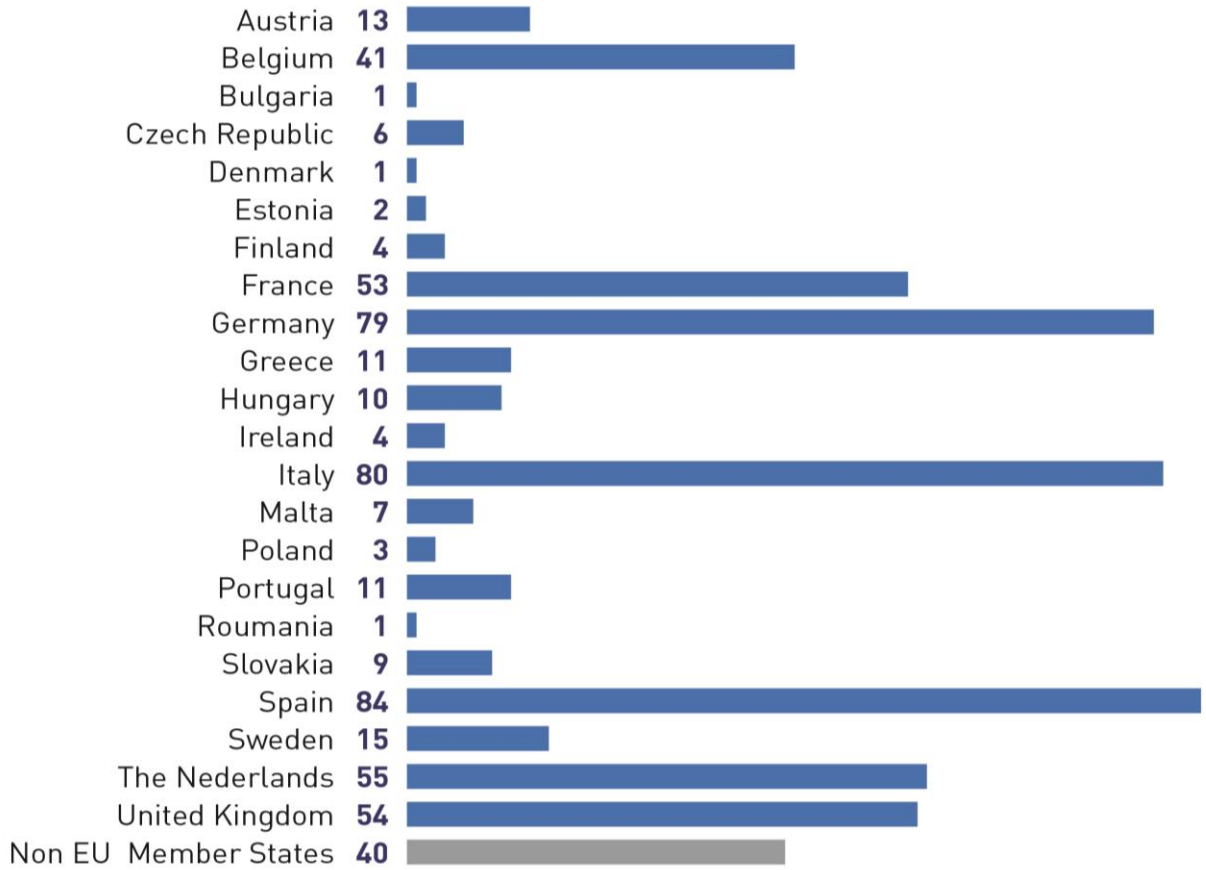
28 proposals were selected: 15 in the work area "ATM Excellent Science and Outreach research and 13 in "ATM application oriented research."

No redress procedure occurred and the Grant Agreement Preparation started in November 2015.

Commitment appropriations for the SJU contribution amounted to a total of EUR 20.563.622.

The geographic origin of both the coordinator and members of all eligible proposals received is outlined below.

1st SESAR 2020 Exploratory Research Call: Proposals Received by Country



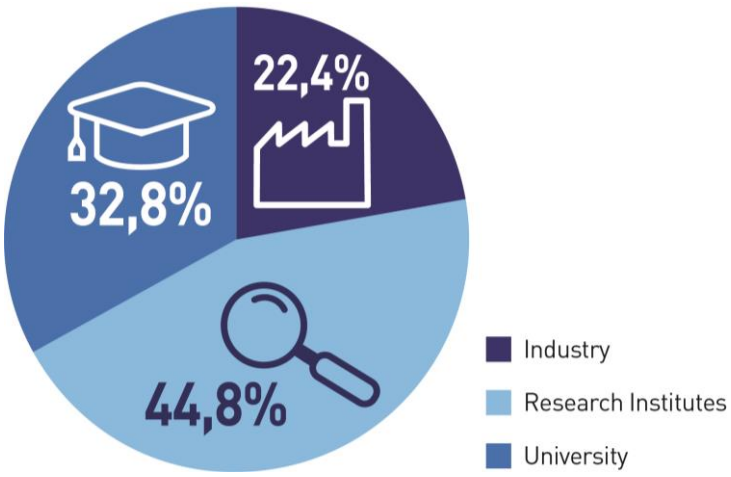
1st SESAR 2020 Exploratory Research Call: Proposals Received by Topics

24	**Topic 1:** Automation in ATM
10	**Topic 2:** Data Science in ATM
7	**Topic 3:** Information Management in ATM
10	**Topic 4:** Environment and meteorology in ATM
9	**Topic 5:** Economics and Legal Change in ATM
12	**Topic 6:** High Performing Airport Operations
9	**Topic 7:** Separation Management & Separation Standards
14	**Topic 8:** Communication Navigation & Surveillance
12	**Topic 9:** Trajectory Based Operations
6	**Topic 10:** ATM Architecture
10	**Topic 11:** ATM Performance

123 TOTAL

A breakdown of the number of eligible proposals received by topic and the industry sector from which the proposals were received is outlined below (see section 1.4 for topic names and summaries).

1st SESAR 2020 Exploratory Research Call: Proposals Received by Type of Entities



All eligible proposals were evaluated remotely during the period June 26th to August 21st and centrally from August 24th to October 2nd. The evaluation was undertaken pursuant to Article 15 of the Rules of Participation, Article 133(1) of the Commission's Financial Regulation and Article 204 (1) of the Rules of Application. A summary table of the 28 selected proposals in this call is outlined below.

No	*REF*	*Proposal Acronym*	*Coordinator Name*	*Short Description of Selected Proposal*	*Country*
1	Topic 01 - 01	AUTOPACE	CENTRO DE REFERENCIA INVESTIGACION DESARROLLO E INNOVACION ATM, A.I.E.	AUTOPACE proposes basic research on a Psychological Model to quantitatively predict how automation would impact on human performance based on cognitive resources modelling (demanded and available), tasks characteristics (automation), psychological factors modelling (fatigue, stress and emotions) and ATCo expectations (overconfidence vs fears of automation).	ES
2	Topic 01 - 02	TaCo	DEEP BLUE SRL	TACO project aims at defining algorithms and solutions to improve automation in surface operations concerning vehicles and aircraft, providing tools to the controller to supervise the system and investigating the interaction between humans and the system.	IT
3	Topic 01 - 03	AGENT	UNIVERSITAT AUTONOMA DE BARCELONA	The project targets the creation of a new automatic airborne tactical conflict-resolution tool which is based on the TCAS logic and architecture, combined with a ground ATC monitoring tool that would detect instances of insoluble conflicts that would require ground-based centralised ATM to take over.	ES
4	Topic 01 - 04	STRESS	DEEP BLUE SRL	STRESS project's objective is to explore in an innovative and reliable way human performance in highly automated systems, in order to provide new knowledge and guidelines needed for the design and implementation of higher levels of automation. The project collects technologies and methods already validated in non ATM sectors and apply them in realistic future ATM scenarios.	IT
5	Topic 01 - 05	MINIMA	DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV	This project aims at identifying how to apply higher automation to complex systems while mitigating the negative effects of monitoring tasks. This will allow benefiting from performance increases of higher levels of automation while keeping the human operator performance on a high level to ensure safe operations.	DE
6	Topic 02 - 01	BigData4ATM	NOMMON SOLUTIONS AND TECHNOLOGIES SL	The goal of BigData4ATM is to investigate how large-scale dynamic data can be analysed and combined with more traditional demographic, economic and air transport databases to extract relevant information about passengers' behaviour and use this information to inform ATM decision making processes.	ES
7	Topic 02 - 02	DART	UNIVERSITY OF PIRAEUS RESEARCH CENTER	DART will deliver understanding on the suitability of applying big data techniques for predicting multiple correlated aircraft trajectories based on data driven models and accounting for ATM network complexity effects.	EL

No	REF	Proposal Acronym	Coordinator Name	Short Description of Selected Proposal	Country
8	Topic 02 - 03	MALORCA	DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV	The aim of MALORCA project is to apply assistant based speech recognition to ATM, i.e. combining ATM contextual information and speech recognition to improve learning algorithms by using the contextual information for feedback. This is expected to lead to faster and cost-effective learning during both deployment and maintenance.	DE
9	Topic 03 - 01	BEST	STIFTELSEN SINTEF	BEST will determine how semantic technologies can be used effectively to maximise the benefits of adopting SWIM, one of the major results of SESAR. The full benefits of SWIM can only be achieved if advanced support can be provided for developing smart SWIM-based applications that manage information effectively, and semantic technologies offer a promising way to do that.	NO
10	Topic 04 - 01	TBO-MET	UNIVERSIDAD DE SEVILLA	In this project the problem of analysing and quantifying the effects of meteorological uncertainty in Trajectory Based Operations is addressed. A methodology will be developed to measure the uncertainty of sector demand (probabilistic sector loading) based on the uncertainty of the individual trajectories.	ES
11	Topic 04 - 02	ATM4E	DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV	ATM4E aims to integrate existing methodologies for the environmental impact (including local air quality, noise and climate change) of aviation, in order to evaluate the impact of environmentally optimized flight operations on European ATM, considering climate, air quality and noise impacts.	DE
12	Topic 04 - 03	PNOWWA	ILMATIETEEN LAITOS	The PNOWWA project will produce methods for the probabilistic short-term forecasting of winter weather and enable the assessment of the uncertainty in the ground part of 4D trajectories.	FI
13	Topic 05 - 01	COCTA	Univerzitet u Beogradu - Saobracajni fakultet	COCTA project proposes coordinated economic measures aiming to pre-emptively reconcile air traffic demand and airspace capacity and aims to reduce the cost arising from lack of coordination in the ATM system, stemming both from divorced planning horizons of ANSPs and aircraft operators (AOs), and from an inadequate pricing of navigation services.	RS
14	Topic 05 - 02	COMPAIR	TRANSPORT & MOBILITY LEUVEN NV	The overall goal of COMPAIR is to investigate how to introduce competitive incentives in the ATM sector so as to best contribute to the achievement of the European high-level policy objectives for aviation.	BE
15	Topic 05 - 03	Vista	THE UNIVERSITY OF WESTMINSTER LBG	Vista examines the effects of conflicting market forces on European performance in ATM, through the evaluation of impact metrics on four key stakeholders, and the environment. The project comprises a systematic, impact trade-off analysis using classical and complexity metrics, encompassing both fully monetised and quasi-cost impact measures.	UK

No	REF	Proposal Acronym	Coordinator Name	Short Description of Selected Proposal	Country
16	Topic 06 - 01	MOTO	DEEP BLUE SRL	The end goal is to enhance human performance, by exploiting other channels than the visual channel and considering the role of all human senses for tower operations.	IT
17	Topic 06 - 02	RETINA	ALMA MATER STUDIORUM - UNIVERSITA DI BOLOGNA	The RETINA project will investigate the potential and applicability of SV tools and Virtual/Augmented Reality (V/AR) display techniques for the Air Traffic Control (ATC) service provision by the airport control tower.	IT
18	Topic 07 - 01	SALSA	AIRBUS DEFENCE AND SPACE LTD	SALSA is an exploratory research project relating to multi-source ADS-B system. The study will assess the impact of performance of such a system of systems approach in the context of separation standards; it will provide an assessment of the procedural impact and impact to flight safety due to the revised minima and the system configuration.	UK
19	Topic 07 - 02	R-WAKE	GTD SISTEMAS DE INFORMACION SA	This project (R-Wake) aims at developing a simulation framework to assess the risk and hazards of potential wake vortex encounters for the en-route phase of flight.	ES
20	Topic 08 - 01	NAVISAS	TEKEVER ASDS	NAVISAS proposes a novel concept of APNT for small aircraft that will integrate novel technologies and will merge multiple navigation avionics into one with no major impact on avionics. Specifically, NAVISAS is devoted to combine multiple GNSS constellations (GLONASS, GPS and Galileo) and a novel concept of atomic micro-gyroscope based on atomic spin and nuclear magnetic moment precessions, and to assess the improvements in performance and security.	PT
21	Topic 08 - 02	SAPIENT	THALES ALENIA SPACE ITALIA SPA	SAPIENT project addresses a new innovative application in the field of CNS/ATM system focusing exploitation of the synergies of Communications and Navigation technologies and the 4D trajectory management concept, aiming at supporting the Technology Communication and Navigation roadmaps and the stakeholders roadmaps for the Air-Ground datalinks.	IT
22	Topic 09 - 01	OptiFrame	LANCASTER UNIVERSITY	The main objective of OptiFrame is the application of principles of mathematical modelling and optimization to optimally configure and assess the performance of the Trajectory Based Operations concept to support the ATFCM decision making process.	UK
23	Topic 09 - 02	COPTRA	CENTRO DE REFERENCIA INVESTIGACION DESARROLLO E INNOVACION ATM, A.I.E.	COPTRA aims to propose, in a TBO, an efficient method to build probabilistic traffic forecasts on the basis of flight trajectory predictions. Its main objectives are: using the improvements brought to Trajectory Prediction by the future TBO environment; bring measurable improvements to Traffic Prediction in ATC Planning, specifically to the prediction of occupancy counts.	ES

No	REF	Proposal Acronym	Coordinator Name	Short Description of Selected Proposal	Country
24	Topic 09 - 03	PARTAKE	UNIVERSITAT AUTONOMA DE BARCELONA	PARTAKE project proposes a causal model to enhance the potential synergies that could be achieved by exploiting to the maximum extend the gap provided by the strategic decision variables (i.e. departure slots fixed by ATFM) with the tactical decision making at airport level (i.e. departure sequence preserving slot assigned) and the operational decision making at flight execution level between zones that could affect trajectory adherence due to tight interdependencies between RBT's.	ES
25	Topic 10 - 01	PACAS	UNIVERSITA DEGLI STUDI DI TRENTO	PACAS has a clearly defined goal of delivering a change management platform which has the potential to increase stakeholder understanding of the implications of changes to the ATM system through modelling. The project seeks to achieve this through the development of a design process to support change management, by developing concepts for modelling ATM systems to capture the strategic objectives of safety, security, economic and organizational concerns and to develop reasoning techniques to support analysis.	IT
26	Topic 11 - 01	INTUIT	NOMMON SOLUTIONS AND TECHNOLOGIES SL	The goal of INTUIT is to explore the potential of visual analytics, machine learning and systems modelling techniques to improve our understanding of the trade-offs between ATM KPAs, identify cause-effect relationships between KPIs at different scales, and develop new decision support tools for ATM performance monitoring and management.	ES
27	Topic 11 - 02	AURORA	CENTRO DE REFERENCIA INVESTIGACION DESARROLLO E INNOVACION ATM, A.I.E.	This project will propose advanced metrics to assess the operational efficiency of the ATM system. These new metrics will be developed with the aim of encapsulating the airspace users' operational objectives, considering fuel consumption, schedule adherence and cost efficiency of the flights.	ES
28	Topic 11 - 03	APACHE	ADVANCED LOGISTICS GROUP SAU	APACHE project addresses the challenge of adapting the current performance scheme to the long term ATM concept of Performance Based Operations paradigm through the understanding and further implementation of dynamic (real-time) traffic and airspace planning with consideration of 4 interdependent KPA (Capacity, Safety - including consideration of navigation uncertainties, wind prediction errors, take-off delays -, ATM cost-effectiveness, Flight efficiency and environmental impact).	ES

1.6.1.2. Industrial Research & VLD (Wave 1) - H2020-SESAR-2015-2

The call for proposals for SESAR2020 Transversal Activities, Industrial Research & Validation (IR) and Very Large Demonstrations (VLD) Call (Wave 1), H2020-SESAR-2015-2, was launched in December 2015 and was restricted to the pre-qualified SJU candidate Members. It has a total budget envelope of EUR 260 million. The proposals will be evaluated in Q2 2016.

This IRV/VLD call comprises of three types of action (Innovation, Research and Innovation and Coordination & Support Actions). The 28 topics of the call are split into 3 work areas (outlined in more detail in section 1.4).

1.7. Call for tenders

A full list of tenders launched during the reporting period is included at Annex 4.

1.8. Dissemination and information about projects results

SJU dissemination addresses the process of making the results and deliverables of the programmes and projects available to relevant stakeholders and to a wider audience. Dissemination is recognised as essential for take-up, and take-up is crucial for the success of projects and for the sustainability of outputs in the long term.

In addition to numerous presentations made during international conferences, information days and workshops, SJU funded projects have produced a significant volume of research publications (primarily drawn from Work Package E - see Annex 7 for further details) in 2015.

Additionally, the development and validation in preparation for industrialisation and deployment (and therefore further dissemination) of identified solutions is delivered through the release process, culminating in SESAR Solutions that are published by the SJU.

1.8.1. SESAR delivery process

Guided by the European ATM Master Plan, the SJU is responsible for concentrating all ATM research and innovation efforts and for defining, developing and validating SESAR Solutions in preparation for their deployment. These solutions undergo thorough pre-industrial development and integration testing within a given timeframe in order to establish their readiness for industrialisation and subsequent deployment. This process is called a Release[12].

There have been four SESAR1 releases launched in the period 2011 to 2015 and activity relating to these Release processes, encompassing SESAR solutions expected to be ready for industrialisation, continued throughout 2015. In particular, the consolidation and assessment of the validation results from Release 4 were undertaken in Q1 2015, the results of which formed the basis of the eight SESAR solution packages published in November 2015 (see below). Such solutions have been developed according to a set of Essential Operational Changes for the ATM industry, as outlined in the European ATM Master Plan (Key Features). Six key features[13] were defined to capture the operational improvements and technical enablers required to deliver SESAR's contribution to the goal of a Single European Sky, with solutions clustered in line with these areas, which were as follows:

- **Traffic synchronisation;**

Traffic Synchronisation covers all aspects related to improving arrival/departure management. It aims to achieve an optimum traffic sequence resulting in significantly less need for air traffic control (ATC) tactical intervention and the optimisation of climbing and descending traffic profiles.

[12] A release is an element of the SESAR Programme that focuses on groups of projects delivering, in a determined timeframe, R&D results that will support decision to move related activities to the industrialisation stage (after the end of V3). A Release follows a cycle of 3 phases: 1. Definition Phase: Considering the V&V roadmap exercises as main input, this phase aims at identifying the scope of the release and at getting the commitment of all the involved actors; 2. Development Phase: this phase mainly concerns system prototype development, validation platforms development, integration and preparation of the validation exercises i.e. developing the pieces of concept description and solution (system and/or procedures) that are due for the on-going release; 3. validation Phase: this phase aims at validating the pieces of solution developed for the Release, and at assessing their maturity in order to determine whether it is possible to move to following phases of E-OCVM methodology (V4).

[13] As per the 2012 edition of the Master Plan. These key features have now been revised to four in the 2015 update of the Master Plan, approved by the Administrative Board of the SJU on 15 December 2015.

- **Airport integration and throughput;**

Airport Integration and Throughput aims at achieving a full integration of airports into the ATM network, ensuring a seamless process through Collaborative Decision Making. Airports will contribute to achieving SESAR performance goals through the increase of runway throughput and improved surface movement management.

- **Moving from airspace to 4D trajectory management;**

Moving from Airspace to 4D Trajectory Management entails the systematic sharing of aircraft trajectories between various participants in the ATM process to ensure that all partners have a common view of a flight and have access to the most up-to-date data available to perform their tasks. It enables the dynamic adjustment of airspace characteristics to meet predicted demand with minimum distortions to the aircraft trajectories.

- **Network collaborative management and demand and capacity balancing;**

Collaborative Management of the ATM Network' relies on successive phases of operation planning from long to medium and short term. In this context, all involved ATM stakeholders progressively share more and more precise data to build a common traffic and operational environment picture called the Network Operations Plan (NOP). This NOP is updated in real time to reflect any changes in ATM operations.

The NOP also covers military activity, taking full account of the needs of mission trajectories and military airspace demands. Throughout the lifecycle of the flights, the traffic demand/available capacity is monitored by the different ATM actors. When an imbalance occurs, capacity shortfall scenarios are collaboratively agreed and implemented. When required, the Aircraft Operators submit the revised user-preferred trajectories, integrating the ATM constraints.

- **Conflict management and automation;**

Conflict Management and Automation aims at substantially reducing controller task load per flight through a significant enhancement of integrated automation support, whilst simultaneously meeting the safety and environmental goals of SESAR. Human operators will remain at the core of the system (overall system managers) using automated systems with the required degree of integrity and redundancy.

In addition, this strategic business need covers the evolution of Ground and Airborne Safety Nets (and their mutual compatibility) through the use of new surveillance means and system wide information sharing. They will be fully adapted to SESAR future trajectory management systems and new separation modes, thus ensuring their continuing effectiveness as a last safety layer against the risk of collision (and other hazards).

- **System Wide Information Management (SWIM).**

The concept of SWIM covers a complete change in paradigm of how information is managed along its full lifecycle, involving stakeholders from across the whole European ATM network. SWIM is SESAR's most important enabler for assuring that the right information will be available with the right quality to the right person at the right time. It covers all ATM information, including aeronautical, flight, aerodrome, meteorological, air traffic flow, and surveillance. SWIM consists of standards, infrastructure and governance enabling the management of ATM information and its exchange between qualified parties via interoperable services.

1.8.2. SESAR Release Activity in 2015

Solutions are operational and technological improvements developed by SESAR members and partners which aim to contribute to the modernisation of the European and global ATM system. Through the SESAR Release process, solutions are systematically validated in real operational environments in order to have conclusive and sufficient proof to support a decision for their industrialisation.

The eight, Release 4 solutions published as ready for industrialisation in 2015 (clustered around three of the key features described above) are summarised below.

1. **Extended arrival management (E-AMAN) horizon (traffic synchronisation);**

This solution allows for the sequencing of arrival traffic much earlier than is currently the case by extending the AMAN horizon from around the airspace around the airport to further upstream.

2. **Enhanced terminal operations with localiser performance with vertical guidance approach (LPV) procedures (traffic synchronisation);**

This solution refers to the use of GNSS-based advanced required navigation performance (A-RNP) approach procedures to enhance terminal area operations (TMA).

3. **Pre-departure sequencing supported by route planning (traffic synchronisation);**

This solution concerns pre-departure management delivering optimal traffic flow to the runway by factoring in accurate taxi-time forecasts and route planning.

4. **Flow-based AMAN/DMAN integration (traffic synchronisation).**

This solution provides integrated AMAN and DMAN with the aim of increasing throughput and predictability at airports by improved coordination between en-route, approach and tower controllers.

5. **Remote tower for two low-density airports (airport integration and throughput);**

Building on the validation of remote tower operations to a single aerodrome, this solution refers to the provision of ATC services and AFIS to two low-density airports simultaneously by a single controller located at a remote location.

6. **Precision approaches using GBAS CAT II/III based on GPS L1 (airport integration and throughput);**

GBAS augments the global navigation satellite system (GNSS) signals by sending the positioning corrections to aircraft from precision approach and landing.

7. **Air traffic flow management slot swapping (network collaborative management and dynamic capacity balancing);**

This solution uses slot-swapping as a means to reduce the impact of delays on airspace user operations. This it does by introducing aircraft operators' tactical priorities in a cooperative process with the Network Manager through air traffic flow management (ATFM) slot exchanges made between flights within a single airline company.

8. **User-driven prioritisation process (UDPP) departures (network collaborative management and dynamic capacity balancing);**

Taking place during pre-tactical operations, this solution provides airspace users with a means to identify their best swapping partners, in addition to accrued flexibility in the slot swapping rules such as multi-swap and substitution on cancellation.

A further eight, Release 4 solutions have, during the reporting period, been further validated in order to assess their readiness for industrialisation:

1. **Controlled time of arrival (CTA) in medium density and complexity environments (traffic synchronisation);**

This solution deals with 'Controlled Time of Arrival (CTA) operations, with aircraft downlinking the required time of arrival (RTA) min/max window to the ground system, corresponding to the earliest and latest time the aircraft can reach its metering fix. This window is taken into account by AMAN which allocates delay and assigns a corresponding time of arrival. This time constraint (the CTA) is then uplinked directly from the ground systems to the airborne systems, allowing the aircraft to self-manage its speed. This solution is not yet ready for industrialisation and exercises will continue in Release 5.

2. Airborne separation assistance system (ASAS) spacing applications 'remain behind' and 'merge behind' (traffic synchronisation).

ASPA-IM-S&M manoeuvres allow flight crew to achieve and maintain spacing for a designated aircraft. The applications are specified in new air traffic control instructions, allowing flight crew to achieve and maintain a given spacing in distance or time from a designated aircraft. Further validation activities will be conducted as part of Release 5.

3. Advanced short ATFCM measures (STAM) (network collaborative management & dynamic capacity building);

STAMs enable air navigation service providers (ANSPs) to improve the predictability of operations and optimise traffic throughput thanks to Air Traffic Flow and Capacity Management (ATFCM) measures coordinated between upstream and downstream air traffic control sectors (e.g. flight-level capping, re-routing). Further validation activities for this solution will be conducted as part of Release 5.

4. Automated support for traffic complexity detection and resolution (network collaborative management & dynamic capacity building);

The solution contains a traffic complexity tool, as well as automated support for resolving situations where too high complexity is predicted. Further work on this solution will continue in Release 5, where further work will be undertaken to refine the complexity algorithm and to assess performance benefits.

5. Variable profile military reserved areas and enhanced (further automated) civil/military collaboration (network collaborative management & dynamic capacity building);

This solution offers greater flexibility by allowing dynamic airspace management in all phases of ATM operations, from initial planning through to the execution phase, taking into account local traffic characteristics. The solution includes support tools, operational procedures and processes for real-time airspace status data exchange and for managing variable profile areas (VPAs). Further validation activities will be conducted as part of Release 5, during which safety and security assessments will be made.

6. Digital integrated briefing (System Wide Information Management);

This solution aims to improve information sharing between pilot, flight dispatchers and air traffic controllers for all phases of flight through the exchange of more accessible and better filtered digital aeronautical (including digital NOTAM) and MET data. Further validation activities will be conducted as part of Release 5, which will further refine the pilot briefing application.

7. Initial system-side information management (SWIM);

This solution brings together several core elements for the initial implementation of SWIM, namely services for information exchange and governance; SWIM security; SWIM technical infrastructure profiles; SWIM foundation; ATM information reference model (AIRM) and information service reference model (ISRM). Work using SWIM-based information sharing will continue in Release 5. Initial SWIM is part of deployment plans in accordance with the PCP.

8. Display and use of ACAS resolution advisory downlink on the controller working position (conflict management and automation);

Controllers are automatically informed when ACAS generates a resolution advisory (RA). This improvement is intended to complement voice reporting by pilots. Further R&D is required to: i) establish an operationally acceptable procedure (including legal aspects); ii) quantify safety benefits; iii) evaluate the interaction with other controller working position (CWP) functions and; (iv) evaluate equipment costs.

In addition to the above release activity, the Release 5 plan was published and 14 exercises from Release 5 were finalised during the reporting period.

A number of the 'pipeline' and mature solutions outlined above (numbers 1, 2, 3, 9, 12, 13, 14, 15, 16, 17, 18 and 20) have been incorporated into a Pilot Common Project (PCP[14]) by the European Commission. The Pilot Common Project identifies a first set of ATM functionalities[15] to be deployed in a timely, coordinated and synchronised way so as to achieve the essential operational changes stemming from the European ATM Master Plan and the above identified solutions were considered mature enough for synchronised deployment across Europe within the period 2015 to 2020.

Based on first results of research & development activities, the PCP was developed by the SESAR JU upon a European Commission mandate. Following stakeholders' consultation the PCP became the first tangible evidence of stakeholder commitment to deploy a first set of SESAR Solutions and of the Commission's deployment strategy. Solutions contained in the PCP will be deployed between 2015 and 2024 across Europe, and will deliver a total of about 12.1 Billion Euros worth of performance gains for some 3.8 Billion Euros of investment.

1.8.3. SESAR Deployment Manager

In 2015, the third phase of SESAR, the Deployment phase (meaning the industrialisation and entry into operations of SESAR solutions) was launched. The deployment phase is enabled by the European Commission's deployment strategy[16]. While maintaining its focus on R&D, SESAR JU will play a central role in establishing the bridge between R&D and the following industrialisation and deployment phases.

To manage deployment effectively, the SESAR Deployment Programme (managed by the SESAR Deployment Manager) continues to aim to ensure that the solutions delivered by SJU enter into day-to-day operations across Europe. Throughout the reporting period, the SJU continued to identify and exploit synergies and improve cooperation and communication between the two parties, as formalised and agreed within a Memorandum of Cooperation with the Deployment Manager. The Steering Committee established as a result of the above MoC met twice during the course of 2015 and agreed to ensure continuity between the EU ATM Master Plan and the Development Programme; to put in place specific working arrangements to support the technical coordination and communication and external relations activities.

1.9. Operational budget execution

The operational budget for 2015 consisted of the following three main elements:

SESAR1 "Studies and developments carried out by the SJU" (SESAR1 Chapter 3.1): In 2015 the SJU committed the full budget (100.0%) of EUR 21.0 million for operational activities related to the Work Programme but not carried out by the JU's Members (e.g. WPE Long-term Research activities). Payments amounted to EUR 38.4 million (78.1% of the budgeted payment appropriations), out of which EUR 32.0 million were payments against commitments carried forward from previous years (e.g. Demonstration Activities).

SESAR1 "Studies and developments carried out by the SJU Members" (SESAR1 Chapter 3.3): No commitments were budgeted as the last funds related to SESAR1 Members' activities were committed in 2013. Payments against these commitments carried forward amounted to EUR 66.9 million (98.3% of the budgeted payment appropriations), almost entirely for interim payment requests (only EUR 0.2 million were paid for pre-financings). These co-financing payments relate to eligible costs for

[14] EC Implementing Regulation (EU) 716/2014 27 June 2014 on the establishment of the Pilot Common Project.

[15] The Pilot Common Project identifies six ATM functionalities, namely Extended Arrival Management and Performance Based Navigation in the High Density Terminal Maneuvering Areas; Airport Integration and Throughput; Flexible Airspace Management and Free Route; Network Collaborative Management; Initial System Wide Information Management and Initial Trajectory Information Sharing. It is intended that the deployment of those six ATM functionalities should be made mandatory.

[16] Commission Regulation (EU) No 409/2013 of 3 May 2013 on the definition of common projects, the establishment of governance and the identification of incentives supporting the implementation of the European Air Traffic Management Master Plan

programme deliverables and work-in-progress that were reported by the JU's Members in their 2014 Interim Financial Statements and accepted by the SJU in 2015.

SESAR2020 "Studies and developments carried out by the SJU Members" (SESAR2020 Chapter 3.3): The only budgetary transaction related to the new SESAR2020 Programme was a Level-1 Commitment of EUR 51.5 million related to the new SESAR2020 Membership[17]. With the first call for IR/VLD-call launched at the end of 2015, these funds received from the EU as planned were pre-committed and carried forward to 2016 where they will be broken down into individual commitments per project following the respective Grant awards.

1.10. Cash and In-kind contributions[18]

In accordance with SJU's establishing regulation, all Members other than the European Commission can contribute to the SJU in cash and in-kind (the Commission contributes only in cash). For the SESAR1 Programme, the following provisions were established:

Cash Contributions: At least 5% of each Member's contribution shall be in cash in order to finance the running costs of the Joint Undertaking (i.e. staff- and administrative costs). The remaining part of the Cash Contributions is used to co-finance the Industry's costs incurred in relation with the operational activities of the SJU (see below).

In-kind Contributions: In-kind contributions consist of the operational activities carried out by the Industry and Eurocontrol for developing jointly and under the SJU's supervision the next generation of air traffic management systems in Europe. The following distinction applies in principle:

- For Eurocontrol, 100% of their activities performed under the SJU Work Programme are accepted as In-kind Contributions.
- For the Industry, only half of their activities performed under the SJU Work Programme are accepted as In-kind Contributions, as they receive max. 50% Co-Financing from the SJU for the same activities. The Co-Financing is taken from the remaining Cash Contribution from the Commission (and to a smaller extent from Eurocontrol) as explained above.

During 2015 all 15 Members reported to the SJU the Deliverables produced and the actual costs incurred during the previous year by submitting Interim Financial Statements (IFS), certified by their own auditors. The SJU assessed the IFS for each individual Member, each Project's Cost Breakdown Form and the Audit-Certificates from operational and financial perspective ex-ante. For all but one Member[19], the SJU fixed an amount of EUR 177.3 million as Eligible costs (100.0%), paid the due Co-Financing of EUR 88.2 million to the Members (49.7%) and validated the difference of EUR 89.1 million as In-Kind Contributions (50.3%) for each Member and each Project, leading to the following cumulative amounts on 31/12/2015 since the start of the Programme:

EUR (Million)	EC	Eurocontrol	Industry	SJU Total
Cash Contribution	522.1	111.9	25.5	659.5

[17] The 2015 Budget for S2020 (Section 2) also foresaw revenues and payment appropriations of EUR 10.3 million for Pre-Financing payments under the first Exploratory Research call launched in 2015, however, in order to keep the cash balance at year end low, the SJU had requested the Commission in November 2015 to transfer these funds only in January 2016 where they are used for the first Pre-Financing payments at present.

[18] A report on in-kind contributions during 2015 is currently (June 2016) being drafted by the SJU. Should the content become available before 1 July, this section will be updated to reflect this.

[19] Clarifications on the IFS of this Member were still pending as of 31 December 2015. In mid-April 2016, however, the IFS was fully accepted and paid.

EUR (Million)	EC	Eurocontrol	Industry	SJU Total
of which SJU running costs (committed by 31/12/2015)	21.9	21.5	21.2	64.6
IN-KIND Contribution	-	236.6	368.7	605.3
= TOTAL Contribution	522.1	348.5	394.2	1 264.8
% of Max. Contributions	*74.6%*	*51.2%*	*67.5%*	*64.7%*

2. SUPPORT TO OPERATIONS

2.1. External Affairs and Communication activities

2.1.1. Third Party Engagement and Coordination with Other Programmes

A fundamental principle of the SJU is to broaden and deepen collaboration with a range of different stakeholders in order to benefit from their expertise and gain their assurance that SESAR Solutions meet the needs of the entire European ATM and aviation community (the fact that such stakeholders contribute to projects and validation activities secures to a large extent the operational inputs necessary and is in line with the users' expectations on the delivery of SESAR solutions). As such, third party participation and active input into SESAR projects continued during the reporting period.

A key highlight of 2015 was the signature of a Memorandum of Understanding between the SESAR Joint Undertaking and the SESAR Deployment Manager (SDM) during the World ATM Congress 2015 in Madrid. This agreement provides a platform on which to build cooperation for the smooth and timely delivery and deployment of SESAR Solutions to the ATM community. The Memorandum of Understanding has several guiding principles, based on both organisations developing synergies where possible and endeavouring to be complementary to each other's activities. This involves the mutual and timely sharing of information for effective operations and communications, and the harnessing existing cooperation mechanisms. Above all, a critical factor for success will be the exchange of information to support the industrialisation phase, to ensure effective bridging between R&D and deployment and to facilitate interoperability.

Over the course of 2015, the SJU also continued to foster strong ties with all other key stakeholder groups, the details of which are included below.

2.1.1.1. European Aviation Safety Agency

Cooperation continued between the SJU and EASA over the course of 2015, focusing on the next steps for effective PCP implementation preparations for SESAR 2020 and specific areas such as data communications, Remote Tower Services, GBAS CAT II/II, SWIM, RPAS and cybersecurity.

EASA also took an active part in reviewing the final reports and first results of the SESAR demonstration projects. This ongoing collaboration resulted in several recommendations to be considered by the SJU in its work, in particular in the preparation of SESAR Solutions. For its part, the EASA Rulemaking Plan was adapted to include SESAR regulatory needs related to Remote Tower Services; SWIM; GBAS & PBN, while for some of the work related to Notice of Proposed Amendments (NPA) are currently undergoing public consultation, taking into account SESAR results & the EU's PCP regulatory framework.

2.1.1.2. EUROCAE

The SJU contributed 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.

In 2015, several standardisation needs originating from SESAR were incorporated into the EUROCAE Technical Work Programme and subsequently also impacted the RTCA work. The two organisations also worked closely together to ensure standardisation needs and developments were fully reflected in the PCP to de-risk implementations. As part of its delivery of SESAR Solutions, the SJU actively engaged with EUROCAE to systematise and streamline the processes for the timely deliveries and production of standardisation material.

2.1.1.3. EASCG

In 2015 the SJU has been an active participant in the establishing of the European Air Traffic Management Standards Coordination Group (EASCG), with the objectives to coordinate standardisation

activities, identify their links with the R&D activities and to provide a forum for discussion. The result of this activity is reflected in the European ATM Standardisation Rolling Development Plan, a living plan developed and maintained by the EASCG as well as a specific PCP focused standardisation roadmap.

2.1.1.4. National Authorities

The SJU continued to play an active role in fora at which national authorities coordinate and take decisions, such as the European Commission Single Sky Committee and EASA ATM Thematic Advisory Group. Close relations were also maintained through the National Supervisory Authorities (NSA) Coordination Platform, and, in particular, a working group addressing and de-risking potential SESAR development and deployment issues. The working group enabled the SJU to raise early awareness among the authorities of ongoing SESAR activities, thus helping the authorities to provide better input on important points for the development activities and to make sure the bridge between development and deployment activities continued to be effective and beneficial for both sides.

The SJU also continued to leverage the expertise of some 80 NSA experts through Memoranda of Understanding established with 17 National Authorities from 13 States. These experts provided input on draft PCP documentation, as well as on a wide range of 'live' SESAR topics, including RPAS, Remote Towers, GBAS CATII/III and SWIM applications coming to realisation, in addition to being involved in SESAR Demonstration Activities. The results from assessments made by the Authorities and their participation in validation exercises were integrated into 2015 SESAR deliverables. These have also been used for the elaboration of Regulatory Overviews of several SESAR Solutions.

2.1.1.5. Military and State Aviation

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.

Since its establishment in 2011, the SJU has enabled a structured and active participation of national military experts directly to SESAR project activities in many aspects of concern to the military community. Bearing in mind that the military is not only an airspace user but also an airport operator and in several cases an ANSP, as well as an Authority has meant that the SESAR programme so far has a cross coverage as well as specific projects looking into the specific requirements and solutions being adaptable to the military needs. In some cases there has been creation of specific panels to gather a large number of inputs from military and state aviation in specific technical and operational domains. In 2015, 24 military experts (11 % pilots, 51% air defence experts, 32% ATC experts, 6% engineers) from 10 countries (Belgium, France, Finland, Germany, Italy, Netherlands, Portugal, Spain, Sweden and the UK) took part in the MEPS in 18 projects within 11 Work Packages.

2.1.1.6. The European Defence Agency

SJU and the European Defence Agency (EDA) have been engaged in close dialogue since 2011 and this relationship continues to provide input on military matters and opinions into the Programme. Several ministerial mandates and EU Regulations (CIR 409/2013, new proposal of Basic Regulation) set the responsibilities for EDA to facilitate the coordination of military views with regard to Single European Sky and SESAR. In 2014, EDA established a specific ad-hoc programme "Military Implementation of SESAR (MIOS)" which allows for additional military expertise in this domain within EDA CPS Directorate. This programme allows for reinforced engagement with SJU and was further exploited during 2015.In general, the 2015 collaboration between the EDA and SESAR focused on:

- Establishing all SJU military coordination through EDA incl. NATO;
- Master Planning (2015 campaign)
- Defence investment and procurement;
- Planning for the evolution of relevant military technologies;
- Risk mitigation actions related to military implementation of SESAR;
- Provision of expertise or organisation of fora to gather the required results in key areas.

In late 2015, the SJU identified in conjunction with the EDA the need to revise the current cooperative arrangements in place with the aim to finalise and sign an amended MoC in the first half 2016 to accommodate the required changes needed to prepare effectively for SESAR2020.

2.1.1.7. Professional Staff Associations

The SJU collaborates closely with all relevant professional Staff Associations through the third party arrangements above represented by the participation in the programme of the following five professional staff associations: International Federation of Air Traffic Controllers' Associations (IFATCA), European Cockpit Association (ECA), International Federation of Air Traffic Safety Electronics Associations (IFATSEA), European Transport Workers' Federation (ETF), and Air Traffic Controllers European Union Coordination (ATCEUC).

The integration of professional staff associations' representatives into the Programme at different levels remains in place and a pool of 90 licensed and operational controllers, pilots and engineers of all nationalities continue to work on the International Validation Team (IVT). The IVT participated successfully in validation activities during 2015, bringing vital operational input and value to the performance and exercise outcomes.

In terms of outreach, the SJU also attended the various meetings of its PSO members. Similarly, professional staff experts were invited to contribute to SJU activities such as the ATM Master Plan Edition 2015, where their views on the role of human factors were accommodated in a dedicated chapter. They also presented the results of their research on resilience at various SJU-led events such as the World ATM Conference in Madrid. As well as their active participation in the SESAR Performance Partnership, experts were invited to participate in various working groups related to the RPAS definition work and provide their expertise in areas such as Cybersecurity.

2.1.1.8. SESAR Performance Partnership

The goal of the SESAR Performance Partnership (SPP) is to assist the SJU Executive Director in monitoring the objectives and results of the SESAR Development Phase Work Programme, ensuring transparency, common understanding, participation and the commitment of all stakeholders to changes to the European ATM Master Plan and transition from development to deployment.

During 2015, the focus of the SPP was concentrated on supporting the SJU Executive Director in the decision-making process related to the preparation for the update of the European ATM Master Plan. The SPP also focused on cross-checking SESAR development activities against PCP objectives, as well as the level of ambition of the Step 2 Concept of Operations.

2.1.1.9. Airports Council International, Europe

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

In 2015, the ACI -SJU collaboration focussed on spreading news about SESAR developments, carrying out joint communications activities and consulting on technical issues such as safety, environmental concerns and the European ATM Master Plan. Highlights included a number of ACI-SESAR Roadshows aiming at disseminating R&D results hosted in Madrid, Helsinki and Budapest, as well as workshops and working sessions with ACI members on the revision of the ATM Master Plan. The SJU organised visits to Heathrow Airport with the European Commissioner and the Director General of MOVE.

2.1.1.10. 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 the third party arrangements above and their expertise is recognised as key in ensuring the overall success of SESAR. During the course of 2015, airspace user's engagement was prioritised on the following areas: launch of SESAR 2020, PCP R&D delivery, Demonstration Activities and the refinement of the level of ambition of the SESAR Concept of Operations to prepare for the ATM Master Plan update.

Thanks to their expertise, civil airspace users also made significant contributions to numerous SESAR activities such as the ones described in SESAR Release 4 and 5. In parallel, this group maintained its key role in SJU Governance bodies with a particular focus on the Administrative Board, Programme Committee (opened to airspace users in 2014 with observer status) and the SESAR Performance Partnership (SPP) group.

2.1.1.11. 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.

In 2015 the SJU and ESA, through the Iris programme, continued to have a productive working arrangement whereby ESA staff participated in SESAR projects and the SJU contributed directly to the Joint Iris Advisory Committee (JIAC) and Iris Expert Group. This allowed for technical coordination between ESA, SJU and other stakeholders for example on the development of SESAR data link requirements using satellite communications in support of 4D trajectory operations.

With the establishment of the Iris Precursor or Iris 2017 by Inmarsat, the SJU launched a complementary project to fully explore its operational and technical viability, in particular in relation to supporting initial 4D operations in oceanic and remote areas, as well as providing backup to the existing continental VDL2 data link environment. The project is also examining service continuity and Airspace User cost implications of Iris 2017. During the end of 2015 discussions started for the development of a Memorandum of Cooperation between the SJU and ESA to better govern the structure of the cooperative arrangements.

2.1.1.12. Clean Sky

The SJU continued the work of close coordination with the Clean Sky JTI, focusing on specific areas of common interest such as:

- Gate-to-gate aircraft operational improvements (WP16) for fuel and environmental savings, environment metrics and modelling and the Clean Sky Technology Evaluator work;
- Aircraft Systems in support of SESAR Trajectory-Based Operations (WP9) and Clean Sky Trajectories for Green Operations.

In 2015 as during 2014, the two organisations exchanged operational information on a number of topics: PBN; Vertical Profile in the TMA; Ground and Airborne Capabilities to Implement Sequence; and Airborne Spacing (ASPA) Sequencing & Merging (S&M). These discussions confirmed that Clean Sky and SESAR activities are aligned. The SJU continued the proactive coordination's to enhance cooperation and governance with Director-level meetings and exchanges of information on matters relating to the scope of SESAR 2020 & Clean Sky2 and the setup of the two organisations under Horizon 2020. This work resulted in a MoC between the SJU and Clean Sky2 which was signed in December 2015.

2.1.2. Communication Activities

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

In 2015, the SESAR JU carried a number of communications activities in accordance with the objectives of its 2015-2020 Communications Strategy. Outreach on SESAR topics was further formalised in 2015 with the signing of a Memorandum of Cooperation (MoC) between the SESAR JU and SESAR Deployment Manager in which it was agreed to collaborate on specific communications and stakeholder activities.

The following is a summary of activities undertaken by the SESAR JU, many of which in collaboration with the SESAR Deployment Manager.

2.1.2.1. Events

Over the course of 2015, the SESAR JU organised a number of events, many of which took place within the framework of larger aviation/air transport events. This approach allows the SESAR JU maintain a high profile and engage with relevant stakeholders across the ATM community. The following are highlights from events in which the SESAR JU actively participated during 2015:

World ATM Congress, 9-12 March 2015, Madrid:

From 9 to 12 March, a number of SESAR-led events took place as part of the World ATM Congress:

- The Annual SESAR Gathering welcomed over 200 participants and featured talks and updates about the SESAR R&I activities. The Annual Gathering also formed the backdrop for the SESAR R&I Project Awards ceremony;
- Co-hosted by the SESAR JU and SESAR DM, the SESAR Exchange Theatre attracted over 500 participants to hear about the technological and operational innovations in the SESAR pipeline, in addition to deployment plans;
- The 2015 demo focussed on the SESAR Solution of extending arrival management (E-AMAN) to the en-route phase of a flight. Attracting over 150 visitors, the demonstration showcased how through cross-border collaboration between ATM actors, innovative solutions for ATM modernisation can be developed.

Connecting Europe TENT-T Days 2015:

The TEN-T Days 2015 took place from 22 - 23 June 2015 in Riga and was held within the context of the Latvian Presidency of the Council of the European Union. SESAR was showcased at the TEN-T days through a joint communications activity between the SESAR JU and SESAR DM. The two organisations co-hosted an exhibition stand, as well as workshop highlighting the value of SESAR as a performance driven, synchronised and industry-led project.

SESAR Solutions workshop: Extended AMAN

On 16-17 September 2015 in Paris, more than 200 aviation stakeholders came together to find out more about Extended Arrival Management (E-AMAN), a SESAR Solution that aims to overcome congestion and delays at busy airports across Europe. Organised by the SESAR JU and hosted by DSNA, participants had an opportunity to visit a number of demonstration platforms and hear first-hand from the ATM experts carrying out the research and validation of the solution. The workshop also presented the current status of the solution's implementation and heard from representatives of airports, airlines and air navigation service providers (ANSPs) about the benefits in terms of efficiency, costs and the environment that this solution will bring to their operations.

Aerodays 2015

The 7th edition of Aerodays, the European flagship event in aviation research and innovation was held from 20-23 October in London. The event presented strategic perspectives for aviation, including research and innovation, sharing achievements of collaborative research and innovation in aeronautics and air transport. Through a dedicated stand and forum, the SESAR JU showcased projects in the fields of green ATM, RPAS and ATM safety, as well as highlighted what's to be expected with the SESAR 2020.

ATC Global

The SESAR JU represented SESAR and its members at the ATC Global Exhibition & Conference which took place on 5-7 October 2015 in Dubai, UAE. Supported by UAE General Civil Aviation Authority (GCAA), Dubai Air Navigation Services (DANS), Dubai Airports and Emirates Airline, the three-day event included a large scale exhibition whereby SESAR hosted a stand offering visitors the chance to learn the latest on SESAR activities and results. SESAR also took also part in ATC Global's thought leadership conference and hosted a workshop showcasing some of the programme's latest achievements.

SESAR Innovation Days

From 1 to 3 December 2015, the SESAR JU held its annual SESAR Innovation Days event, which was hosted by the University of Bologna in Italy. The three-day event put ATM exploratory research under the spotlight through a series of workshops, presentations, research exhibitions and networking events. It was also the backdrop for the SESAR Young Scientist Award, which each year recognises young scientific excellence contributing to the modernisation of ATM.

7th European Innovation Summit

From 7 to 10 December 2015, the SESAR JU together with five other industry JUs presented the results of their programmes at the European Parliament. The event took place in the framework of the 7th European Innovation Summit and attracted policy makers, industries, SMEs, and academic and research organisations. SESAR JU showcased its activities through a dedicated stand and through participation at a joint session with six other Joint Undertakings.

SESAR SWIM Master Class

The 4th edition of the SESAR SWIM Master Class welcomed 55 international teams increasing the awareness of SWIM and the practical uptake culminated in an awards ceremony that took place on 11 December in Brussels. Held annually, the Master Class is a chance for ATM stakeholders to network and to share their experiences and best practices in implementing SWIM. The event is also the backdrop for the SESAR SWIM Master Class Awards, which recognises highly-innovative SWIM applications and services.

ACI Exchange

SESAR participated in the ACI Airport Exchange from 8-10 December in Istanbul, an annual gathering of airport operations professionals. SESAR participated in the operation and safety conference, hosted a workshop showcasing SESAR developments and upcoming activities related to airports, and organised a stand co-hosted between the SESAR JU and SESAR DM. The objective of SESAR participation was to communicate and raise awareness on how SESAR can improve the capacity, efficiency, safety and environmental gains in all sizes of airports.

In addition, SESAR JU staff participated in over 100 further events, raising the visibility of the SESAR project.

2.1.2.2. Publications

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

European ATM Master Plan

Published in December 2015, the latest edition presents the SESAR vision of ATM - a critical element in the future air transport system - and details the development and deployment activities necessary to achieve this vision between now and 2035.

Seeing is Believing: A Summary of SESAR Demonstration Activities 2012-2014

The report provides the results of the 18 SESAR Demonstration Activities, which were completed by the end of 2014, as well as lessons learned and next steps.

NextGen – SESAR State of Harmonisation Document

The document provides a high-level summary of the current state of progress toward achieving the necessary level of interoperability between the Next Generation Air Transportation System (NextGen) and SESAR, based on the cooperative activities between the US and EU.

2014 SJU Annual Report

The report provides highlights of the work undertaken by the SESAR JU and its members over the course of 2014.

Release 5

The brochure gives an overview of Release 5, covering 33 potential SESAR Solutions through 38 exercises – which aim to demonstrate that these solutions are sufficiently mature, allowing for a decision to be taken for their industrialisation and subsequent deployment.

High Performing Aviation for Europe (Passenger Brochure)

The brochure presents the work of SESAR from the perspective of the passenger, detailing the changes that SESAR is bringing behind the scenes at every stage of the flight.

SESAR Leaflet - Enabling Greener Flights

The brochure gives a brief overview of how SESAR is contributing to the goal of reducing the environmental footprint of aviation. Several examples are given of solutions that are resulting in greater fuel efficiency and lower carbon emissions.

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

2.1.2.3. Digital media

The SESAR JU dedicates significant resources to developing short animations and videos about the work of the programme. In 2015, the SESAR JU produced the following digital material which is disseminated through various channels.

Extended arrival management (E-AMAN) in action

This video answers explains the SESAR solution of E-AMAN and provides examples of how the solution can be applied in different contexts.

SESAR ground-to-ground interoperability

This animation explains the SESAR solution of ground-to-ground interoperability, indicating the benefits that this solution will bring to ATM performance in Europe.

SESAR: Enabling greener flights

This short animation gives an overview of how SESAR is contributing to the goal of reducing the environmental footprint of aviation.

Towards drone integration in the European aviation system

This video explains how over the coming years, SESAR with work with its ATM partners and stakeholders to further research, validate and demonstrate solutions for the integration of drones into European aviation system, which will spur the growth of this pioneering area of aviation.

In addition to this digital material, the SESAR JU supported SESAR members by validating the content of dedicated project animations and videos.

2.1.2.4. Online communications

Website

In 2015, the SESAR JU public website attracted some 102,399 visitors and 393,539 page views. A monthly e-news was sent to external audiences (nearly 25,000 contacts), as well as dedicated event mailshots and press releases attracting further readers to the SESAR JU website. Among the most popular news stories were the launch of SESAR 2020 and the first exploratory research call, the European ATM Master Plan and the SESAR SWIM Master Class.

Social media

The SESAR JU made significant use of social media in 2015, in particular Twitter, which proved to be an effective means to engage with stakeholders at events and promote validation and demonstration activities. Twitter followers more than doubled in 2015, while the number of views/impressions peaked significantly during key events. The SESAR JU continued to engage with stakeholder through LinkedIn (5,097 members) and YouTube (30,639 views) through regular postings.

2.1.2.5. Press

In 2015, SESAR JU focused its press activities on increasing outreach with trade press and member/partner media channels. The SESAR JU was featured in articles and interviews in a range of magazines and online media:

- Trade or specialised press, including International Airport Review, Aviation Today, and Air Traffic Management Magazine, Usine Nouvelle, Scientific America, etc;
- Brussels-based press as the Parliament Magazine and Pan-European Network;
- National press, including the UK Times (special supplement on aviation);
- Member/partner media (NATS, ENAV, EDA, ERAA, etc)

Much of press interest stemmed from hot topics, such as the environment, the EU aviation strategy or key aviation and ATM events, such as the Aerodays, World ATM Congress, SESAR SWIM Master Class.

2.2. Legal and financial framework

The legal framework refers to the following:

SESAR JU is a Joint Undertaking within the meaning of Article 187 of the Treaty on the Functioning of the European Union, set up by the EC 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), as amended by Council Regulation (EC) No 1361/2008 of 16 December 2008, and by EC Council Regulation (EU) No 721/2014 of 16 June 2014 as regards the extension of the Joint Undertaking until 2024.

The financial framework applicable is established by:

- Financial Regulation (FR) — Regulation (EC, 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 European Union (OJ L 298, 26.10.2012, p.1). The SJU is a "Union Body" as referred to in Article 208 of Regulation (EU, Euratom) No 966/2012;
- Rules of Application (RAP) — Commission Regulation (EC, Euratom) No 1268/2012 of 29 October 2012 on the rules of application of l Regulation (EC, 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 298, 26.10.2012, p.1);
- SESAR Joint Undertaking Financial Rules adopted by the Administrative Board in June 2015.

The management of Calls for proposals within the framework of the SESAR2020 programme is governed by the H2020 legislation, in particular:

- H2020 Framework Programme — Regulation (EU) No 1291/2013 of the European Parliament and of the Council of 11 December 2013 establishing Horizon 2020 - The Framework Programme for Research and Innovation (2014-2020) (OJ 347, 20.12.2013, p. 104).
- Rules for Participation (RfP) — Regulation (EU) No 1290/2013 of the European Parliament and of the Council of 11 of December 2013 laying down the rules for the participation and dissemination in Horizon 2020 – the Framework Programme for Research and Innovation (2014-2020) (OJ L 347, 20.12.2013, p.81).
- Specific programme implementing Horizon 2020 - Council Decision 2013/743/EU of 3 December 2013 establishing the specific programme implementing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020) and repealing Decisions 2006/971/EC, 2006/972/EC, 2006/973/EC, 2006/974/EC and 2006/975/EC.

2.3. Budgetary and financial management

The final Budget, i.e. the Revised Budget approved by the Administrative Board on 12 December 2015 to take into account all transfers for SESAR1 during the year, included revenue appropriations for EUR 126.601.112, of which EUR 21.436.603 as Budget Result from the previous year (called 'Budget Outturn' before 2014). In 2015, the SJU cashed-in actual revenues of EUR 123.174.781 of which EUR 82.582.275 from the European Union, EUR 14.859.510 from Eurocontrol and EUR 4.246.362 as cash contributions of the other Members.

In terms of expenditure, of EUR 30.229.774 for overall commitment appropriations budgeted, EUR 30.177.117 (99.8%) were committed by 31.12.2015. In terms of payments, of overall EUR 126.601.112 budgeted for payment appropriations, EUR 112.775.973 (89.1%) were paid in 2015, broken down as follows:

BUDGET TITLE	2015 COMMITMENTS (C1)			2015 PAYMENTS (C1)		
	Budgeted	Consumed	%	Budgeted	Consumed	%
Title 1 - Staff expenditure	5 980 000	5 954 000	**99.6**	5 980 000	5 954 000	**99.6**
Title 2 - Administrative expenditure	3 258 500	3 231 138	**99.2**	3 258 500	3 231 138	**99.2**
Title 3 - Operational expenditure	20 991 274	20 991 274	**100.0**	20 991 274	20 991 274	**100.0**
TOTAL EUR	30 229 774	30 177 117	**99.8**	30 229 774	30 177 117	**99.8**

With the SJU being a multi-annual programme of a limited life-time and with fixed total budget ceilings,

unused payment appropriations at the end of one budgetary year are not cancelled but inscribed as Budget Result in the revenues of the subsequent budget, to be presented to and adopted by the SJU Administrative Board in accordance with the SJU Financial Rules. The provisional Budget Result 2015 (i.e. total revenues of EUR 123.174.781 minus total payments of EUR 112.775.973) amounted to EUR 10.398.808.

2.4. Procurement and Contracts

The acquisition of goods and services continued throughout 2015 with all procurement processes in compliance with the SJU's Financial Rules to ensure fair competition amongst suppliers and the most efficient use of SJU funds. Further efforts were also made to proceduralise best practice and coordination of activities between operational and procurement staff improved during the reporting period.

In 2015 the SJU signed twenty-eight contracts, of which twenty specific contracts under framework contracts and eight contracts as a result of procurement procedures launched in 2014 or in 2015. Three contracts of the latter category were signed as a result of exceptional negotiated procedures and none of those refer to legal services. A full list of procurement procedures launched during the reporting period is included in Annex 4 (a).

2.5. IT and Logistics

During 2015, the Corporate Support area continued to deliver a number of services in support of the efficient functioning of SJU. The area is responsible for the provision, maintenance and coordination of services in the following areas: corporate ICT, facilities management and the coordination of administrative support to programme experts, missions and insurance services.

In particular, 2015 saw improvements in the ICT user support service and in network availability, performance and stability.

SJU's ICT Support also started preparing for the SESAR2020 transition by decommissioning and replacing a number of old platforms. As a result, a significant number of ICT projects were launched, in particular replacing the tape library & local backup system by a new set of devices, delivering a new authentication platform and rolling out the tokens for remote access, setting up the new local servers and storage required to upgrade the virtual environment, performing an ICT Assessment and deploying the new Testa-NG platform to connect the SJU and EC onto their new infrastructure.

During 2015 the SJU also extended the lease on its current premises and oversaw a number of maintenance and minor works projects to improve the quality of office accommodation and other facilities available for staff.

Further, a new function of Expert coordinator was set up within the Corporate Support area, providing support for expert reimbursement & claim process management in accordance with contractual obligations. A new function of Mission Coordinator was also set up to ensure that all Missions were executed in line with the rules of the EC Mission Guide and approval.

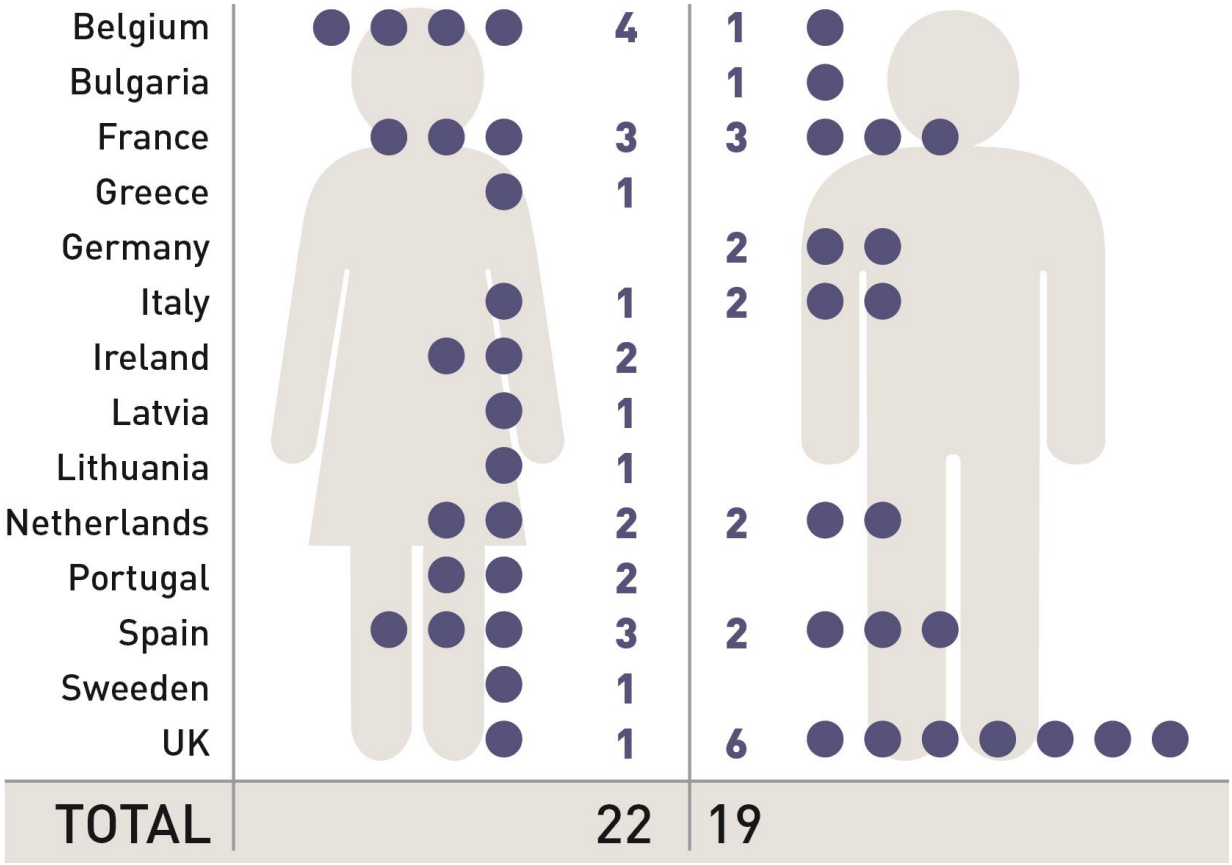
2.6. Human Resources

During 2015 the SJU continued to develop staff to ensure they have the right skills and experience to deliver an outstanding service to all stakeholders. An additional significant effort was undertaken in 2015 to ensure that the SJU staff acquire competency on the new H2020 framework, representing a total 95 days of training for 29 SJU staff. Furthermore, building on its established corporate values, goals and identified drivers of change, 2015 saw the SJU seeking to further define and refine the focus of its efforts to retain, develop and motivate its workforce and to further improve dialogue and relationships between staff and management.

In conjunction with the Commission, the SJU also continued to prepare the adoption the relevant Implementing Rules relating to HR policy. Additionally, the SJU's Multiannual Staff Policy (MSPP) 2016-2018 was adopted by the Administrative Board at its meeting on 25 June 2015.

At the end of 2015, SJU had 41 full-time staff members (35 Temporary Agents, 2 Contract Agents, 1 staff under secondment from SJU Member, 3 Seconded National Experts of which 51% were women and 49% men. Together the staff represented 14 nationalities. The exit turnover of staff was 0% as no full-time employees left the organisation in 2015.

SJU Full-Time Staff: Nationality and Gender as of 31 December 2016



Total of full-time staff members

3. GOVERNANCE

Article 2 of the SJU's statutes state that there are two main governance elements within the Joint Undertaking: the SJU Administrative Board (ADB) and the Executive Director (ED).

The SJU Administrative Board has the responsibility to ensure that the SJU complies with its statutory responsibilities as set out in its establishing regulation, all other relevant legislation and the relevant European Commission financial rules in relation to its use of public funds.

The Executive Director is responsible for the successful leadership and management of the SJU and for the execution of the SESAR programme development phase and is accountable to the Administrative Board, to which he reports on a regular basis.

SJU has continued the implementation of appropriate internal control standards (ICS)[20]. The ICS are 16 standards that provide generic management and governance principles and set out the minimum requirements for internal control activities within EU institutions and Agencies. These standards are in accordance with Commission guidelines and apply to all aspects of the SJU's work, covering all relevant programmatic, operational, financial and compliance activities. During the course of 2015, SJU has continued to build and strengthen its ICS system further (see section 4.8 for further details on the status of each ICS) and such standards have been integrated where feasible into the JU's operational procedures in order to become an integral part of the Agency's governance and risk management systems. In this way the SJU continued to develop robust governance and used the Commission's internal control framework to assess, improve and monitor SJU's corporate governance capabilities.

Within the context of its integrated governance framework, SJU recognises the importance of the principles of risk management and the value of taking a proactive and comprehensive approach to the assessment and control of risk. As such, it has implemented a robust risk management framework that identifies and manages risk appropriately (see section 1.1).

During the course of 2015, the SJU underwent 1 external audit by the Court of Auditors and 3 internal audits. The external audit of the Agency was carried out by the European Court of Auditors and a positive opinion on the Agency's 2014 accounts was obtained. The internal audit of the SJU was carried out by the Internal Audit Service of the European Commission and the Agency's own Internal Auditor. The Internal Audit Capability communicated the audit report, together with the action plans agreed with the auditee, were transmitted to the Executive Director. Details of all audit engagements are outlined in more detail in sections 4 and 5.

3.1. Administrative Board

The Administrative Board is composed of representatives from each Member of the Joint Undertaking and seven representatives from different stakeholders. The Administrative Board is chaired by the representative of the European Union, represented by the European Commission Director General for Mobility and Transport. The vice-chairperson is the representative of Eurocontrol.

During 2015, the Administrative Board (ADB) met three times (in June, October and December) and continued in its role to ensure that the SJU delivers the tasks and results as stipulated in its establishing regulation in the most effective way, taking into account the strategic goals and objectives of the SJU and focusing on the following high-level tasks:

- Setting and monitoring the strategic direction to guide the activities of the SJU;
- Ensuring the effective management of the SJU and its activities; and
- Monitoring the activities of SJU to ensure they remained in keeping with its long-term strategy and mission, vision and values.

[20] As outlined in Articles 29 and43 of the SJU's Financial Rules, adopted by the Administrative Board in October 2010.

In addition to the discussion and approval of a standard suite of documents in the annual budgetary and activity planning cycles, specific matters addressed by the ADB in 2015 included, inter alia, the approval and adoption of the SESAR 2020 multi-annual work programme and the European ATM Master Plan update 2015.

3.2. Executive Director

The Executive Director is the legal representative of the Joint Undertaking and is responsible for its day-to-day management. The Executive Director is supported by a Deputy Executive Director in charge of Corporate Affairs, by an Internal Audit Capability, by a Senior Advisor for Military Affairs and by 5 other senior managers (the Chief Economist and Master Planning, the Chief ATM, the Chief Development and Delivery, the Chief Administration Affairs and the Chief Strategy and External Affairs).

The Executive Director sits in the Administrative Board as the permanent representative of the SJU and chairs the Programme Committee meetings.

3.3. Programme Committee

The Programme Committee (PC) steers the Industrial Research Programme and supports the Executive Director at the highest Programme level in the following tasks:

- Monitoring programme progress , risks and issues;
- Identifying the impact of key issues and related mitigating actions to be implemented;
- Monitoring budget implementation;
- Providing strategic guidance and making recommendations on the management of the Programme;
- Ensuring that the SESAR strategy for the Development Phase is fully applied during the activities performed under the SJU Public Private Partnership.

The Programme Committee is composed by the 16 Members and the SJU.

By representing their organisations, the PC Members commit them on decisions taken by the PC that affect the SESAR Programme on technical and contractual matters. During 2015, the PC met four times.

3.4. Scientific Committee

During the reporting period, the Scientific Committee (SC) continued to provide advice and guidance to the SJU Executive Director on the SESAR Exploratory research programme and associated activities (e.g. Work Package-E, SESAR Innovation Days, 'Young Scientist Award' Prize, etc.).

In 2015 the SC committee met three times (in February, September and December) and supported the SJU in reinforcing its innovative and scientific approach in preparation for SESAR2020 Exploratory Research calls through focusing on the following high level tasks:

- Assessing and analysing the findings of Work Package-E projects and SESAR research network activities (in 2015, SC Members analysing more than 25 WP-E projects and presented their recommendations at the SC meeting) ;
- Identifying research gaps , new exploratory research topics and maturity assessment criteria for SESAR2020 Exploratory Research programme;
- Selecting papers for the SESAR Innovation Days 2015;
- Promoting and selecting appropriate candidates for the SESAR Young Scientist Award.

4. INTERNAL CONTROL FRAMEWORK

In 2015, there was an impact on the internal control system caused by the launch of SESAR2020. This change necessitated a different approach and the introduction of new processes that will need to continue to be implemented under the H2020 framework. This strategic, legal and operational transition will require the revision of the governance structure of the SJU to better meet the new challenges of H2020. Furthermore during 2015,the programme and funding management of SESAR2020 became subjected to the regulations and principles governing Horizon 2020, requiring a number of changes to the administrative and operational structure and environment of the Joint Undertaking[21].

These circumstances have clearly had an impact on the governance, internal control and risk management of SJU. Nevertheless the Joint Undertaking could continue to demonstrate a robust framework of internal controls, using an efficient and effective combination of ex ante and ex post controls, adequate segregation of duties, established and documented processes and procedures, the promotion of ethical behaviour, and sound management. These are embedded across SJU's administrative, support and grant management systems and workflows.

4.1. Financial Procedures

During 2015 SJU has further revised its Manual of Financial Procedures to ensure the robustness and appropriateness of its financial circuits. This has involved the improvement of checklists, delegations of authority and backup systems in order to provide clarity and consistency between financial procedures. Special emphasis has been put on integrating new provisions and workflows stemming from Horizon 2020 rules and tools into the existing SJU financial environment and set-up.

4.2. Ex ante Controls on Operational Expenditure

To ensure the legality and economic efficiency of actions, the SJU's financial circuits are consistently applied ensuring segregation of duties as required by the SJU Financial Rules.

In accordance with the Financial Rules, the SJU follows the 'four-eyes' principle that ensures before a transaction is authorised, all its financial and operational aspects have been verified initiated by a staff member other than the individual who verified and/or authorised initiated the operation subsequently[22].

The verification process aims to ensure rigorous compliance with all applicable financial rules and reinforces the principles of sound financial management. An exception register provides details, of those transactions which did not respect in full the provisions of the SJU Financial Rules and related procedures. Details of all exceptions recorded during 2015 are outlined in more detail in Annex 5.

4.3. Ex-post Control of Operational Expenditure and Error Rates identified (SESAR 1)

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

- Assess the legality and regularity of the validation of cost claims performed by SJU's management;
- provide an adequate indication on the effectiveness of related ex-ante controls;
- provide the basis for corrective and recovery activities, if necessary.

[21] Council Regulation (EU) No 721/2014 amending Regulation (EC) No 219/2007 and the corresponding H2020 legal framework became applicable to SJU's activities in relation to H2020 funding and grants relating to SESAR2020.

[22] For low risk transactions the verification aspects are often directly covered by the Authorising Officer ensuring nevertheless adherence to the 'four-eyes' principle at all times.

On the basis of the ex-post audit strategy, as adopted by the SJU Administrative Board in October 2015, 15 audit exercises were scheduled and several remaining audits from previous reporting periods were finalised. During the reporting period, 15 audits have been planned in five Selected Members and 12 of these audits were finalised. The remaining 3 are in the pre-final stage and are expected to be finished in the first quarter of 2016. However, because of the fact that the findings of the three open audits are not expected to be challenged, we have taken into account their audit findings for the purpose of calculating the error rates.

4.3.1. SESAR 1 Overview

The total amounts of costs declared in the Interim financial Statements 2013 (IFS 2013) by all 15 Members (excluding Eurocontrol) of the SJU amounted to EUR 158.1 million.

The audits performed in 2015 complemented the second cycle of audits of all 15 Members as described in the SJU Ex-Post Audit Strategy. Based on its defined methodology, Batch 5 was composed of 5 Members that were audited during the second cycle of audits in Batch 2 and it was reinforced by follow-up audits of CBFs of previous periods in order to ensure that after the first audit, errors have been corrected, recommendations have been implemented and therefore the IFSs of previous periods are free from systematic errors and material misstatements. The audits confirmed that this was the case in 4 of the 7 audited entities.

For the remaining three:

- in one case the corrections were not made because the impact was immaterial compared to the administrative burden;
- in another case the Member was compliant with the SJU eligibility criteria during the first audit in 2011, but because of a change of the person responsible for the preparation of the IFS, significant errors have been identified;
- In the third case the Member followed the SJU recommendations and submitted corrections, however the findings were the result of a different error (use of standard productive hours when actual hours were higher than standard.)

4.3.2. SESAR1 Coverage

The Interim Financial Statements received by all 5 Members (that were included in Batch 5) – EUR 158.1 million– were examined at project level; 100 CBFs were selected, representing EUR 17.2 million (i.e. 11% of the IFSs of the 15 Selected Members and 42% of total costs accepted for the 5 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 SJU is of the opinion that;

1. the cost claims submitted for the IFS2013 of the audited Members, are not any longer affected by systematic errors, and;
2. nothing appeared to the attention of the auditors concerning the respect of the principles of regularity and legality of the underlying expenditure and sound financial management.

Furthermore, the Members audited in the course of 2015 demonstrated their willingness to adopt the Project Audit Reports' recommendations to avoid in the future similar mistakes to those detected.

4.3.3. SESAR 1 Representative Error Rate

Based on 100 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 6.09%.

Where systematic errors are detected, audited Members are requested to take immediate actions to correct them and implement recommendations made by the auditors in the audit reports. The errors found concerned mainly the incorrect calculation of labour costs, by using the wrong number of productive hours or inclusion of ineligible items in the pool of indirect costs. The amounts to be

recovered from the Members were identified and will be recovered from the co-financing to be paid for the IFS 2015.

4.3.4. SESAR 1 Residual Error Rate

The residual error, defined as the error remaining in the population after the corrections and recoveries are made, for the year 2015 was calculated to 4.75%. This year's annual error appears to be above 2% because there were audits performed in those entities of a Member that have never been audited themselves in the past either by the SJU or any other European Commission Service; therefore these entities were not fully aware of the FP7 and TEN-T rules of eligibility of costs. As this figure results from the sample audits of only 5 out of 15 Members (in compliance with the SJU Ex-Post Audit Strategy), it cannot be considered a representative value for the entire Programme's residual error.

4.3.5. SESAR 1 Cumulative Error Rates

Given the multiannual nature of the Programme which is considered to be closed per Member at the last deliverable accepted within the Programme (i.e. in 2016), the cumulative error rate of previous years gives the global and representative view of the error on the entire population of the SJU. 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 of 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 560.8 million, of which 257 cost statements were audited representing all 15 Members amounting to EUR 61 million of (i.e. 11%), after the 2015 audit exercise the new representative error rate is 5.48% and the **new residual error rate is 0.70%.**

4.3.6. Implementation of SESAR 1 audit results

The following table presents an overview of the implementation of the audits which resulted in an adjustment at cost level in favour of the SJU. The adjustments are mainly recovered through offsetting against subsequent payments. For 2015 recovery orders are issued and netting off will be done with payment of IFS2015.

Audit closing year	Results from external audits		Adjustments in contradictory procedure		Adjustments implemented		
	Number of participations	Adjustments at cost level (in favour of SJU)	Number	Value	Number	Value	Value - Co-financing 50%
2011	5	-22.167,06	0	0	5	-23.710,78	-11.855,39
2012	10	-46.505,75	0	0	10	-33.900,50	-16.950,25
2013	15	-303.097,25	0	0	15	-303.097,30	-151.548,65
2014	15	-649.569,56	0	0	10	-649.569,62	-324.784,81
2015	15	-922.642,09	0	0	12	-567.356,54	-283.678,27
Total	**60**	**-1.943.981,71**	**0**	**0**	**52**	**-1.577.634,74**	**-788.817,37**

4.3.7. Extension of SESAR 1 audit findings

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

As shown in the table below, 9 participations suffered from systematic errors and all of them are corrected with issuance of recovery orders.

Audit closing year	Number of participations with expected systematic errors	Number of participations without systematic errors	Implemented cases				Number of participations to be implemented
			In favour of the SJU		In favour of the beneficiary		
			Number	Value	Number	Value	
2011	5	1	3	-19.431,46	1	5.265,40	0
2012	10	5	3	-39.433,57	2	53.944,27	0
2013	15	7	7	-287.642,45	1	14.863,97	0
2014	9	3	7	-626.241,43	2	108.665,70	0
2015	9	4	7	-567.356,45	4	28.061,94	3
Total	**48**	**20**	**27**	**1.540.105,36**	**10**	**210.801,28**	**3**

4.3.8. SESAR 1 Risk-based audits

No risk-based audit was performed during 2015.

4.3.9. SESAR 1 Performance audit

A performance audit is an audit of sound financial management, namely the economy, efficiency and effectiveness with which the audited entity has used the SJU funds in achieving the Programme objectives; it may consequently include both technical and financial aspects.

Taking into account the status and maturity of the current Programme and the imminent launch of SESAR 2020, in 2013 the SJU began to undertake performance audits of projects performed by its Members and their affiliates, subsidiaries, subcontractors, associates and any other third parties involved in the execution of the MFA. In 2015 a final report was produced, which contributed to significant lessons learnt.

4.3.10. Desk Control

One of the representative audits of Batch 4 was transformed to Desk Control because of the fact that the Member is based in Melbourne-Australia. The control is currently on-going and is expected to be finalised by the end of 2016.

4.3.11. Other budget lines

No contracts have been audited on other budget lines.

4.3.12. Resources

During 2015, 11 audits were performed by E&Y and 4 audits of affiliates of one Member were carried out by PKF, because of an identified conflict of interest of the Member with Ernst & Young (statutory

auditor). The resources devoted to the audits outsourced and those done by the SJU are shown in the table below.

Resource Allocated to SESAR 1 Project Audits in 2015

	2014	2015
SJU Internal Resources	1 FTE	1 FTE
Cost of Outsourced Auditing	€357,633	€465,000

The SJU also has a revised framework contract in place for audit services with three external audit firms. The audit activity is performed solely by those firms. No material issue has been identified in the audits performed to date that would require the attention of the Administrative Board.

4.4. Audit of the European Court of Auditors and Discharge

The report on the annual accounts of the SESAR Joint Undertaking for the financial year 2014 was issued on 16 November 2015. The Court's opinion is that the Joint Undertaking's annual accounts present fairly, in all material respects, its financial position as at 31 December 2014 and the results of its operations and its cash flows for the year then ended, in accordance with the provisions of its financial rules and the accounting rules adopted by the Commission's accounting officer. Additionally, in the Court's opinion, the transactions underlying the annual accounts for the year ended 31 December 2014 are, in all material respects, legal and regular. The European Parliament adopted the Resolution granting the 2014 discharge on 28 April 2016.

See section 5 (concerning management assurance) for details of ECA audits in 2015.

4.5. Internal Audit

In 2015, the Internal Audit Service of the Commission (IAS) performed an audit on operational governance and the Master Plan update. The field work was performed in October 2015. The Internal Audit Capability (IAC) performed 2 follow up audits concerning contract management and Internal Control Standards, which relate to audit recommendations which were issued in the past.

Concerning the ICS audit undertaken by the IAC, of the 9 recommendations issued at the time, one very important recommendation and five of the six important recommendations were implemented, whilst one important recommendation remains in progress. Two desirable recommendations were both implemented.

Concerning the IAC audit on procurement/contract management, of the 5 recommendations issued at the time, 2 of the 3 important recommendations have now been implemented whilst 1 remains in progress. The two desirable recommendations were both implemented.

The IAS audit on the Master Plan made three major recommendations. The SJU has set up a detailed action plan to address them.

Section 5 concerning Management Assurance gives further details of all IAC and IAS audits undertaken during the reporting period.

On 29 April 2015, the European Parliament granted discharge in respect of the implementation of the budget of the SJU for the financial year 2013.

On 16 November 2015, the Court of Auditors published their Annual Audit of the accounts for the financial year 2014. The European Parliament has raised a number of queries as part of the 2014 discharge process relating to in-kind contributions, payment beneficiaries, completed projects and the social and economic benefits of the completed projects, the state of play of SESAR 1, the utilisation rate for payment appropriations and some questions concerning an audit of risk management carried out in

2014 by the IAS. The SJU has provided all the material needed and requested in order to answer the questions raised by the Parliament.

Additionally, during the course of 2015, the Anti-Fraud Strategy of the SJU was created, setting out the approach of the SJU in this area and providing the objectives of the Executive Director and the Management Board in the fight against fraud over the next two to three year period. The document takes into account the priorities set by the Commission within the framework of the Common Approach on EU decentralised agencies, ensuring proper handling of conflicts of interests and developing anti-fraud activities through prevention, detection, awareness raising and cooperation with OLAF.

4.6. Data Protection

SJU continues to ensure full and rigorous compliance with all data protection provisions concerning any access to personal data within its SESAR1 and SESAR2020 programmes, using an information governance model that pro-actively protects and manages information to ensure application of an appropriate level of security, access and availability.

The JU also maintains a full data protection regime regarding its administrative operations, integrating core data protection considerations into existing project management and risk management methodologies and policies

4.7. Risk management and Conflict of Interest

Within the context of the overall internal control framework outlined above, throughout 2015 the SJU effectively reviewed, managed and mitigated risks through the adoption of a multi-faceted approach. This comprised regular and detailed discussions at management and board level, the setup of a corporate risk register and dedicated action plans and mitigation measures designed to address identified risks.

As part of the overall risk framework, the SJU undertakes a regular risk review exercise covering the SJU's operational and administrative activity areas with the aim of identifying possible critical risks, assessing their likelihood and impact on the Agency's operations and objectives and determining the Agency's response in order to mitigate/reduce/eliminate them to the extent feasible.

A summary of the SJU's main risks and the mitigations undertaken in 2015 is outlined in section 1.1.

The SJU has verification mechanisms in place to enable a proper prevention and management of conflicts of interest. The Administrative Board adopted a first decision to concretely implement the conflict of interest measures already on 21 February 2008, well before the membership agreements with the industrial partners were established and signed. The decision was further reviewed in 2012 when the Administrative Board further reinforced the conflict of interest measures adopting a code of conduct for the Administrative Board Members and new templates for the declarations used by all bodies and staff of the SJU.

4.8. Compliance and effectiveness of Internal Control

SJU's Internal Control Standards (ICSs) (as outlined in Articles 29 and 43 of the SJU's Financial Rules) were adopted by the Administrative Board by written procedure in October 2010. The 16 individual control standards are structured around six major areas:

i) mission and values;
ii) human resources;
iii) planning and risk management process;
iv) operations and control activities;
v) information and financial reporting and
vi) evaluation and audit.

SJU's internal control system integrates all 16 ICSs adopted by the joint undertaking, establishing the overall internal control environment and providing assurance that objectives are being achieved with robust financial and operational checks and balances in place. This framework is monitored on a regular basis to ensure that controls that are in place work effectively. A summary of the results of the implementation of the prioritised standards during the reporting period are outlined below:

ICS Category	ICS Name	Rationale	Summary of Actions Undertaken Toward Compliance by 31 December 2015	ICS Owner
1.Mission and Values	Mission	SJU's purpose is clearly defined in up-to-date and concise mission statements developed from the perspective of its stakeholders.	Annual exercise undertaken by senior management to review SJU's organisational mission statement. Revised vision, mission and values statement included in SJU's 2016 annual work programme.	ED
2.Mission and Values	Ethical and Organisational Values	Management and staff are aware of and share appropriate ethical and organisational values and uphold these through their own behaviour and decision-making.	A code of good administrative behaviour applicable to all staff members and a code of conduct specific to ADB members approved and implemented, mandatory signature of a declaration on conflict of interest by each participant before each meeting of the Administrative Board, recruitment board, procurement/grant board, or any other similar body or committee within the SJU; mandatory signature by staff, under any contractual form, of a declaration of commitment and conflict of interest upon their appointment as well as an annual declaration of interests; mandatory signature by experts or consultants under any contractual form upon their appointment of a declaration of independence, commitment, confidentiality and conflict of interest. Additionally, visibility of ethics guidelines for staff members was enhanced in 2015.	Admin Affairs

ICS Category	ICS Name	Rationale	Summary of Actions Undertaken Toward Compliance by 31 December 2015	ICS Owner
3.Human Resources	Staff Allocation and Mobility	The allocation and recruitment of staff is based on SJU's objectives and priorities. Management promote and plan staff mobility so as to strike the right balance between continuity and renewal.	Multi-Annual-Staff-Policy Plan continually revised to align establishment plan to SJU's objectives and priorities.	Admin Affairs
4.Human Resources	Staff Appraisal and Development	Staff performance to be appraised annually. Adequate measures taken to develop the skills necessary to achieve the objectives set.	Annual appraisal exercise 2015 finalised (including identifying staff training requirements).	Admin Affairs
5.Planning and Risk Management Processes	Objectives and Performance Indicators	SJU's objectives are clearly defined and updated when necessary and formulated in a way that makes it possible to monitor their performance. Key indicators to be established to help management evaluate and report on progress made in relation to their objectives.	Programme objectives defined at a multi-annual level and an annual basis in the SJU work programme. Appropriate indicators used to monitor implementation of the AWP and will be used to measure programme implementation in the 2016 activity report. Corporate performance dashboard to be put in place to measure important elements of organisational performance.	Corporate Affairs
6.Planning and Risk Management Processes	Risk Management Process	A risk management process that is in line with applicable provisions and guidelines is integrated into the annual activity planning.	Risk management processes in place. Corporate and programme risk management framework applied and 2015 risk management exercise undertaken.	Economics & Master Planning
7.Operations and Control Activities	Operational Structure	SJU's operational structure supports effective decision-making by suitable delegation of powers. Risks associated with SJU's sensitive functions are managed through mitigating controls and ultimately staff mobility.	ED Decisions on delegation of authority and approvals in place. Sensitive functions within SJU are identified and managed.	Admin Affairs
8.Operations and Control Activities	Processes and Procedures	SJU's processes and procedures used for the implementation & control of its activities are effective & efficient, adequately documented and compliant with applicable provisions. They include arrangements to ensure segregation of duties & to track and give prior approval to control overrides or deviations from policies and procedures.	SJU's financial circuits have been formalised and consistently applied ensuring segregation of duties. 'Four-eyes' principle applied to all financial transactions. Quality manual and quality management system that will bring processes and procedures across the whole SJU under a central management and control are currently being created with the intent of going live in Q1 2016	Corporate Affairs

ICS Category	ICS Name	Rationale	Summary of Actions Undertaken Toward Compliance by 31 December 2015	ICS Owner
9.Operations and Control Activities	Management Supervision	Management supervision is performed to ensure that the implementation of activities is running efficiently and effectively while complying with applicable provisions.	Units and departments implement the SJU's work programmes in a structured way. A new organisational chart came to effect on 1 January 2015.	ED
10.Operations and Control Activities	Business Continuity	Adequate measures are in place to ensure continuity of service in case of service interruption. Business Continuity Plans are in place to ensure that the Agency can continue operating whatever the nature of the disruption.	SJU's business continuity plan finalised and published on SJU's intranet. BCP exercise to be undertaken on an annual basis and plans updated as a result. The BCP contains crisis response and recovery arrangements regarding major disruptions (such as pandemic diseases, terrorist attacks, natural disasters, etc.). Some of these measures included in the BCP, proved to be working during the terrorist alert in November 2015. Additionally, in 2015, staff awareness in the area of safety (fire intervention and first aid) was enhanced and the interaction between the property owner and the SJU improved since the building was sold to a new property owner. Follow up of reported issues is done on a regular basis and is documented.	Corporate Affairs
11.Operations and Control Activities	Document Management	Appropriate processes and procedures are in place to ensure that the SJU's document management is secure, efficient (in particular as regards retrieving appropriate information) and complies with applicable legislation.	Archiving policy in place. DMS / BMS application to be implemented. The setup of additional controls in the field of document management took more time than initially planned as in the course of 2015, the SJU gained experience in the adaptation of its procedures to the H2020 tooling and decided to focus establishing document management system fully compatible available EC tools, such as ARES and SYSPER.	Corporate Affairs
12.Information and Financial Reporting	Information and Communication	Internal communication enables management and staff to fulfil their responsibilities effectively and efficiently, including internal controls. SJU also has an external communication strategy to ensure that its external communication is effective, coherent & in line with COM's key messages. IT systems used/managed by SJU (where SJU is owner) adequately protected against threats to confidentiality & integrity.	Internal communication to staff takes place on a regular basis via email and also via the SJU intranet. An external communication strategy is in place and followed by the SJU. Copyright provisions are respected in all external communication efforts and sufficiently documented.	Strategy & External Affairs

ICS Category	ICS Name	Rationale	Summary of Actions Undertaken Toward Compliance by 31 December 2015	ICS Owner
13.Information and Financial Reporting	Accounting and Financial Reporting	Adequate procedures and controls are in place to ensure that accounting data and related information used for preparing SJU's annual accounts and financial reports are accurate, complete and timely.	Checklists in place to assure a standardised approach to the validation of financial transactions. Further manuals/checklists for the management of assets and contracts under construction/in place.	Admin Affairs
14.Evaluation and Audit	Evaluation of Activities	Evaluations of expenditure programmes, legislation & other non-spending activities are performed to assess the results, impacts and needs that these activities aim to achieve & satisfy	The Commission's Second Interim Evaluation was carried out from October 2013 to March 2014 and assessed the Joint Undertaking in terms of implementation of the regulation, working methods, results obtained and general financial situation. The two recommendations were discussed and adopted by the Governing Board. Actions are ongoing.	Admin Affairs
15.Evaluation and Audit	Assessment of Internal Control Systems	Management assess the effectiveness of SJU's key internal control systems, including processes carried out by implementing bodies on a regular basis.	Annual ad-hoc audits by IA of SJU's internal control standards to verify their effectiveness and efficiency.	Internal Audit Capability
16.Evaluation and Audit	Internal Audit Capability	The Agency has an Internal Audit Capability (IAC), which provides independent, objective assurance and consulting services designed to add value and improve the operations of SJU.	Audit charter and IAC Annual Audit Plan in place. Annual IAC report and Annual Audit Plan prepared and presented to ADB.	Internal Audit Capability

5. MANAGEMENT ASSURANCE

5.1. Assessment of the Annual Activity Report by the Governing Board

The Administrative Board has assessed the SESAR Joint Undertaking's Annual Activity Report for 2015 and, having reviewed the document, notes that:

1. the SJU met its key policy and operational objectives as outlined in the adopted 2015 work programme;
2. the SJU's key achievements in 2015 were the following:
    a. launching the SESAR 2020 Programme and transition to the H2020 environment;
    b. the progress of the work on Release 5;
    c. completion of 80% of the SESAR 1 Programme;
    d. the work on specific mandates relating to Data-Communication and Remotely Piloted Aircraft Systems;
    e. the update of the European ATM Master Plan (Edition 2015).
3. The SJU used its resources in line with the activities as described in the work plan;
4. The performance indicators show that overall the targets were met;
5. internal control and management systems were in place and working adequately;
6. the required building blocks of assurance (management assessment, exception register, audits etc) were in place;
7. the main risks for the delivery of the SJU's key objectives were identified and the relevant mitigating measures taken.

Consequently, the Administrative Board concludes that the CAAR 2015 accurately describes the work performed by the SJU in 2015.

5.2. 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 SJU, 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:

Based on the control procedures performed by staff of the SJU, a positive conclusion on the legality and regularity of transactions could be drawn. This conclusion takes into consideration the need for SJU 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 requirements of the 16 ICSs adopted and to ensure the achievement of objectives in its annual work plan.

Building block 2: Register of exceptions:

The SJU has a procedure in place since 2009 for registering exceptions. Its overall objective is to establish appropriate arrangements to ensure that any exceptional circumstance of significant instances of overriding controls or deviations from the established regulatory framework is well explained, registered and reported in accordance with the principle of transparency. An exception must be documented, justified and approved at the appropriate level before any action is taken.

In 2015, three deviations and/or exceptions from the established procedures were registered (see Annex 5)

Building block 3: Audit results during the reporting period:

On 16 November 2015 the European Court Auditors issued its final report on the audit of the SJU's annual accounts for the financial year 2014. In this report, the Court confirms that Joint Undertaking's annual accounts present fairly, in all material respects, its financial position as at 31 December 2014 and that the transactions underlying the annual accounts are, in all material respects, legal and regular.

The Court did not make specific observations.

The below table provides a summary of the internal audits carried out in 2015 by SJU's Internal Audit Capability (IAC) and the Internal Audit Service of the European Commission (IAS):

#	Internal Audits carried out in 2015	Status Update / Recommendations as of 31 December 2015	
1	**IAC Follow-Up Audit on Internal Control Standards** (No. 2. Ethical and Organisational Values, No. 8. Processes and Procedures, No. 10. Business Continuity, No. 11. Document Management). Type: Assurance – follow up audit Fieldwork: December 2015 Deliverable: Final report dated 11 January 2016	The fieldwork of the audit under assessment was finalised on 6 December 2012. All observations and recommendations relate to the situation as of that date. Of the 9 recommendations issued at the time, 1 very important recommendation and five of the six important recommendations have been implemented, whilst one important recommendation remains in progress. Two desirable recommendations were both implemented. **Outstanding action still to be implemented:** Recommendation 9 (Important): Complement the Document Management Policy with operational implementation guidelines and an implementing tool	
2	**IAC follow up audit on Procurement / Contract Management** Type: Assurance – follow up audit Fieldwork: December 2015 Deliverable: Final report dated 11 January 2016	The fieldwork of the audit under assessment was finalised at the end of June 2013. All observations and recommendations relate to the situation as of that date. Of the 5 recommendations issued at the time, 2 of the 3 important recommendations have now been implemented whilst 1 remains in progress. The two desirable recommendations were both implemented. **Outstanding action still to be implemented:** Recommendation 4 (Important): Document Management: Ensure easy access and traceability of all documents related to a contract	
3	IAS Audit on operational governance and Master Plan update (2015) Type: Assurance Fieldwork: October 2015 Deliverable: Final report dated 22 February 2016	Recommendation N° 1 (Very Important): Reinforce the MP update and reporting	The SJU has set up a detailed action plan which is currently being implemented
		Recommendation N° 2 (Important): Improve co-ordination with the Deployment Manager with regard to Level 3 monitoring and reporting	
		Recommendation 3 (Important): Appointment of the new SJU working groups	

Building block 4: Follow-up of reservations from previous reporting periods

The declaration of assurance of the Authorising Officer in the Annual Activity Report 2014 did not contain any reservations.

5.3. Reservations

None.

5.4. Overall conclusion

No qualification is to be made on SESAR JU's programme activities. There are also no reservations on the procedures relating to the selection of participants for SESAR 2020 projects in 2015 and the corresponding underlying financial operations (legal and financial commitments). This is also the case for SJU payments relating to administration and procurement.

6. DECLARATION OF ASSURANCE

I, the undersigned,

Executive Director of SJU

In my capacity as Authorising Officer

Declare that the information contained in this report gives a true and fair view[23].

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 Capability, the observations of the Internal Audit Service 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 Joint Undertaking.

Place: Brussels, 31 March 2016

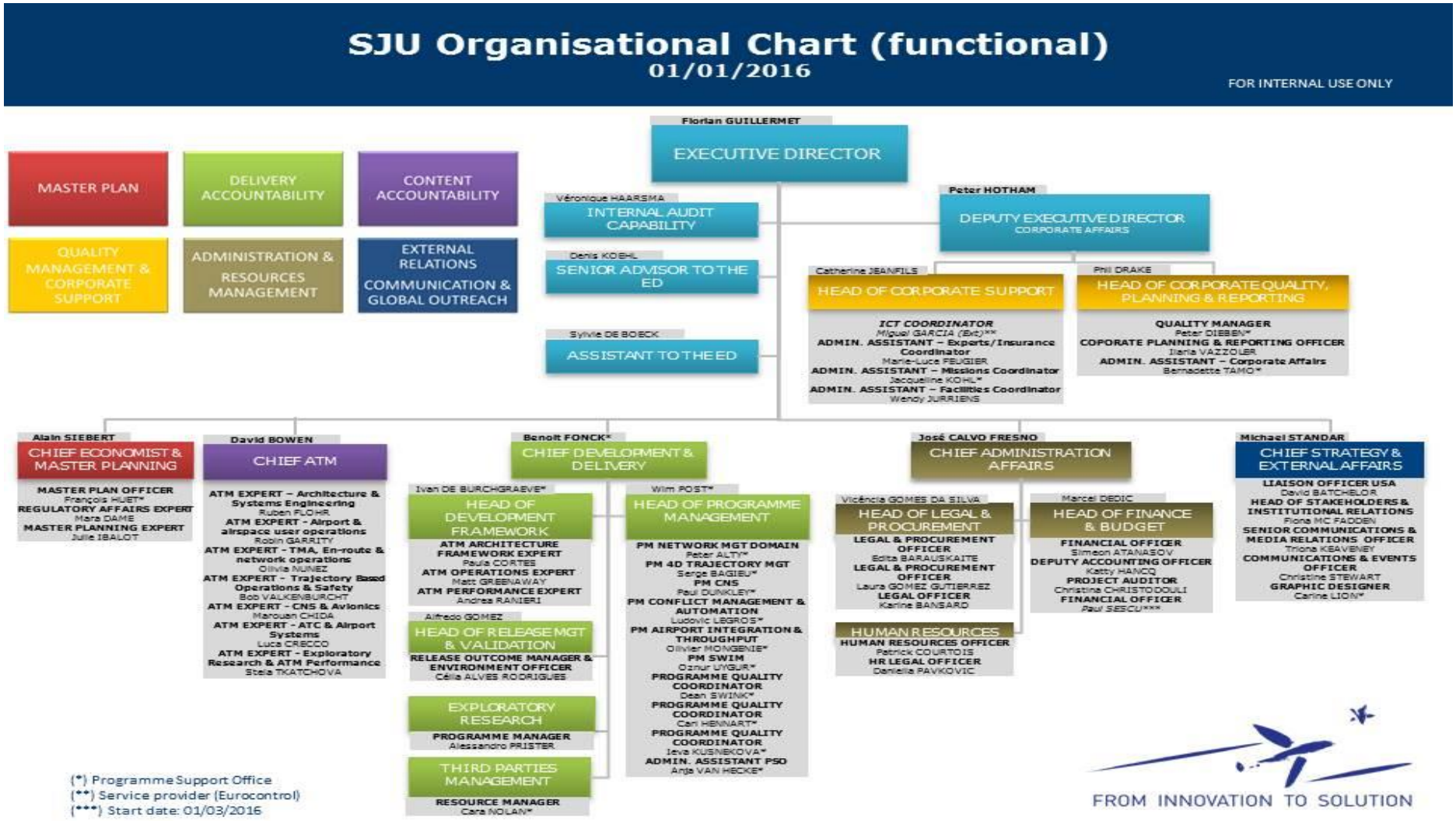
Florian Guillermet

Executive Director

[23] True and fair in this context means a reliable, complete and correct view on the state of affairs in the Joint Undertaking.

7. ANNEXES

Annex 1. Organisational Chart



Annex 2. Establishment plan

Function group and grade	2015				2016		2017			
	Authorised under the EU Budget		Actually filled as of 31/12/2015		Authorised under the EU Budget		Request of the Agency		Draft Budget Request	
	Permanent posts	Temporary posts	Permanent posts	Temporary posts	Permanent posts	Temporary posts	Permanent posts	Temporary posts	Permanent posts	Temporary posts
AD 16										
AD 15										
AD 14		1		1		1		1		1
AD 13										
AD 12		4		3		4		4		4
AD 11										
AD 10		5		5		5		5		5
AD 9										
AD 8		5		5		5		5		5
AD 7		4		4		4		4		4
AD 6		4		4		4		4		4
AD 5		10		10		10		10		10
AD TOTAL		33		32		33		33		33
AST 11										
AST 10										
AST 9										
AST 8										
AST 7		1		1		1		1		1
AST 6										
AST 5		1		1		1		1		1
AST 4										
AST 3		2		2		2		2		2
AST 2										
AST 1		2		2		2		2		2
AST TOTAL		6		6		6		6		6
TOTAL		39		38		39		39		39
GRAND TOTAL	**39**		**38**		**39**		**39**		**39**	

Annex 3. HR Benchmarking Exercise

SJU has undertaken a benchmarking exercise to identify the ratio administrative and operational staff in order to begin to respond to the new requirements of the Framework Financial Regulation (FFR)[24] that stipulates that all EU Bodies should carry out such a benchmarking exercise [on an annual basis] to justify administrative expenditure in a more structured and transparent way.

The complex nature of the FFR's full requirement to cost and compare horizontal services has necessitated a staggered approach to implementation. For 2015 this means that initially the exercise will consist of a review of SJU posts in order to identify the ratio of administrative/coordination to operational staff.

The results of the 2015 screening were as follows:

	Operational/Policy Posts	Admin Posts	Neutral Posts	Total
Number of Posts	21	17	1	**39**
Percentage	54%	44%	2%	100%

Table of 39 positions of the Staff establishment plan per area and activity for 2015-2018

Activity/Sector	Function / Job title	Contract Type/duration	Grade	# Staff	Admin support or policy/ops
Executive Director	Executive Director	TA fixed term + renewable	AD 14	1	
Executive secretariat	Assistant to the Executive Director	TA indefinite (*)	AST 1	1	Admin
Vacant	TBD	TA fixed term + renewable	AD12	1	Policy/Ops
Audit	Internal Audit Capability	TA fixed term + renewable	AD 5	1	Admin
Military aspects of the Programme	Senior Advisor for Military Affairs	TA fixed term + renewable	AD10	1	Policy/Ops
Corporate Affairs including corporate support and corporate quality, planning and reporting	Deputy Executive Director Corporate Affairs	TA indefinite (*)	AD 12	1	Policy
	Head of corporate support	TA indefinite (*)	AD 7	1	Admin
	Administrative assistant	TA indefinite (*)	AST 3	1	Admin
	Head of Corporate quality, planning & reporting	TA fixed term + renewable	AD 8	1	Policy
	Corporate reporting officer	TA fixed term + renewable (**)	AST3	1	Policy
	Administrative assistant	TA indefinite (*)	AST 1	1	Admin

[24] Article 29(3) of the FFR specifies that a benchmarking exercise shall include a review of the efficiency of EU Bodies' horizontal services and a cost-benefit analysis of sharing services or transferring them entirely to another Body or the Commission. Article 38(1) FFR states that taking part in the benchmarking exercise is one of the conditions for the modification of establishment plan up to 10% of authorised posts (except in the case of grades AD 13-16).

Activity/Sector	Function / Job title	Contract Type/duration	Grade	# Staff	Admin support or policy/ops
Strategies and relations with ICAO, follow up of MoC with third countries and communication	Chief Strategies & external Relations	TA indefinite (*)	AD 12	1	Policy
Liaison FAA	Liaison Officer	TA fixed term + renewable	AD 10	1	Policy
Communication internal/external, media	Corporate communication officer	TA fixed term + renewable	AD 5	1	Admin
Implementation of the day-to-day communication strategy	Communication Associate	TA fixed term + renewable	AD 5	1	Admin
Relations with different stakeholders and coordination of ED activities	Head of stakeholders and institutional relations	TA fixed term + renewable	AD10	1	Policy
Development & delivery, Release and validation	Head of Release Management & Validation Team	TA fixed term + renewable	AD 7		Policy/Ops
Development & delivery, Release and validation	Release outcome manager	TA fixed term + renewable	AD 7	1	Policy/Ops
Development & delivery, development framework	Architecture expert	TA fixed term + renewable	AD5	1	Policy/Ops
Development & delivery, development framework	Performance expert	TA fixed term + renewable	AD 5	1	Policy/Ops
Development & delivery, development framework	Conops expert	TA fixed term + renewable	AD6	1	Policy/Ops
ATM	Chief ATM	TA fixed term + renewable	AD10	1	Policy/Ops
ATM	Information Management expert	TA fixed term + renewable	AD 8	1	Policy/Ops
ATM	ATM Expert	TA fixed term + renewable	AD 6	1	Policy/Ops
ATM	ATM Expert	TA fixed term + renewable	AD 6	1	Policy/Ops
ATM	En route ops expert	TA fixed term + renewable	AD 5	1	Policy/Ops
ATM	Long Term Research and Innovation expert	TA fixed term + renewable	AD 7	1	Policy/Ops
ATM	Airport & ATC Systems Engineer	Secondment from Member / 2 years	NA	1	Policy/Ops
AU relations, business case, Master Planning	Chief, Economics & Master planning	TA indefinite (*)	AD 10	1	Policy/Ops
General administration, Finance, legal and HR	Chief Administration Affairs	TA fixed term + renewable	AD 12	1	Admin
Project Audit	Project Auditor	TA fixed term + renewable	AD5	1	Admin

Activity/Sector	Function / Job title	Contract Type/duration	Grade	# Staff	Admin support or policy/ops
Coordination of the Finance and Budget and Sector and responsibility for the follow up of the SJU Budget	Head of Finance & Budget Sector	TA indefinite (*)	AD 8	1	Admin
Accounting	Assistant Accounting Officer	TA fixed term + renewable	AST5	1	Admin
Financial administration	Financial Officer	TA fixed term + renewable	AD6	1	Admin
Legal Affairs and Contract	Head of the Legal Affairs & Contract Sector	TA indefinite *(*)*	AD8	1	Admin
Legal Affairs and Contract	Legal & Procurement Officer	TA fixed term + renewable	AD 5	1	Admin
Procurement procedures, personal data protection, day-to-day legal issues	Legal & Procurement Officer	TA fixed term + renewable (**)	AD 5	1	Admin
HR Legal matters	HR Legal Officer and Data protection officer	TA fixed term + renewable (**)	AD5	1	Admin
Recruitment, HR Administration, staff development	HR Officer	TA indefinite (*)	AST 7	1	Admin

(*) Staff member eligible to Transitional Provisions Article 2 of Council Regulation (EC) 1361/2008 (10 staff)
(**) Position currently covered by a CA (see below)

The 2 additional positions requested for 2016 and 2017 are the following:

Financial administration	Financial Officer	CA fixed term (2 years)	FGIV	1	Admin
Legal Affairs and Contract	Legal officer	CA fixed term (2 years)	FGIV	1	Admin

Annex 4. List of tenders launched by SJU in 2015

Procurements

CALL REF	*TITLE*	*Procurement or Grant?*	*Type*	*Amount (€)*	*Date Launched*	*Status at end 2015*
SJU/LC/107-CFT	SJU Web conference solution	Procurement	Open call for tenders	60,000	09/03/2015	Cancelled
SJU/LC/117-CFT	Office Refurbishment Works	Procurement	Negotiated low value	60,000	22/06/2015	Awarded
SJU/LC/118-CFT	Study on the assessment of the SJU Rules alignment to H2020	Procurement	Negotiated low value	60,000	20/07/2015	Cancelled
SJU/LC/116-CFT	Young Scientist Award 2015	Procurement	Contest	5,000	04/08/2015	Awarded
SJU/LC/119-CFT	Additional Office Refurbishment Works	Procurement	Negotiated procedure Article 134(1)(e) RAP	10,000	01/09/2015	Awarded
SJU/LC/123-CFT	Provision of strategic communications, editorial support, graphical, digital and events-related communications services	Procurement	Open call for tenders	900,000	03/11/2015	Ongoing
SJU/LC/120-CFT	Industrial Support - Contract SJU/0006-CTR extension	Procurement	Negotiated 134.1 e	4,926,000	06/11/2015	Ongoing
SJU/LC/121-CFT	Replacement of Flooring at SJU Premises	Procurement	Open call for tenders	60,000	18/11/2015	Ongoing
SJU/LC/124-CFT	Additional Services and Supplies (shadings)	Procurement	Negotiated procedure Article 134(1)(e) RAP	4,000	18/11/2015	Awarded
SJU/LC/122-CFP	Call for Final Membership Applications	Procurement	Restricted Ad Hoc Call	n/a	25/11/2015	Ongoing
SJU/LC/125-CFT	Definition and implementation of the ATM Master Planning	Procurement	Low Value Contract	15.000	21/12/2015	Ongoing

CALL REF	TITLE	Procurement or Grant?	Type	Amount (€)	Date Launched	Status at end 2015
	Committee					

Grants

CALL REF	TITLE	Procurement or Grant?	Type	Amount (€)	Date Launched	Status at end 2015
H2020-SESAR-2015-1	Exploratory Research H2020 Call 1	Grant	Open call for proposals	20,600,000	19/03/2015	Ongoing
H2020-SESAR-2015-2	Industrial Research / VLD SESAR2020 Wave 1	Grant	Restricted call for proposals	50,000,000	22/10/2015	Ongoing

Annex 5. Exception Register 2015

Under Article 32(3) of the EU's Financial Regulation and Article 29 of the SJU's Financial Regulation, the Joint Undertaking is required to implement its budget in compliance with effective and efficient internal control. In practice this means that there must be procedures for monitoring of performance and for follow-up of internal control weaknesses and exceptions.

According to the European Commission's Standing Instructions for Annual Activity Reports, a reservation should be included in the annual declaration of assurance in the context of the annual activity reporting on the basis of (both qualitative and quantitative) materiality criteria. From a qualitative point of view, the significance is judged on the basis of the following: nature and scope of the weakness; duration of the weakness; existence of satisfactory compensatory measures (mitigating controls) and existence of effective corrective actions (action plans). From a quantitative point of view, a weakness is considered material if the financial impact or risk of loss is greater than 2% of the authorised payments of the reporting year. Having regard for the above, the authorising officer then determines whether significant deficiencies exist that would lead to a formal reservation in the declaration of assurance on the basis of such defined materiality.

The SJU has had a procedure in place for the registration and management of exceptions since 2009. Details of exceptions registered by the SJU in 2015 are outlined below.

#1.

Exception type:	Financial
Sub-type:	Budgetary
Description of Exception:	Ex-post budget commitment
Location:	Brussels, Belgium
Material?[25]	N
Comment:	Late budget commitment to cover renewal of legal commitment concerning extension of a cleaning contract with Atalian Cleaning Services.
Corrective Action Taken:	n/a

#2.

Exception type:	Legal
Sub-type:	Procurement
Description of Exception:	Implementation of a specific contract before signature of all parties constituting a breach of the procurement rules.
Location:	Brussels, Belgium
Material?	N

[25] See qualitative and quantitative materiality criteria in para 1 of this annex.

Comment:	A supplier provided promotional material for an SJU event without a signed contract. The Framework Contract under which this process was initiated does not explicitly disallow a retroactive entry into force. Therefore a 'retroactive into force' clause was inserted into the contract. Because this constitutes a breach of the procurement rules, an exception was registered.
Corrective Action Taken:	n/a

#3.

Exception type:	Legal
Sub-type:	Procurement
Description of Exception:	Signature of an amendment after expiry of an agreement and retroactive entry into force of a proposed contract extension.
Location:	Brussels, Belgium
Material?	N
Comment:	Amendment and retroactive entry into force of a co-financing agreement with the Newbridge project consortium due to significant project delays. The granting of the extension to the contract can be justified for the purposes of reflecting the correct consortium composition, the principles of FP7 funding and to accommodate the late delivery of the project.
Corrective Action Taken:	n/a

Annex 6. SESAR Work Package Updates

WP 3 – Validation Infrastructure Adaptation and Integration

Scope:

The scope of WP3 is defined by the evolution of required Industry-Based/Pre-Operational Verification and Validation Platforms to include simulation, shadow mode and/or live trials capabilities. Combined with the connection/integration of the necessary test tools, this allows these platforms to be used for verification and validation activities.

WP3 also has the responsibility of SESAR Verification and Validation Infrastructure (V&VI) that includes the set of preparation/analysis tools, Validation and Verification facilities and test equipment.

Objectives:

The objective of WP3 is to support the SESAR Partners and operational and technical threads to define and coordinate the timely evolution and setting up of Verification and Validation Platforms along with the required support to adaptation and integration of the relevant tools and prototypes focusing on V2 and V3 maturity phases.

Relevant Activity in 2015:

WP3 continued to support SJU in the analysis of completeness, correctness and coherency of the Verification and Validation (V&V)data. In the context of Release 5, WP3 led successfully the System Engineering Review 2 following the validation exercises life cycle.

For validation exercises (either R5 or no-release exercises) WP3 continued to support operational, system and transversal projects at different stages of the validation chain by:

- capturing V&V needs,
- supporting the development and/or the adaptation of the Validation Industrial Platforms (IBPs), the V&VI infrastructure and the measurement tools,
- integrating the prototypes made available by the primary system projects into the IBPs, doing their technical acceptance in order to ensure their readiness for validation exercise execution.

Furthermore, in Release 5, WP3 assessed 4 exercises SWIM-enabled in the SE#2.

WP3 has established recognised system engineering and information methodology within the programme for all aspects linked to the V&V Platforms evolution, including its verification. The steadily increasing number of projects requesting for WP3 support for their validation activities confirms this.

The activities planned by WP3 were conducted in due time and quality, the planned tasks progress being continuously monitored.

WP 4 – En-Route Operations

Scope:

The scope of Work Package 4 is to provide the operational concept description for the En- Route Operations and perform its validation. The term “En-Route” includes both ‘continental’ and ‘oceanic’ applications. The applications of 4D and performance-based operations are also seen as a cornerstone of future en-route operations.

Objectives:

The objectives of WP4 are to:

- Develop, refine and update the En Route concept, based upon the SESAR CONOPS and ensure consistency with other elements of the work programme;
- Define and perform the necessary validation activities including operability, safety & performance assessment at all levels;
- Demonstrate the operational feasibility of the En Route Operations concept in a complete ATM environment (including systems) in order to:
    - Improve the provision of the Separation service through the development of concept using advanced RNP capabilities, full aircraft capabilities in terms of 4D while optimizing the controller work (evaluating the concept of Multi Sector Planners for improve sector productivity);
    - Improve the ground safety nets functionalities considering the proposed operational functionalities such as used of Downlink Aircraft Parameters, or the improved air-ground collaboration;
    - Improve the airborne safety nets in order to reduce false alerts and to consider latest evolutions.

These objectives are being achieved through a portfolio of 16 R&I projects.

Relevant Activity in 2015:

The concept activity has been consolidated with the one of the other domains under the umbrella of B04.02 to produce a first draft of the TRANSITION CONOPS S2020; the development of the supporting TRANSITION S2020 Validation Strategy has been done under the leadership of Project 05.02.

The major focus has been on the Business Trajectory with the delivery of the first Interoperability document and major progress on the associated validation activity; as one of the SESAR pillars the Programme Committee has been working on a new approach to secure the development of the Business Trajectory till the end of the Programme. It is to be noted that FREE ROUTE operations solutions have also matured at v2 level, while full validation of PBN SESAR Solution for PCP has been performed.

Safety nets are reinforced with the development of a technical solution to downlink resolution advisories and with the definition of European needs & acceptability criteria for ACAS Xa (in close collaboration with the FAA and EUROCAE). Projects dedicated to mid-term conflicts management have achieved key results through V3 validation of innovative Tactical Controllers Tools for evolutive traffic.

The project dedicated to Rotorcrafts & General aviation is now up and fully running in the Programme with a set of validation activities defined to mature operations & technologies such as Pins, i4D for rotorcrafts in 2016.

<u>WP 5 – TMA Operations</u>

Scope:

Work Package 5 manages and performs all Research, Development and Validation activities required to define the Terminal Manoeuvring Area (TMA) ATM Target Concept (i.e. Concept of Operations, System Architecture & enabling technologies). This covers all phases of planning and execution of flights/trajectories and the identification of supporting technical systems/functions necessary for TMA Operations. TMA Operations are considered as those from ‘top-of-descent’ until landing and from take-off until ‘top-of-climb’. Also, the applications of 4D, time-based operations are seen as a cornerstone of future TMA and En-route operations.

Objectives:

The objectives of WP5 are to:

- Refine the concept definition at TMA operational context level and for co-ordinating and consolidating the various projects and sub work packages that encompasses Terminal Airspace Operations;
- Define and perform the necessary validation activities including operability, safety & performance assessment at all levels;
- Demonstrate the operational feasibility of the TMA Operations concept in a complete ATM environment (including systems);
- Consider the potential for operational trials and the early introduction of SESAR Concepts in a TMA environment;
- Develop, refine and update the TMA concept, based upon the SESAR CONOPS and ensure consistency with other elements of the work programme;
- Define and perform the necessary validation activities including operability, safety & performance assessment at all levels;
- Demonstrate the operational feasibility of the TMA Operations concept in a complete ATM environment (including systems) in order to:
    - Improve the Traffic Synchronisation service through the development of concept using advanced RNP capabilities, full aircraft capabilities in terms of 4D while optimizing the controller work by evaluating the concept of Multi Sector Planners for improve sector productivity;
    - Improve the Vertical Profile management functionalities considering the RNAV aircraft capabilities;
    - Improve the Controller Working Position for both En Route and TMA Operations

Relevant Activity in 2015:

The concept activity has been consolidated with the one of the other domains under the umbrella of B04.02 to produce a first draft of the TRANSITION CONOPS S2020; the development of the supporting TRANSITION S2020 Validation Strategy has been done under the leadership of Project 05.02.

Several projects were closed in 2015 (such as P05.06.03 and P05.06.04 as they contributed to the delivery of SESAR Solutions on Extended AMAN and Transition RNP to LPV, as expected by the PCP). It is to be noted that key validation activities at v3 level have been completed to secure SESAR Solution deliveries (such as CTA operations and CDO). In addition, new perspectives for ASPA sequencing and merging have been investigated through a benchmarking of all activities in this domain (e.g. FAA FIM programme, EUROCAE-RTCA standardisation activities, etc.)

For the first time, integrated validations of various pieces of concept and solution have been achieved bringing new perspective for the maturity of individual Solutions and opening the door for the need for future complex validation activities.

WP 6 – Airport Operations

Scope:

The Airport Operations Work Package addresses developments associated with the ‘airside’ elements of airport operations. To ensure effective planning and management, ‘landside’ elements (such as passenger and baggage handling) are also being taken into consideration, but with associated developments being undertaken outside SESAR.

Objectives:

The objectives of WP06 are to:

- Develop, refine and update the Airport Operations concept, based upon the SESAR CONOPS and ensure consistency with other elements of the work programme;
- Develop collaborative airport planning, monitoring and management including development of the Airport Operations Plan (AOP) and the Airport Operations Centre (APOC), as well as improvements to Airport CDM;
- Improve the management of airport surface traffic (which includes aircraft and vehicle traffic) through the definition of safety nets to prevent conflicts and collisions, as well as the better routing, guidance and tactical planning of traffic movements under all weather conditions;
- Improve runway management through enhanced procedures, dynamic separations (including wake vortex) and the definition of associated system operational requirements (both ground and airborne). The focus is on improving runway throughput at all times, whilst preventing runway incursions and reducing queuing;
- Improve the provision of aerodrome control services for small and medium airports through the development of the remote tower concept, and maximise the available airport capacity through the use of remote contingency towers.

These objectives are being achieved through a portfolio of 17 R&I projects.

Relevant Activity in 2015:

2015 saw the refinement of the operational concept and the planning and execution of many validation activities. Most of the operational concepts under development in WP06 reached an initial and sometimes final V3 maturity level.

WP06 delivered two SESAR Solutions in Release 4: Remote Tower for two low density aerodromes (Solution #52), Pre-departure sequencing supported by Route Planning (Solution #53), Flow based Integration of Arrival and Departure Management (Solution #54) and Precision approaches using GBAS CAT II/III based on GPS L1 (Solution #55). It must be noted that Solution #53 contributes to PCP AF#2 'Departure Management Synchronised with Pre-departure sequencing' sub-functionality.

Several Release 5 V3 validation exercises, many of them addressing more than one SESAR Solution, were planned and sometimes executed in the course of 2015.

WPs 7 & 13 – Network Operations

Scope:

The scope of the Network Operations Work Package covers the evolution of services taking place in the business development and planning phases to prepare and support trajectory-based operations including airspace management, collaborative flight planning, demand capacity balancing and Network Operations Plan (NOP). It encompasses the services included in the execution phase to facilitate trajectory-based operations in case of capacity issues.

Objectives:

The objectives of the Network Operations Work Package are to:

- Develop, refine and update the Network Operations concept and architecture, based upon the SESAR CONOPS and ensure consistency with other elements of the work programme;
- Develop the methodologies for airspace management and organisation, including processes for an improved flexible use of airspace, the accommodation of user preferred routes and dynamic airspace configurations;
- Develop the Business/Mission Trajectory management (including the Shared Business Trajectory, used for advanced planning and the Reference Business trajectory, which is the final and agreed trajectory);

- Define and develop the User Driven Prioritisation Process (UDPP), whereby operators can apply their own priorities during periods of capacity shortfall, based upon a CDM approach.
- Further develop the Network Operations Plan (NOP), a dynamic rolling plan providing a detailed overview (past, current and forecast) of the European ATM environment to those concerned;
- Improve Demand Capacity Balancing (DCB) process to ensure that the ATM network is able to meet the demands of all users, taking into account the 4D trajectories, described through Reference Business Trajectories (RBT);
- Develop improved flight briefings for pilots and flight dispatchers, through the use of integrated digital Aeronautical (including Digital NOTAM) and MET data.

Relevant Activity in 2015:

During 2015, the Work Package 7/13 projects made significant progress on the validation of 'Network Operations' concepts, many of which are highly relevant to the Pilot Common Project.

- Project 07.05.04 performed two major validation exercises addressing the Advance Flexible Use of Airspace concept: VP710 validated the feasibility and benefits of updating the real-time airspace status automatically into the Network Manager systems, delivering a CDM process between ASM Support Systems, NM systems, ATC and airspace users; VP717 validated the use of the Variable Profile Area (VPA) design principle for Airspace Reservations (ARES) both in the ATS route network and in free route airspace.
- Project 07.06.01 defined operational requirements and planned integrated validations addressing three main lines of action for the Network Operations Plan (NOP), namely: AOP-NOP integration, NOP-MET integration, and Performance Management. These integrated validations – principally VP700 and VP749 – are planned to be completed in 2016.
- Project 07.06.02 performed major validation activities for Business/Mission Trajectory Management, including: preparations are at an advanced stage for VP713 which, in early 2016, will validate the impact of the Extended Flight Plan on flight plan validation and distribution, and network predictability; the VP714 exercise validated the integration of the Network Manager and Maastricht UAC in the Flight Object Network; the VP716 exercise demonstrated the feasibility of implementing the improved OAT flight plan and the corresponding environment data in the central flight plan management and validation process of the Network Manager.
- Project 07.06.02 also performed important concept development and validation activities addressing the User Driven Prioritisation process (UDPP): for UDPP Step 1 – which covers flight exchanges within a sequence list at a point of congestion (e.g. arrival, en-route, departure) - fully documented SESAR Solutions were published for ATFM slot swapping and airport departure sequencing; for UDPP Step 2 – which addresses a more anticipative management of flight schedules - 'expert gaming' validations were performed on the Fleet Delay Apportionment (FDA) and Selective Flight Protection (SFP) measures.
- Project 13.02.02 developed digital briefing systems that integrate digital aeronautical (including digital NOTAM) and meteorological data. In early 2016, VP461 plans to validate the improvements to situational awareness for airspace users making use of these products in pre-flight and in-flight briefings.
- Project 13.02.03 has progressed important concept development and validation work for both Short-Term ATFCM Measures (STAM) and Target Time Management. The VP700 local STAM tools exercise is validating improvements to Demand & Capacity Balancing measures through the use of local tools at several ANSPs. The VP749 exercise – to be held in April/May 2016 – will validate the benefits of using locally generated target times; the exercise is aligned with the iStream Large Scale Demonstration.
- Project 07.02 has actively participated in the SESAR 2020 Transition activities related to concept and architecture.

Looking ahead to 2016, Work Package 7 and 13 projects must deliver fully documented SESAR Solutions, supported by evidence in the form of validation reports.

WP 8 – Information Management

Scope:

In order to realise the concept of SWIM (System Wide Information Management) for ATM, which is needed to achieve interoperability and inter-system seamless operations, WP8 primarily defines the ATM Information Reference Model (AIRM) and the Information Service Model (ISRM) to be used by the various ATM services and necessary to develop the SWIM specifications and test platforms.

Objectives:

The Objectives of WP 8 are to:

- Describe the performance and operational requirements of ATM wide information sharing;
- Strongly contribute to the definition of the Information View of the European ATM Architectural Framework and the ATM Information Model;
- Develop and document the European ATM Information Reference Model (AIRM);
- Support the standardisation of ATM Information;
- Secure semantic and syntactic interoperability within ATM for Europe and support to an overall global commitment in the same field;
- Be responsible for ensuring the effectiveness and integrity of the functional architecture for Information Management;
- Integrate the ATM world in the information sense, a necessary step towards the realisation of Service Oriented Approach (SoA);
- Produce and document (ATM) Information Service in support to a variety of system WPs or other Industry segments;
- Directly drive the operational requirements for the technical system architecture of Information Management to be developed in the SWIM Work Package (WP 14);
- Validate deliverables from various Operational WPs in.

Relevant Activity in 2015:

During the course of 2015, project 08.03.01 has been closed while WP-B addressed the need for SWIM supervision at system level.

WP08 is composed of the below listed projects;

- 08.01.01 for the main task; SWIM governance.
- 08.01.03 for the main task; information modelling.
- 08.03.10 for the main task; service development.

WP8 has been in 'steady production mode' in 2015.

The SWIM compliance framework was updated by 08.01.01 for R5 SWIM enabled exercises. This framework has been implemented for several SWIM enabled exercises. 08.01.01 project gathered the feedback during compliance checks and R2SE2 reviews were used for the improvement of the SWIM compliance framework. The new SWIM registry tool was made public as the SESAR Working Method on Services (WMS) foresees the use of a SWIM Registry for publication and discovery of information related to logical services as well as service implementations.

The SWIM Registry can be used for the following;

- As a repository of guidance materials, which will help to the service providers implement SWIM Compliant Services by identifying what needs to be done to implement SWIM compliant services;

- As an implementation repository that keeps track of all SWIM service prototypes produced in SESAR by supporting service providers to register their service implementations and allowing the consumers to discover the implemented services;
- As a repository of SWIM compliance assessments.

An update of the SWIM Concept of Operations and IM Functions documents were produced by project 08.01.01. These documents are considered to be one of the important outputs of the SESAR programme for the first SWIM deployment. It is revealed during the assessment of these documents that the documents still need to be improved to reach a certain maturity level. It is decided with the project that the experience of implementing and operating the SWIM Evolution Management function within the programme will be used to achieve this goal. Several SEMG meetings were executed and the discussions were also reflected to the other 08.01.01 deliverables such as the SWIM foundation.

In general 08.01.03 has been steadily progressing according to plan. Two AIRM releases were delivered providing a baseline vocabulary for the operational projects. The actual and consistent use of this standard vocabulary by those projects remains to be better assured. The AIRM governance has reached a mature level of operations allowing a controlled and traceable evolution of the AIRM. Also the AIRM Foundation Rulebook has been delivered as a separate deliverable.

In general 08.03.10 has been steadily progressing according to plan. Two ISRM (Information Service Reference Model) releases were delivered providing the service descriptions and the model. The improved structure of the project was maintained and the project was delivered according to the agreed plan. Assessment of the delivered models was presented that the maturity level of the ISRM deliveries were increased progressively.

WP08 participated to the SCG meetings and keep their AIRM and ISRM development plans up to date according to the service roadmap (R5 validation activities). An analysis was undertaken to outline how the SCG can achieve full coverage on the development of the required services for the PCP[26]).

All WP08 projects contributed to SESAR 2020 preparation activities such as the WMS (working method and services) and SESAR 2020 architecture definition activities.

WP 9– Aircraft Systems

Scope:

The scope of the Aircraft System Work Package covers the required evolutions of the aircraft platform, in particular to progressively introduce 4D Trajectory management functions in mainline, regional and business aircraft to provide 4D trajectory management capabilities. In addition the Aircraft System Work Package is required to develop the necessary technological solution in support of the SESAR operational validation and ATM solution (e.g. GBAS, Software Define Radios, D-TAXI …). The work package addresses:

- Developing and validating at aircraft level all airborne functions identified in the SESAR ATM Master Plan;
- Ensuring operational & functional consistency across stakeholder airborne segments (Commercial Aircraft, Business Aviation, General Aviation, Military Aircraft, UAS, etc.);
- Identifying technical solutions for different airborne platform types such as Mainline aircraft, Regional aircraft and Business Jets;
- Ensuring global interoperability and coordination with important external initiatives such as NextGen in the U.S.

[26] Commission Implementing Regulation (EU) No 716/2014 27 June 2014

Objectives:
The objectives of WP9 are to:

- Achieve a greater integration of the aircraft in heart of the performance-based European ATM system allowing an optimum exploitation of the increasing aircraft capabilities;
- Introduce progressively the 4D Trajectory management functions. Initial 4D Trajectory capabilities will require, first, the downlink airborne computed predictions on the ground to establish a sequence on a merging point, and, second, improved time constraints management capabilities both contributing to first generalise Continuous Descent Approaches from Top to Descent in mid and high density areas. A further step will allow the full exploitation of 4D Trajectory through ensuring that the aircraft is able to compute and to share reliable gate to gate 4D trajectory predictions with the ground and execute the agreed reference trajectory with possibly imposed times constraints;
- Enhance On-board approach functionalities and validate them to provide improved and all weather operations. This will allow initial CAT II/III GBAS L1 approach for new aircraft, providing rapid benefits under low visibility conditions. A second step will address the implementation of full multi-constellation (GPS, GALILEO) GBAS Cat II/III in the airborne equipment;
- Develop future on-board surveillance systems, including dedicated wake encounter and significant weather (e.g. clear air turbulence) avoidance functions, to reduce the risk of severe upsets due to atmospheric disturbances;
- Address environmental impact through Advanced Continuous Descent Approach aiming at minimising fuel burning and emissions, and decreasing noise;
- Improve surface movement operations through the introduction of functions to initially provide guidance and then alerting on traffic;
- Ensure interoperability between civil “Business trajectories” and military “Mission Trajectories” to allow the conformance of military aircraft with new operational concepts and to enable military aircraft to fly with the same performance level than civil aircraft to better exploit airspace resource avoiding restricting part of it for military use only;
- Provide a globally compatible avionics transition roadmap supporting the different SESAR Steps, to be used as a reference by avionics and airframe manufacturers for development planning, hence minimising the number of transition steps for a better cost efficiency;
- Develop a gradual evolution of Airborne Separation Assistance services allowing first to an aircraft to establish and maintain time spacing from a target aircraft designated by the Air Traffic Controller (ASAS-Spacing). On-board functions will be further validated to gradually introduce ASAS Separation Crossing and Passing (C&P) manoeuvres with the aim to help controllers in resolving conflicts between aircraft by temporarily delegating to the Pilots the responsibility to do the requested manoeuvre (e.g. vertical or lateral C&P) and maintaining separation during that manoeuvre.

In order to support the above evolutions, enhancement and additions to the CNS Technologies are foreseen, including updates to ADS-B, Airport datalink and Flexible communication avionics and improved navigation positioning technologies while addressing the different types of airborne platforms.

Relevant Activity in 2015:

In 2015, twenty-three system projects were under execution (P09.30 merged into P09.11), one federating project (P09.49) and 1 Management Project. Of these, the six projects that have been formally closed in 2015 include P09.09, P09.10, P09.16, P09.20, P09.24 and P09.48. At the end of the year, 17 are in Execution Phase and one proposed for closure. Three projects are proposed for closure in the first quarter of 2016, namely P09.11, P09.33 and P09.39.

Of these, a maximum number of projects are fully integrated within Operational Focus Areas, namely P09.12 and P09.27 in OFA01.01.01, P09.14 in OFA01.02.01, P09.01, P09.03 and P09.05 into OFA04.01.02, P09.13 and P09.31 merged into 09.11 and within OFA04.02.01 and P09.39 P09.11

(including the scope of merged P09.30) into OFA03.03.01. It should also be noted that the closed projects P09.09 and P09.10 were within OFA03.02.01.

The remaining WP09 projects were grouped with WP15 projects for incorporation within three Enablers consisting of ENB01.01.03 for Communication, ENB01.01.04 for Navigation and ENB01.01.05 for Surveillance.

In terms of progress and maturity:

- Five projects have progressed to V3 (P09.01, P09.05, P09.13, P09.14 and P09.33) and developing core step 1 airborne functions. These are used to perform a large number of operational validation activities with several operational projects and partners;
- Two Technology projects (P09.12 and P09.16) have developed prototypes and completed testing against ground equipment;
- SESAR Technical Solutions – Airport Surface Data Link AeroMACS (09.16 / 15.02.07) and Hybrid Surveillance (P09.47), Flexible Communication Avionics (09.44) and SESAR Operational and Technical Solution GBAS CAT II/III GPS L1 (P9.12, P15.3.6).

In 2015,

- Project 09.01:Further to the Operational evaluations successfully demonstrated the technical feasibility of the i4D concept within the Airborne Initial 4D Trajectory Management project, the validation activities have been extended into 2016 in order to improve the airborne systems with enhanced ATM functions. Regional activities are considered as completed. The consolidation of Rotorcraft (P04.10), Military (P09.03) and Civil (P09.01) i4D requirements are in progress. P09.01 was involved in major release exercises: • EXE-05.06.01-VP-477 and EXE-05.03-VP-805. The EUROCAE ED75 standard on required navigation performance for area navigation has now been published and is in line with functional and performance requirements defined in SESAR prototypes;
- Project 09.02: The “Airborne Full 4D Trajectory Management & 4D contract capability” project has undertaken a 4D Operations on-board need analysis and workshop. The High Level Functional Requirement and Operational Assumptions Definition- Issue 1 was produce in 2015 and the second version is planned for 2016;
- Project 09.05: ASAS-ASPA project has been supporting a number of Release 5 Exercises with ASA Spacing function combined with Controlled Time of Arrival;
- Projects 09.09 and 09.10 addressing RNP to xLS which were integrated within the OFA 02.01.01 Optimised 2D/3D Routes are now closed;
- Projects P09.11 (including P09.30) is scheduled for closure. Developments of a prototype HMI supporting the prediction, alerting and avoidance of severe wake encounters and its integration in a cockpit simulator have been completed;
- Further to the completion of P09.21, Project 09.22 “Mid & Full ADS-B Capability Research” initial results have proved positive. The second phase of this project has been commenced to continue with ADS-B ES evolution, namely with phase modulation of the 1090 Extended Squitter. The project was extended as the focal project for the further development of the ATSU prototype through to 2016 and has now completed its activities with the delivery of the 4th generation of aircraft Datalink Communication computer (ATSU) for mainline Airbus, in preparation for future Very Large Scale demonstration;
- Project 09.12 GBAS Cat II/III has included significant contributions to the definition of GBAS – GAST-D and to International standardisation, including flight trials for mainline and business aircraft. Good progress is being made on GBAS Cat 3 validation and the final SARPS should be available in December 2016;
- Military data link accommodation contributions from 09.20, 09.24 and 15.02.08 are complete with flight trials performed in September 2014 and projects closed in 2015. The output of these projects contributed towards the 09.03 flight trials at the end of 2015; Tests

performed within the frame of EXE-5.3-VP805 have demonstrated the compatibility of military aircraft to consider ADS-B to fly ASAS Spacing operations;

- Project 09.29 was successfully developed and validated at V2 maturity level HMI and algorithms for business and regional aircraft Combined Vision System (CVS) to support more efficient approach and landing in low visibility conditions. The project is now in phase 3;
- Continuous Climbing Cruise Project 09.39 has performed additional opportunity studies. The project is now preparing for closure;
- Flexible Communication Avionics 09.44 demonstrated initial feasibility and benefits. The phase 2 activities to develop prototype elements for verification is progressing well with closure planned for mid-2016;
- Project 09.49 Global Interoperability – Airborne Architecture and Avionics Interoperability Roadmap: the final versions of the functional architecture and Avionics roadmap have been delivered. The multi-function (9.01, 9.05, 9.33) integration activities have been performed based on the Validation platform developed by Airbus. The retrofit analysis and Interoperability analysis are being finalised;

Other projects have also progressed, producing functional requirements, functional architectures as well as technical studies to validate technical choices or to secure key points.

The majority of projects are also contributing to standardisation.

WP 10 – En-Route & Approach ATC Systems

Scope:

The scope of this Work Package covers En-Route & TMA ATC System systems' changes, and related technical activities of phases V1-V3 of the development lifecycle reference model (i.e. up to the validation of system performance using pre-industrial prototypes). It addresses system/technical aspects such as functional and technical architecture, technical performance & safety requirements, technical interoperability requirements, associated specifications, models/simulation platforms and prototypes, technical validation and the development of inputs /proposals to technical standards groups.

Objectives:

The objectives of WP 10 are:

- ATC system impact analysis of the operational improvements and identification of the induced system requirement to implement the evolution;
- Technical feasibility assessment of the operational changes from an architecture and technology point of view;
- Define, design, specify and validate the En-route & TMA ATC Systems needed to support the SESAR ATM target concept;
- Prototype development for system and operational validation.

Relevant Activity in 2015:

The technical architecture activity has been consolidated with the one of the other domain under the umbrella of B04.03 to produce a first draft of the TRANSITION ADD S2020.

Several prototypes were developed and successfully used in v3 validation activities securing the full maturity of the corresponding solutions; in particular for PCP related solutions such Extended AMAN (P10.09.02) but also FREE Route Operations (P10.04.01), and RA Downlink to CWP position (P10.04.03).

Regarding IOP, P10.02.05 has succeeded to mature new prototypes interfacing with recent FDPs (iTeC, Coflight) and achieving successful set of validation activities both at factory-level and operational-level.

Several projects have been closed as they achieved their full scope and produced full documentation in support of the SESAR Solution (e.g. 10.04.04).

WP 11.01 – Flight Operations Centre

Scope:

The scope of 11.01 covers Flight Operations Centres and Wing Operations Centres. Since WP11.01 is both an operational and a system work package, the work covers concept development, validation, system development and verification.

Objectives:

The objective of WP11.01 is to provide the system definition and contribution to operational validations for a generic Flight Operations Centre / Wing Operations Centre (FOC/WOC) that meets the user needs operating in the SESAR target ATM network. A key aim is to promote effective collaboration and interoperability between the FOC/WOC and the rest of the ATM system.

Relevant Activity in 2015:

During 2015, Work Package 11.01, under the overall coordination of Airbus SAS, continued to work on a close integration of Flight Operations Centre and Wing Operations Centre perspectives with the rest of the Programme. There was a major involvement of airspace users in this work.

- Lufthansa Systems and Sabre Airline Solutions developed prototypes for the VP713 Extended Flight Plan validation exercise which is due to be completed in first quarter 2016.
- Lufthansa Systems contributed to the VP710 Advanced Flexible Use of Airspace validation exercise, addressing the feasibility and benefits, from an airspace user perspective, of the automatic update of real-time airspace status. They also contributed to the VP797 Free Routing validation exercise.
- Airbus Defence & Space Systems developed prototypes and led the VP789 validation exercise, addressing the following aspects of the State Airspace Users' mission: maintaining aeronautical data; airspace reservation and CDM; flight planning; mission monitoring. They also contributed to the validation of the improved OAT flight plan.
- Sabre Airline Solutions have developed a prototype for the VP791 validation exercise, addressing the integration of global ensemble weather forecasts into the trajectory management optimisation and flight planning processes. This work was performed in close collaboration with the 11.02 Meteorological Information Services work package.
- Sabre Airline Solutions developed a prototype and contributed to the validation of the Step 2 User Driven Prioritisation Process, a concept, which addresses a more anticipative management of flight schedules using the Fleet Delay Apportionment (FDA) and Selective Flight Protection (SFP) measures.
- Honeywell and Sabre Airline Solutions developed prototypes and contributed to the VP461 validation of Integrated Digital Briefing across all phases of flight.
- Work Package 11.01 has actively participated in the SESAR 2020 Transition activities related to concept and architecture for the FOC/WOC aspects.

Looking ahead to 2016, a key challenge for 11.01 will be to ensure that the FOC/WOC and airspace user perspectives are taken into account in the SESAR Solutions and the supporting documentation.

WP 11.02 – Meteorological Information Services

Scope:

The scope of the standalone Work Package, 11.02, covers: promoting current and future MET capabilities with the aim of gathering robust and detailed requirements for MET data and services; the design and development of MET infrastructure (including MET prototypes and the 4DWxCube) to support validation.

Objectives:

WP11.02 addresses the requirements for meteorology within the SESAR Programme, in particular in relation to the impact meteorology will have on 4D trajectory based systems of the future, and in managing predictability in an efficient way.

When considering the integration of MET with the rest of SESAR, a distinction should be made between the provision and exchange of MET information (the role of 11.02), and the integration and use of MET information (performed by the operational projects).

Relevant Activity in 2015:

During 2015, Work Package 11.02 developed prototypes for advanced MET capabilities for use in integrated validation exercises led by operational projects.

- The 4D Weather Cube/MET-Gate was verified in June. This solution enables tailored MET information to be made available to ATM stakeholders via a SWIM compliant MET-Gate. The 4DWxCube received a Best-in-Class award at the SWIM Master Class 2015.
- The following MET capability prototypes were developed in 2015: radar composite for 3D convection; nowcasting of convection; super-ensemble mesoscale forecast of convection; forecast of icing; forecast of Clear Air Turbulence (CAT); 4D-Trajectory (using weather ensembles); Mode-S observations of wind/temperature and enhanced Numerical Weather Prediction.
- 11.02 contributed to the VP791 validation exercise addressing the integration of global ensemble weather forecasts into the trajectory management optimization and flight planning processes. 11.02 contributions were planned for the following validation exercise/demonstrations in 2016: VP700 Short-term ATFCM Measures (STAM); VP513 De-icing management for airport-CDM; VP669 Airport integration; TOPLINK.
- 11.02 developed a MET Technical Architecture Document (TAD) and contributed to the SESAR 2020 Transition documents for concept and architecture work.

Looking ahead to 2016, the main challenge for the 11.02 partners, including EUMETNET, will be to ensure smooth transition from SESAR 1 to SESAR 2020 to ensure the continuing development of MET capabilities and their use in support of integrated validations led by operational projects.

WP 12 – Airport Systems

Scope:

The scope of the Airport Systems Work Package encompasses all Research & Development activities to define, design, specify and validate the airport systems needed to support the SESAR ATM target concept. It also addresses system/technical aspects such as functional and technical architecture, technical performance & safety requirements, technical interoperability requirements, associated specifications, models/simulation platforms and prototypes, technical validation and the development of inputs/proposals to technical standards groups.

WP 12 undertakes technical developments and verification and support to validation, providing the ground-based system support to the new concepts, procedures and practices described by WP06.

Objectives:
The objectives of WP 12 are to:

- Support collaborative airport planning, including decision support and sequencing tools, meteorological observation and forecasting systems;
- Improve airport surface management, including advanced surveillance techniques, ground-based safety nets, ground-based routing and guidance systems as well as sequencing tools (e.g. A-SMGCS and integrated AMAN/DMAN);
- Define and develop new runway management tools and systems supporting the dynamic application of wake vortex separations (i.e. wake vortex detection and prediction systems);
- Improve safety through the definition and development of ground-based safety nets, with a priority upon detecting runway incursions and preventing collisions;
- Define and develop the technical systems associated with the remote towers, including the appropriate surveillance means.

All of these developments will be brought together so that they support the controller in his tasks by the prototyping of an advanced controller working position, through which a set of core HMI principles will be established.

These objectives are being achieved through a portfolio of 22 R&I projects

Relevant Activity in 2015:

Throughout 2015 WP12 projects actively supported the development of SESAR Solutions by developing and verifying prototypes that were then used in V2 and V3 validations. Those prototypes include:

- Non-conformance and conflicting clearance monitoring and alerting tools;
- Wake vortex detection/prediction tools;
- Integrated Arrival and departure manager;
- A-SMGCS planning, routing and guidance tools;
- Airport operations plan;
- Airport operations monitoring and management tools;
- Advanced airport controller working positions;
- Remote tower systems.

WP 14– SWIM technical architecture

Scope:

The SWIM technical architecture Work Package is the follow-up in the context of SESAR of the SWIM-SUIT European Commission FP6 project. It uses as an input the SWIM-SUIT deliverables and adapts them and/or further develops them to cope with the SESAR Work Programme components.

Objectives:

The primary objectives of WP14 are to define and validate the technical infrastructure solution for SWIM addressing the requirements received from WP8and interfacing with all other System WPs (9-15). WP14 will in particular provide adequate support for SWIM exploitation to the other System WPs in order to ensure that system WPs can implement SWIM compliant services and service consuming applications.

In detail the objectives are to:

- Define and validate the infrastructure solution for SWIM addressing the requirement received from Information Management (WP8). The SWIM WP will have to interface with all other System WPs (9-15);
- Further develop the ‘Intranet for ATM concept’ by:

- Performing an assessment of the Information Management needs of the SESAR CONOPS, as scoped by WP 8, to define the SWIM technical services that will be required,
- Using the SWIM-SUIT results, to translate the results of the assessment into an architectural description, technological options and system solutions;
- Develop SWIM test platforms to support the operational and technical aspects of the SWIM validation and to provide regular SWIM demonstrations;
- Provide adequate support for SWIM exploitation to the other System WPs in order to ensure that system WPs can develop SWIM compliant services and service consuming applications

Relevant Activity in 2015:

WP14 projects have worked in synchronised mode on the SWIM Technical Infrastructure design, specifications and prototyping.

Project 14.02.02 completed its Security Risk Analysis (SRA) for the SWIM TI as input for the next iteration of SWIM Technical Infrastructure developments and the project was successfully closed.

Projects 14.01.03 and 14.01.04 delivered the iteration 3.1 of the SWIM Technical Infrastructure architecture (TAD), the SWIM TI Profiles and the Technical Specifications (TS) according to the scope agreed with SJU. Also the 14.02.02 outcome is used as an input for these deliverables and the needed security requirements were defined in the 3.1 TS and the 3.1 TAD was also produced according to these requirements.

14.02.09 provided the SWIM prototypes and technical support for the SWIM enabled R5 exercises successfully. Also the 3.1 TS was fed by 14.02.09 project regarding the WHAT-IF IOP requirements.

The fourth successful 'SESAR SWIM Master Class' was organised by project 14.04. This last edition saw yet more services that could be used, and more services and applications being developed by teams from around the world. The Registry prototype from WP08 provided again an important contribution by hosting all the service and application information for the development teams and by supporting the service development workflow and governance.

SWIM Global Demonstration (SGD) was initiated to;

- Ensure that the audience understands how SWIM is supporting fundament SESAR KPAs (cost, capacity, safety, security, interoperability…)
- Increase the awareness of the global community about SWIM by practicing the ICAO SWIM CONOPS principles in reality.
- Feedback any experiences to the ICAO\IMP.

SGD activity was gained speed during the 2015 summer and several global partners, which are; Australia, Brazil, USA, Israel, Arab Emirates, Mongolia were convinced to participate to the event. Several European partners coming from the SESAR projects and SWIM Master class contributors were confirmed their participation to the event. The aim of the scenarios that will be used in the SGD are to demonstrate the use of WIXM, WXXM, and AIXM on a flight (Pre-Planning, Flight Planning, Departure (Stand to Off, includes Tower), InFlight (Climb-out, Cruise), Boundary Coordination, Inflight (Cruise, Descent), Arrival (On-Final to at Stand, includes Tower), WXXM Data Sharing (SIGMET (Severe Weather, Volcanic Ashe)), AIXM Data Sharing (OTS, SAA, NOTAM), Possible other events (Reroutes, Separation Conflict, etc)) from different locations. Scenario and technical infrastructure definitions were evolved and the required milestones (such as integration, testing, etc.) were defined and started to be executed. WP 14 projects (especially 14.01.04 and 14.02.09) were provided and are providing a significant effort for the SGD to ensure the success of the event.

WP 15– Non Avionic CNS System

Scope:

The Non Avionic CNS System Work Package addresses CNS technologies development and validation also considering their compatibility with the Military and General Aviation user needs. It identifies

and defines the future mobile datalink systems to serve communication and surveillance services, the ground SWIM backbone system. It addresses the best combination of GNSS and non-GNSS Navigation technologies to support Performance Based Navigation and precision approach requirements. It proceeds to the optimisation of the ground Surveillance infrastructure, the evolution of the Ground surveillance station to introduce ADS-B information as well as the development of Airport weather information services.

Objectives:

The objectives of WP15 are to:

- Address subjects concerning Spectrum Management for using the spectrum in the most efficient manner and for promoting CNS spectrum allocation at ITU allowing the future CNS SESAR Concept enablers to operate properly as well as undertaking the appropriate actions to minimise the impact on aeronautical spectrum from non-aeronautical systems;
- Define the future Mobile communication system supporting the SESAR Concept, capable to provide to all the types of users the required functions and quality of service, and to support Air/Ground and Air/Air services. It will be composed of a new ground-station-based system associated to complementary systems (a satellite communication system in close cooperation with and benefiting from a related activity at the European Space Agency, a an aircraft communication system at the airport AeroMACS and a new terrestrial (continental) datalink e.g. LDACS). This set of systems will constitute the mobile part of the SWIM backbone. Interconnection of military aircraft through their specific datalink is also addressed. Enhancement of the Ground/Ground communications PENS infrastructure will also be progressed in order that it becomes the ground SWIM backbone;
- Define from a sub-system perspective, the best combination of GNSS and non-GNSS Navigation technologies to support Performance Based Navigation and precision approach requirements in a roadmap perspective as well as to enable transition from current terminal and en route operations (with a mixture of B-RNAV, P-RNAV and conventional) to a total PBN environment. In addition the refinement and validation of GNSS based precision approaches, in line with the evolution of the SESAR ATM capability levels will be performed based in a first step on GBAS Cat II/III GPS L1 and in a further step on GBAS Multi GNSS (GPS + Galileo) Cat II/III allowing rationalisation of the infrastructure and optimisation of the runway capacity under low visibility conditions;
- Consider the rationalisation of conventional terrestrial navigation aids;
- Proceed with enhancements to the ground Surveillance systems and introduction of new Surveillance systems and services (e.g. WAM, ADS-B applications beyond initial operational capabilities). Considering these enhancements and new means, the surveillance infrastructure will be rationalised by considering decommissioning legacy technologies (e.g. SSR) thus decreasing operating costs while balancing the necessary non-cooperative requirements in TMA and for military purposes;
- Decrease delays due to weather, prevent accidents, and help to improve long-term airport operation, relevant sensors matching airport category needs for detecting weather and weather related hazards as well as the integration of their complementary characteristics will be realised.

Relevant Activity in 2015:

In 2015, seventeen projects were under execution, and 4 management projects (with 15 projects and 4 management projects, remaining at the end of the year). Of these, two projects have now been formally closed, namely include P15.02.08 and P15.04.05.b).

In 2015,

- Future Communication System (15.02.04) with a focus on the system elements has completed the Future Communication Infrastructure Operational Concept along with the Quality of Service Concept. This has been updated to ensure alignment to the ATM Master

Plan 2015. The FCI Security Requirements having already been delivered. A separate VDLM2 capacity study has been completed and published. The second VDLM2 call on Measurement, Analysis and Simulation campaign is due for completion in the summer of 2016. The technology work (currently LDACS) will still need to be addressed as a separate issue and is being incorporated within SESAR2020;

- 4D Trajectory Exchange using SatCOM IRIS Precursor (15.02.05) has submitted the System Interface Document ATSU-SATCOM and SATCOM Prototype. Coordination continues with ESA and Inmarsat;
- Future Mobile Satellite Communication (15.02.06) has progressed key deliverables, namely the SATCOM Mission Requirements Definition and Iris Interface Control Document definition after coordination and alignment with P15.02.04 FCI. The project is completing the final version of document prior to closure in 2016;
- Airport Surface Data link (15.02.07) has completed its live trial in coordination with P09.16. The outcome is proposed as a SESAR Technical Solution and standardisation and global interoperability are being finalised;
- Good progress continues with the three projects (15.03.01/02/04) working together on Navigation Infrastructure definition and optimisation. Phase 2 work addressing a consolidated SESAR Navigation Baseline and Roadmap;
- GBAS Cat II/III L1 Approach (15.03.06) is progressing well with successful validation exercises. It is focusing on ensuring the full benefit of GBAS on large airports, through enhanced GAST D solutions better suited to large and complex airports environments. Additional it will prepare for the transition from V3 to V4;
- Multi GNSS CAT II/III GBAS (15.03.07) project is developing the GBAS ground stations supporting multi-frequencies and multiple constellations with a special focus on integrity monitoring;
- Integrated Surveillance sensor technologies (15.04.02) project addresses the analysis of new integrated solutions for ground-based cooperative & non-cooperative ATM surveillance. It has addressed the preliminary operational requirements and preliminary system requirements and a number of studies. The Improved 1090MHz ADS-B Ground station capacity and security (15.04.06) project is currently developing the ADS-B security prototype;
- “Surveillance ground station for ADS-B integration” projects (15.4.5a and b) have completed their third iterations of the SDPD prototype and the respective validation activities. The project 15.04.05.b was closed and the 15.04.05.a is due for closure in 2016 Q1;
- Project 15.04.09 was split into 3 elements. The final Project 15.04.09c on Weather Sensing Technologies is progressing in coordination with 11.02 and fully integrated into OFA 05.01.01 Airport Operations Management;
- Other projects have also satisfactorily progressed, producing functional requirements, functional architectures as well as technical studies to validate technical choices or to secure key points;

Most of the projects progressed according to their original schedule. The impact of the Closure earlier in 2016 is being managed, whilst planning to maintain the maximum scope of each project.

Due to the maturity of the CNS projects in WP15, most of the projects have contributed significantly to CNS standardisation activities within the ICAO framework or within industry standards bodies such as EUROCARE.

Airspace Users supported the projects and the added value was recognised both by project team and by airspace users.

WP 16 – R&I Transversal Areas

Scope:

The scope of the R&I Transversal Areas Work Package covers the improvements needed to adapt the Transversal Area (TA) (safety, security, environment, human performance and CBA/business Case) management system practices to SESAR as well as towards an integrated management system. WP16 also provides support and coordination for the consistent and coherent application of the already existing as well as newly developed TA-related practices to SESAR operational and system Work Packages.

Objectives:

The Objectives of WP16 are to:

- TA R&I: Pro-actively provide SESAR projects with the best TA-related practices, guidelines, tools, methods, models and techniques (TA Reference Material) in function of needs and areas of improvements identified;
- TA Support & Coordination Function (Safety, Security, Environment, HP): Ensure coordination & consistent approach of TA aspects and application of TA practices throughout SESAR Development Phase, including a contribution to validation acceptance for TA aspects, as well as coaching to support production of evidence on the acceptability of Operational Focus Areas (OFA) from a TA perspective,
- Collect, assess and report upon SESAR Cases per TA assessment area with the aim to identify and mitigate TA-related issues in projects and to aggregate in performance views at programme and masterplan level.

Relevant Activity in 2015:

- TA R&I work done over the past years was consolidated into sets of guidance for each TA area. TA Research project were closed or merged in 5 remaining projects (level 16.6.x)
- Extension or improvements to TA Guidance in function of experience gained (e.g. extension resilience methodology) or feedback received from external stakeholders like EASA (for safety);
- Support the 2015 Master Plan campaign;
- Support the OFA related projects running R#4 and R#5 validations;
- Support the 2015 Performance Assessment;
- Prepare for the SESAR 1 Business Case broken down as per 10 SESAR (non 1st PCP related) Solution

WP E – Long Term and Innovative Research Programme

Scope:

Long term / innovative research addresses knowledge creation and breakthrough technologies/concept elements beyond the current SESAR vision in the main stream of SESAR work programme; it has been launched in the framework of WP E to complement advanced research in aeronautics.

WP E encourages the ATM research that explores novel, unconventional areas involving new technologies, concepts or ideas. It stimulates long-term research thinking, creativity and innovation to help develop the scientific knowledge aimed at extending the SESAR vision and to complement existing SESAR activities, thus assuring the continuity in implementations beyond the existing horizons (both in time and scope).

Objectives:

The objectives of WPE are to establish Research Networks, PhDs and a portfolio of Research Projects to explore several topics (concept element and/or technology) extending the SESAR vision without any predefined time frame.

- Towards higher levels of Automation in ATM;
- Mastering complex systems safely;
- System Architecture & System Design;
- Information Management, Uncertainty & Optimisation
- Enabling Change in ATM

The research themes have been used to establish the work in WPE to date, consisting of three Research Networks, more than 20 PhDs and 40 Research Projects (details can be found on the SJU website). WP-E is the package dedicated for ATM long-term and innovative research activities, encompassing:

- Research Networks – HALA ATACCS/CW Data Science workshop;
- PhDs;
- WP_E Call 2 Research projects;
- SESAR Innovation Days;
- Young Scientist Award Prize.

The Research Networks, through involvement of a wide range of universities, research centres and industries, offer a structured way to build competence and capability that will not only continue to serve the needs of the ATM sector in the long term but will also be valuable for other sectors. They also select and manage the PhD activities in their area of competence.

Research Projects are selected by the SJU and assigned to a Research Network that provides ongoing scientific support.

Relevant Activity in 2015:

The objective of Work Package E in 2015 was to close down Call 1 WP-E projects and initiate the closure of Call 2 projects.

WP-E Call 1 Projects

The following WP-E Call 1 projects were closed in 2015[27].

- E.02.01 SUPEROPT, E.02.03 STREAM, E.02.04 ONBOARD, E.02.05 ASHiCS, E.02.06 POEM, E.02.07 TESA, E.02.09 AHADR, E.02.10 MAREA, E.02.11 C- SHARE, E.02.12 COMPASS, E.02.13 ALIAS, E.02.15 UTOPIA, E.02.16 ZefMAP, E.02.17 SPAD.

WP-E Call 2 Projects

In 2015 the following projects undertook their Closure Gates in 2015:

- E.02.02 NEWO, E.02.08 MUFASA, E.02.18 ELSA, E.02.20 AGATHA, E.02.25 6th Sense, E.02.27 SCLOUD, E.02.31ACCHANGE, E.02.36 ProGA, E.02.38 ACF, E.02.37 AeroGame, E.02.40 IMET.

In 2016 there will be the closure gates of the rest of WP-E projects and the two Research Networks HALA and Complex World.

SESAR Innovation Days 2015

SESAR Innovation Days (SIDs) is the academic SESAR symposium where the ATM research community presents the results of WP-E projects, PhD projects and other EU projects. During 2015 at such SESAR innovation Days, there were 180 participants and 27 presentations. The papers were

[27] Decision of the Executive Director SJU/ED/335

selected with the active involvement of the SESAR Scientific Committee and the SJU ATM Team as part of the SID's Program Committee assessing the scientific quality of the papers.

WP B – Target Concept and Architecture Maintenance

Scope:

The scope of the Target Concept and Architecture Maintenance Work Package covers the maintenance and refinement of the high-level ATM Performance Target and Architecture including the Concept of Operations (CONOPS). Defining and ensuring ATM architecture consistency for all SESAR projects. WPB also conducts performance analysis of the ATM Target Concept throughout the SESAR development phase.

Objectives:

The role of WPB was revisited and PC13 agreed on the following updated objectives:

1. To develop proposals for ATM-related content in the following main areas:

    - Performance Framework;
    - High level business model;
    - High level concept of operations;
    - High level architecture of the ATM technical systems;
    - Architecture principles.

8. Taking a top down approach, identify content inconsistencies in the programme and propose mitigating actions through:

    - Preparing, contributing to and performing SE Releases Reviews;
    - Using the Enterprise Architecture (EATMA) as a framework to collect, validate and integrate the information into a common architectural repository;
    - Applying SESAR strategies in the evolution of European ATM.

3. To focus on content produced by the federating projects.

4. To support the SJU in managing the release approach as laid down in the "SEMP Application Guidelines".

WP B is in charge of developing, where requested by the SJU, further guidance to support the application of the SESAR strategies. The guidance material produced will be used to support developments by operational, system and SWIM projects.

In addition 2 new projects were added to the portfolio of activities executed by WP B.

- One project (B.4.4) assesses possible scenarios in function of possible out-sourcing of some ATM data services to information providers supporting multiple stakeholders by defining open interfaces for decoupling the CWPs owned by the ANSPs from the information and data services provided by ATM Data Service Providers (ADSP)
- One project (B.4.5) identified commonality in function of harmonisation and deployment at "regional/FAB" or centralised implementation level operations and assesses impact of the various high level architecture options for the future ATM system in particular in the context of the next steps of the ATM Master Plan.

R**elevant Activity in 2015:**

- Development and evolution of the overall concept of operations aligned with work done at federating projects level;
- Development and evolution of the Technical Architecture (ADD);
- Evolution of the Enterprise Architectural Framework including Repository so to expose the architectural information, aligned with Masterplan, to a wide audience (via ATM Portal);

- Maintenance of the integrated roadmap dataset in support of and aligned with MP 2015 definition;
- Maintenance of the SESAR lexicon to cater for various changes in function of evolution Masterplan;
- Maintenance of the performance framework and assessment, aggregation and reporting of performance figures to management and governance levels.

WP C – Master Plan Maintenance

Scope:

The scope of the Master Plan Maintenance Work Package is to administrate the up-to-date maintenance of the European ATM Master Plan to monitor the progress of development and of implementation. It also maintains the standard and regulatory roadmaps.

Objectives:

The Objectives of WP C are to:

- Maintain Master Plan information up to date and monitor the progress of development and of implementation of the Master Plan by reference to the baseline (including supporting the Integrated Roadmap Maintenance process),
- Administrate the overall process to keep the Master Plan up-to-date, and propose amendments to the SJU Administrative Board,
- Perform Performance Planning from an ATM Master Plan perspective and support when relevant the development and maintenance of the SESAR Business Case(s) (WP 16.6)
- Administrate the process that delivers the Single European Sky Implementation Plan and provides input for development of local/regional performance based implementation plans and targets;
- Monitor and report on the achievement of these local/regional plans and also derive the impact on system wide performance,
- Implement a comprehensive standards and regulatory management process, fully integrated within the SESAR Master Plan maintenance, and interfaced with the SJU work programme from the early identification of needs for new standards and regulations, to contributing to their definition, development and validation.

Relevant Activity in 2015:

2015 was a crucial year for Work Package C with the campaign for the update of the Master Plan.

This one-year campaign was initiated officially with a kick-off event on 16 December 2014 and ended on 15 December 2015 with the approval of the 2015 Edition of the European ATM Master Plan by the SESAR JU Administrative Board.

Work Package C supported the campaign through the leadership of the Master Planning Group (MPG), where experts from all stakeholders and Eurocontrol carried out the ground work of structuring and overseeing the drafting of the Level 1 of the Master Plan. Work Package C also prepared the standardisation and regulatory roadmaps as well as the definition of principles for the financial incentives to stimulate timely and synchronised technology deployment.

Beyond this exceptional campaign which was one of the landmarks of 2015 for the SESAR JU, Work Package C also carried out its yearly task of maintaining Levels 2 (the planning view) and 3 (the implementation view) of the Master Plan. These tasks were carried out in full synchronisation with the campaign of update of the Level 1, allowing the simultaneous approval by the SJU Administrative Board of all three levels on 15 December 2015.

Annex 7. Publications from Projects in 2015

SESAR 1 (Work Package E) Project Name	*Publication Listing in 2015*
E.01.02 HALA Higher Automation Levels in Automation -**Research Network**	F.Saez Nieto et al August 2015, The long journey toward a higher level of automation in ATM as safety critical, sociotechnical and multi-Agent system Proc IMechE Part G: Journal of Aerospace Engineers, DOI: 10.1177/0954410015596763
E.02.23 ALIAS II Addressing the Liability Impact of Automated Systems -**Research Network**	H. Schebesta, G. Contissa, G. Startor, A. Masutti, P. Tomasello, D. Taurino et al 1st-3rd December 2015, *Design According to Liabilities ACAS X and the Treatment of ADS-B Position Data,* SESAR Innovation Days 2015, Paper 8, Bologna, Italy
E.02.24 MOTA Modern Taxiing	Z.K. Chua et al 1st-3rd December 2015, *Self-Managing Conflict Resolution for Autonomous Taxiing Tugs: An Initial Survey*, SESAR Innovation Days 2015, Paper 12, Bologna, Italy Z.K. Chua, F. Andre, M. Cousy et al . 22-26 June 2015, *Development of an ATC Tower Simulator to Simulate Ground Operations*. Proceedings of the 2015 AIAA Modeling and Simulation Technologies Conference. Dallas, Texas, USA F. Lancelot, M. Causse, N. Schneider, M. Mongeau at el 2015*, Human-in-the-loop Multi-Agent Approach for Airport Taxiing Operations*. PAAMS 2015
E.02.25 6th SENSE Increasing Fault Tolerance of Human Machine Interfaces through Sensor Fusion	N.Silva, V.Settgast, E.Eggeling, T. Ullrich, T.Schreck, D.Fellner et 2015, *Increasing Fault Tolerance in Operational Centres Using Human Sensing Technologies: Approach and Initial Results,* VISIGRAP 2015, Scitepress
E.02.27 SCLOUD Secure Data Cloud Secure computation techniques for data exchange in ATM	M.Zanin et al 27th June 2015, *Design and Implementation of a Secure Auction System for Air Transport Slots,* IEEE World Congress, Pages 160-166, ISBN 978-1-4673-7274-9, New York City, USA
E.02.28 TREE Data-driven modelling of network wide extension of the tree of reactionary delays in ECAC area	B. Campanelli, P. Fleurquin, V.M. Eguíluz, J.J. Ramasco, C. Ciruelos, A. Arranz et al 1st-3rd December 2015, *TREE Model: A Tool to Explore Delay Reduction Scenarios in the ECAC Area,* SESAR Innovation Days 2015, Paper 30, Bologna, Italy
E.02.22 NINA Neurometrics Indicators for ATM	Di Flumeri, G., Borghini, G., Aricò, P., Colosimo, A., Pozzi, S., Bonelli, S., Salinari & Babiloni, F. et al 2015 . On the use of cognitive neurometric indexes in aeronautic and air traffic management environments. In Symbiotic Interaction (pp. 45-56). Springer International Publishing Borghini, G., Aricò, P., Di Flumeri, G., Graziani, I., Colosimo, A., Salinari, S., Babiloni, F., Granger, G., Imbert, J-P., Benhacene, R., Golfetti, A., Bonelli, S., Pozzi, S. et al 1st-3rd December 2015,.,*Skill, Rule and Knowledge-based Behaviors Detection during Realistic ATM Simulations by Means of ATCOs' Brain Activity* SESAR Innovation Days 2015, Paper 8, Bologna, Italy

SESAR 1 (Work Package E) Project Name	*Publication Listing in 2015*
E.02.29 ACCESS Application of Agent-Based Computational Economics to Strategic Slot Allocation	R. Herranz, D. Toribio, M. Ramírez, F. Villafáñez, J.A. Araúzo, D. Poza, N. Alsina, L. Garrigó, L. Castelli, T. Bolic et al 1st-3rd December 2015,. Price-Setting Auctions for Airport Slot Allocation: a Multi-Airport Case Study, SESAR Innovation Days 2015, Paper 16, Bologna, Italy
E.02.31 ACCHANGE Accelerating change by regional forerunners	Eef Delhaye , Stef Proost, Amihai Glazer, Thomas Blondiau et al 23rd and 26th of June 2015, Air Traffic Control Regulation in a Union Bargaining Model Setting, ATM Seminar USA-Europe 2015- Seminar 11 , Paper 436, Lisbon-Portugal Nicole Adler , Eran Hanany, Stef Proost et al 23rd and 26th of June 2015, Managing Change in European Air Traffic Control Provision, ATM Seminar USA-Europe 2015- Seminar 11, Paper 357, Lisbon-Portugal T. Blondiau, E. Delhaye, B. Martens, M. Vankeirsbilck et al 1st-3rd December 2015, ACCHANGE Lessons Learned and Way Forward, SESAR Innovation Days 2015, Paper 19, Bologna, Italy
E.02.33 SATURN Strategic Allocation of traffic using redistribution in the Network	L. Delgado et al 23rd and 26th of June 2015, European route choice determinants - examining fuel and route charge trade-offs ATM Seminar USA-Europe 2015- Seminar 11 , Paper 487, Lisbon-Portugal L. Castelli, T. Bolić, S. Costanzo, D. Rigonat, É. Marcotte, G. Tanner et al 1st-3rd December 2015, Modulation of Enroute Charges to Redistribute Traffic in the European Airspace ,SESAR Innovation Days 2015, Paper 35, Bologna, Italy R. Jovanović, O. Babić, M. Živanović, V. Tošić et al 1st-3rd December 2015, Efficiency vs. Flexibility in ATM: Can Pricing Help? SESAR Innovation Days 2015, Paper 40, Bologna, Italy
E.02.34 ERAINT Evaluation of the RPAS-ATM Interaction in Non-Segregated Airspace	M. Pérez-Batlle,R. Cuadrado, C. Barrado,P.Royo ,E.Pastor et al 1st-3rd December 2015, Real-time Simulations to Evaluate RPAS Contingencies in Shared Airspace, SESAR Innovation Days 2015, Paper 22, Bologna, Italy M. Pérez-Batlle, C. Tadeo , E. Pastor et al 13th -17th of September 2015, A Methodology for Measuring the Impact on Flight Inefficiency of Future RPAS Operations, Proceedings of the 34th Digital Avionics Systems Conference. IEEE/AIAA, Prague, Czech Republic
E.02.39 EMERGIA Powerful Emergent Behaviour in ATM	Henk.A.P.Blom and G.J. Bakker et al 22-26th June 2015, Can ground-based separation accommodate very high en route traffic demand as well as advanced self-separation?, Preprint of paper for presentation at 15th AIAA ATIO 2015 Conference, Dallas

SESAR 1 (Work Package E) Project Name	*Publication Listing in 2015*
E.02.40 IMET Investigating optimal approach for future Trajectory Prediction (TP) systems to use Meteorological uncertainty information	Jacob Cheung, Alan Hally , Jaap Heijstek , Adri Marsman and Jean-Louis Brenguier et al 1st-3rd December 2015, Recommendations on trajectory selection in flight planning based on weather uncertainty, SESAR Innovation Days 2015, Paper 24, Bologna, Italy

Annex 8. Scoreboard of Horizon 2020 common KPIs (table I in annex 13)

REF	*Name of H2020 Key Performance Indicator*	*Definition*	*Data to be provided by SJU?*	*Include Indicator in 2015 CAAR?*	*Value in 2015*
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	N	n/a
2	SME - Growth and job creation in participating SMEs (turnover of company, number of employees)	Turnover of company, number of employees	N	N	n/a
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	N	n/a
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	N	n/a
5	Number of prototypes testing activities and clinical trials	Number of prototypes, testing (feasibility/demo) activities, clinical trials	N	N	n/a
6	Number of joint public-private publications in projects	Number and share of joint public-private publications out of all relevant publications.	N	N	n/a
7	New products, processes, and methods launched into the market	Number of projects with new innovative products, processes, and methods	N	N	n/a
8	Time to inform applicants of outcome of evaluation	Number and % of information letters sent to applicants within target. Average TTI (calendar days). Maximum TTI (calendar days)	Y	Y	100% - 144 days
9	Redress after evaluation	Number of redressed requested	Y	Y	0%
10	Time to grant from call deadline to grant signature	Number and % of grants signed within target ;Average TTG in calendar days ;Maximum TTG in calendar days	Y	n/a	n/a

REF	*Name of H2020 Key Performance Indicator*	*Definition*	*Data to be provided by SJU?*	*Include Indicator in 2015 CAAR?*	*Value in 2015*
11	Time to sign from successful applicant letter	Number and % of grants signed within target ;Average TTG in calendar days ;Maximum TTG in calendar days	Y	n/a	n/a
12	Time to pay (% on time) for pre-financing, interim payment & final payment	Time to pay experts	Y	n/a	n/a
13	Vacancy rate (%)	% vacancy rate during the reporting period	Y	Y	2%
14	Budget execution: commitments (% total budget)	% of CA and PA	Y	Y	100%
15	Budget execution: payments (% total budget)	Number of delayed payments	Y	Y	0%

Annex 9. Scoreboard of Indicators for monitoring cross-cutting issues (table II in annex 13)

REF	*Name of H2020 Key Performance Indicator*	*Definition*	*Data to be provided by SJU?*	*Include Indicator in 2015 CAAR?*	*Value in 2015*
16	Number of nationalities in H2020 applicants & beneficiaries	Nationality of Horizon 2020 applicants & beneficiaries (number of)	N	n/a	n/a
17	Total amount of EU financial contribution by member state	Nationality of Horizon 2020 beneficiaries and corresponding EU financial contribution	N	n/a	n/a
18	Number of nationalities in H2020 applicants & beneficiaries (associated countries)	Nationality of Horizon 2020 applicants & beneficiaries (number of)	N	n/a	n/a
19	Total amount of EU financial contribution by associated country	Nationality of Horizon 2020 beneficiaries and corresponding EU financial contribution	N	n/a	n/a
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	n/a	n/a
21	Percentage of women in H2020 projects	Gender of participants in Horizon 2020 projects	N	n/a	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	n/a	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	Y	13.8% women
24	Share of third-country participants in Horizon 2020	Nationality of Horizon 2020 beneficiaries	N	n/a	n/a
25	Percentage of EU financial contribution attributed to third country participants	Nationality of Horizon 2020 beneficiaries and corresponding EU financial contribution	N	n/a	n/a
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	n/a	n/a
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	n/a	n/a

REF	*Name of H2020 Key Performance Indicator*	*Definition*	*Data to be provided by SJU?*	*Include Indicator in 2015 CAAR?*	*Value in 2015*
28	Scale of impact of projects (high-technology readiness level)	Number of projects addressing TRL between …(4-6, 5-7)?	Y	n/a	n/a
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	N	n/a	n/a
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	N	n/a	n/a
31	EU financial contribution for PPP (Art 187)	EU contribution to PPP (Art 187	N	n/a	n/a
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	n/a	n/a
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	n/a	n/a

REF	*Name of H2020 Key Performance Indicator*	*Definition*	*Data to be provided by SJU?*	*Include Indicator in 2015 CAAR?*	*Value in 2015*
34	Proposal evaluators by country	Nationality of proposal evaluators	Y	Y	Israel: 1; Danish: 2; English:7; Sweden; 1; Italian: 3; French: 6; Dutch:5; Spanish:1; Bugarian:1; Greek:1
35	Proposal evaluators by organisations' type of activity	Type of activity of evaluators' organisations	Y	Y	Industry: 3; University: 1; Airspace users: 1; ATM Research: 8 (+5 SJU)
36	Participation of RTOs and Universities in PPPs	Number of participations of RTOs to funded projects and % of the total Number of participations of Universities to funded projects and % of the total % of budget allocated to RTOs and to Universities	N	n/a	n/a
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)	N	Y	0%
38	Error rate	% of common representative error; % residual error	Y	n/a	n/a
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	n/a

Annex 10. Scoreboard of KPIs specific to SJU

REF	Name of H2020 Key Performance Indicator	Definition	Data to be provided by SJU?	Include Indicator in 2015 CAAR?	Value in 2015	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*	*Y*	*N*	*n/a*	*1/3 EU funding, 2/3 non EU funding*
41	*Completion of SESAR 2020 programme*	*Actual v Planned % complete per project as of the end of the reporting period*	*Y*	*N*	*n/a*	*100%*
42	*Delivery of SESAR 2020 Solutions*	*Number of solutions ready for pre-industrialisation v plan*	*Y*	*N*	*n/a*	*70%*[28]

REF	Key Performance Area in SESAR2020 (A)	Key Performance Indicator in SESAR2020(B)	2014 Performance v 2005 Baseline (C)	2015 Performance v 2005 Baseline (D)	2015 Validation Target (E)	Performance 2015 v 2014
43	Cost efficiency: ANS productivity	Gate-to-gate direct ANS cost per flight[29]	-3.56%	-3.82%	-4.19%	⇔
44	Operational efficiency	Fuel Burn per flight	-1.45%	-2.26%	-2.80%	↗
		Flight time per flight[30]	-1.26%	-1.48%	No target	↗
45	Capacity	Departure delay[31]	-16.5%	-19.1%	No target	n/a
		Additional flights at congested airports	12.10%	11.02%	10.40%	⇔
		Network throughput additional flights[32]	24.22%	33.41%	34.00%	↗
46	Environment	CO2 emissions	-1.45%	-2.26%	-2.80%	↗
47	Safety	Accidents with ATM contribution	-40%	-40%	-40%	n/a

[28] Approximate target. The estimated number of solutions will be refined by the end of 2016 as it will be determined by proposals to the call IR-VLD Wave 1 currently open.
[29] Derived from ATCO productivity improvement, considering 30% impact of ATCO costs on the ANSPs cost base and an elasticity factor of 0.75 between productivity and costs
[30] Derived from fuel burn reduction by deducting the contribution of OFA02.01.01 (0,78%), purely due to vertical profile optimisation.
[31] Derived from additional network throughput, considering an elasticity factor of 5 between delays and traffic and assuming ATFM delays account for 25% of primary delays.
[32] Increase in aircraft per volume in current "at-limit" airspace en-route

Annex 11. Annual accounts (Budget Accounts Implementation)

11.1 Budgetary Result 2015

all figures in EUR	2015	2014
REVENUE RECEIVED FOR THE YEAR		
Contribution from the European Union	82.582.275	94.753.384
Contribution from Eurocontrol	14.859.510	14.279.914
Contributions from other Members	4.246.362	4.246.362
Other sources of contribution and revenue	50.031	(37.077)
TOTAL REVENUE (1)	**101.738.178**	**113.242.583**
TOTAL PAYMENTS MADE FOR THE YEAR		
Staff Expenditure	(4.927.129)	(5.146.061)
Administrative Expenditure	(2.446.657)	(2.474.909)
Operating Expenditure	(105.402.187)	(89.708.026)
TOTAL EXPENDITURE (2)	**(112.775.973)**	**(97.328.996)**
BUDGET RESULT of the year (3)=(1)-(2)	***(11.037.795)***	***15.913.587***
Total Budget Result previous year (4)	**21.436.603**	**5.523.016**
NEW TOTAL BUDGET RESULT (5)=(3)+(4)	***10.398.808***	***21.436.603***
COMMITMENTS STILL TO BE PAID (6) *(Carry Forwards from year Title 1&2 only)*	**(3.027.976)**	**(2.973.065)**
TOTAL BUDGET OUTTURN (7)=(5)+(6)	**7.370.832**	**18.463.538**

11.2 Statement of Revenue 2015

all figures in EUR	1	2	3=2/1	4	5	6=5/4	7	8
Type of revenue	Commitment appropriations	Actual Revenues established	% of budget	Payment appropriations	Actual Revenues received	% of budget	Outstanding (from 2015 only)	Outstanding (Total)
Contribution from the European Union	0	0	0,0%	82.800.000	82.582.275	99,7%	217.725	177.863.826
Contribution from Eurocontrol	20.558.736	20.558.736	100,0%	18.018.148	14.859.510	82,5%	3.158.638	15.522.619
Contributions from other Members	4.246.361	4.246.362	100,0%	4.246.361	4.246.362	100,0%		
Other sources of contribution and revenu	100.000	47.839	47,8%	100.000	50.031	50,0%		0
Budget surplus previous year	14.533.412	14.533.412	100,0%	21.436.603	21.436.603	100,0%		
TOTAL REVENUE	**39.438.509**	**39.386.349**	99,9%	**126.601.112**	**123.174.781**	97,3%	**3.376.363**	**193.386.445**

11.3 Statement of Expenditure 2015

all figures in EUR	1	2	3=2/1	4	5	6 = 4 + 5	7	8=7/6	9	10
Type of expenditure	Commitment approp.	Commitments		Payment appropriations			Payments		Commitments still to be paid	Commitments still to be paid
			% of budget	Budget 2015	from 2014*	Total		% of budget	(2015 Carry Forwards only)	(Total)
Staff Expenditure	5.980.000	5.954.705	99,6%	5.980.000		5.980.000	4.927.129	82,4%	654.618	751.208
Administrative Expenditure	3.258.500	3.231.138	99,2%	3.258.500		3.258.500	2.446.655	75,1%	2.373.358	2.614.034
Operating Expenditure	20.991.274	20.991.274	100,0%	117.362.612		117.362.612	105.402.189	89,8%	14.549.343	172.884.213
1. Studies/Development conducted by the SJU	*20.991.274*	*20.991.274*		*49.219.222*		*49.219.222*	*38.437.801*	*78,1%*	*14.549.343*	*52.896.895*
2. Studies/Development conducted by Eurocontrol										
3. Studies/Development conducted by other Members	*0*	*0*		*68.143.390*		*68.143.390*	*66.964.388*	*98,3%*		*119.987.318*
TOTAL EXPENDITURE	**30.229.774**	**30.177.117**	99,8%	**126.601.112**		**126.601.112**	**112.775.973**	89,1%	**17.577.319**	**176.249.455**
TOTAL REVENUE		**39.386.349**					**123.174.781**			
BUDGET SURPLUS		**9.209.232**					**10.398.808**			

** only amounts needed in 2015*

11.4 IN-KIND Contributions (Annex I of the SJU BU)

Annex I of the SJU Budget - In Kind contributions (Revenue)

all figures in EUR	1	2	3=2/1
Type of revenue	**Commitment appropriations**	**Actual Revenues established**	*% of budget*
Contribution from the European Union	0	0	
Contribution from Eurocontrol to be recognized	74.460.000	70.773.000	*95,0%*
Contributions from other Members to be recognized	0	0	
Other sources of contribution and revenu	0	0	
Budget surplus previous year	0	0	
TOTAL REVENUE	**74.460.000**	**70.773.000**	*95,0%*

Annex I of the SJU Budget - In Kind contributions (Expenditure)

all figures in EUR	1	2	3=2/1
Type of expenditure	**Commitment appropriations (Final budget)**	**Actual Commitments**	*% of budget*
Staff Expenditure	0	0	
Administrative Expenditure*	0		
Operating Expenditure	74.460.000	70.773.000	*95,0%*
*1. Studies/Development conducted by the SJU**	*0*		
*2. Studies/Development conducted by Eurocontrol**	*74.460.000*	*70.773.000*	*95,0%*
3. Studies/Development conducted by other Members	*0*	*0*	
TOTAL EXPENDITURE	**74.460.000**	**70.773.000**	*95,0%*
TOTAL REVENUE		**70.773.000**	
BUDGET SURPLUS		**0**	

11.5 Revenue, Expenditure and Budget Result SESAR2020 (Section 2 of the SJU Budget)

all figures in EUR	1	2	3=2/1	4	5	6=5/4
1. Revenue SESAR2020	**Commitment appropriations**	**Actual Revenues established**	***% of budget***	**Payment appropriations**	**Actual Revenues received**	***% of budget***
Contribution from the European Union *(Horizon 2020 Programme)*	51.470.000	51.470.000	*100,0%*	10.300.000	0	*0,0%*
TOTAL REVENUE	**51.470.000**	**51.470.000**	***100,0%***	**10.300.000**	**0**	***0,0%***
2. Expenditure SESAR2020	**Commitment approp.**	**Commitments**		**Payment appropriations**	**Payments**	
Operating Expenditure	51.470.000	51.470.000	*100,0%*	*10.300.000*	0	*0,0%*
1. Studies/Development conducted by the SJU				*10.300.000*	*0*	*0,0%*
2. Studies/Development conducted by Eurocontrol						
3. Studies/Development conducted by other Members	*51.470.000*	*51.470.000*	*100,0%*			
TOTAL EXPENDITURE	**51.470.000**	**51.470.000**	***100,0%***	**10.300.000**	**0**	***0,0%***
BUDGET RESULT (SESAR2020 only)		**0**			**0**	

Annex 12. List of acronyms

Acronym	*Long Name*
4 D	*4 Dimensions*
ABAC	*Accrual Based Accounting*
ACAS	*Airborne Collision Avoidance System*
A-CCD	*Advanced Continuous Climb Departure*
A-CDA	*Advanced Continuous Descent Approach*
ACI	*Airport Council International*
ADS-B	*Automatic Dependence Surveillance-Broadcast*
ADS-C	*Automatic Dependence Surveillance-Contract*
ADEXP	*ATS Data Exchange Presentation*
AeroMacs	*Aeronautical Mobile Airport Communications System*
AFUA/ASM	*Advanced Flexible Use Airspace/Airspace Management*
AIRM	*ATM Information Reference Model*
AMAN	*Arrival Manager*
AOC	*Airlines Operational Communication*
AOP	*Airport Operation Plan*
APOC	*Airport Operations Centre*
ASAS	*Airborne Separation Assistance System*
ASPA	*Airborne Spacing*
ATC	*Air Traffic Control*
ATM	*Air Traffic Management*
ATSA ITP	*Air Traffic Situation Awareness- In-Trail Procedure*
AU	*Civil airspace users*
CCD	*Continuous Climb Departure*
CDA	*Continuous Descent Approach*
CDM	*Collaborative Decision Making*
CNS	*Communication, Navigation, Surveillance*
CTA	*Controlled Time Arrival*
CONOPS	*Concept of Operations*
DCB	*Demand and Capacity Balancing*
DCMAC Euroc.	*Directorate Civil Military ATM Coordination*
DMAN	*Departure Manager*
EPP	*Extended Projected Profile*
FOC	*Flight Operations Centre*
GBAS	*Ground Based Augmentation System*

Acronym	Long Name
GNSS	Global Navigation Satellite System
HMI	Human Machine Interface
I 4D	Initial 4 Dimensions
CWP	Controller Working Position
IOP	Inter-operability
ISRM	Information Service Reference Model
LVP	Low Visibility Procedure
MSP	Multi Sector Planning
NOP	Network Operation Plan
OAT	Operational Air Traffic
PCP	Pilot Common Project
P-RNAV	Precision Area Navigation
RBT	Reference Business Trajectories
RNP	Required Navigation Performance
RPAS	Remotely Piloted Aircraft System
RTCA	US Standards Organisation
RTS	Real Time Simulation
SESAR1	The European Union body established under Regulation (EC) 219/2007 as amended by Regulation (EC) /1361/2008 with '1' added. Used in the report either to reference the configuration of the SJU with its 15 selected Member partners relevant for the first SESAR programme ending December 2016 or to introduce the respective programme activities.
SESAR1 Programme	The technical programme developed by the SJU and performed by the entities secured under SESAR 1 and with EUROCONTROL.
SESAR2020	The European Union body extended under Regulation (EU) 721/2014 with '2020' added. Used in the report either to reference the configuration of the SJU with its 19 selected Member partners relevant for the second SESAR programme ending December 2024 or to introduce the respective programme activities.
SESAR2020 Programme	The technical programme developed by the SJU and performed by the entities secured under SESAR 2020 and with EUROCONTROL.
SOA	Service Oriented Approach
STAM	Short Term ATFCM Measures
S&M	Sequencing & Merging
SBT/RBT	Shared Business Trajectory/Reference Business Trajectory
STCA	Short Term Conflict Alert
SWIM	System Wide Information Management
TMA	Terminal Manoeuvring Area
TTA	Target Time Arrival

Acronym	*Long Name*
UDPP	*User Driven Prioritisation Process*
VVI	*Verification and Validation Infrastructure*
WOC	*Wing Operations Centre*

Annex 13. Definition of H2020 indicators for Joint Undertakings (KPIs tables I & II)

Horizon 2020 INDICATORS FOR JOINT UNDERTAKINGS

- Table I shows the Horizon 2020 KPIs which apply to JUs, both under Industrial Leadership and Societal Challenges (Horizon 2020 Key Performance Indicators (Annex II - Council Decision 2013/743/EU)).

- Table II presents all indicators for monitoring of cross-cutting issues which apply to JUs (Annex III - Council Decision 2013/743/EU).

- In tables I and II, the numbers attributed to the indicators correspond with those in the Horizon 2020 indicators approved by the RTD Director-General and agreed by all the Research family DGs (according to Annexes II and III - Council Decision 2013/743/EU). The missing numbers correspond to KPIs not applicable to the JUs.

- KPIs and Indicators that correspond to those approved by the RTD Director-General are presented with a white background in the tables. They are aligned to what has been discussed between the Common Support Centre and the JUs. KPIs and monitoring indicators in tables I and II, which do not correspond to those approved by the RTD Director-General, are presented with a green background in the tables.

TABLE I

Definition of Horizon 2020 Key Performance Indicators[33] common to all JUs

		Key Performance Indicator	Definition/Responding to Question	Type of Data Required	Data to be Provided by	Baseline at the Start of Horizon 2020 (latest available)	Target at the End of Horizon 2020	Automated
INDUSTRIAL LEADERSHIP	12	SME - Share of participating SMEs introducing innovations new to the company or the market (covering the period of the project plus three years);	Based on Community Innovation Survey (?). Number and % of participating SMEs that have introduced innovations to the company or to the market;	Number of SMEs that have introduced innovations;	HORIZON 2020 beneficiaries through project reporting	n.a. [new approach under Horizon 2020]	50%	Yes
	13	SME - Growth and job creation in participating SMEs	Turnover of company, number of employees	Turnover of company, number of employees;	Horizon 2020 beneficiaries through project reporting	n.a. [new approach under Horizon 2020]	To be developed based on FP7 ex-post evaluation and /or first Horizon 2020 project results	Yes
SOCIETAL CHALLENGES	14	Publications in peer-reviewed high impact journals	The percentage of papers published in the top 10% impact ranked journals by subject category.	Publications from relevant funded projects (DOI: Digital Object Identifiers); Journal impact benchmark (ranking) data to be collected by commercially available bibliometric databases.	Horizon 2020 beneficiaries through project reporting; Responsible Directorate/Service (via access to appropriate bibliometric databases)	n.a. [new approach under Horizon 2020]	[On average, 20 publications per €10 million funding (for all societal challenges)]	Yes

[33] (based on Annex II to Council Decision 2013/743/EU)

		Key Performance Indicator	Definition/Responding to Question	Type of Data Required	Data to be Provided by	Baseline at the Start of Horizon 2020 (latest available)	Target at the End of Horizon 2020	Automated
	15	Patent applications and patents awarded in the area of the JTI	Number of patent applications by theme; Number of awarded patents by theme	Patent application number	Horizon 2020 beneficiaries through project reporting; Responsible Directorate/Service (via worldwide search engines such as ESPACENET, WOPI)	n.a. [new approach under Horizon 2020]	On average, 2 per €10 million funding (2014 - 2020) RTD A6	Yes
	16	Number of prototypes testing activities and clinical trials[34]	Number of prototypes, testing (feasibility/demo) activities, clinical trials	Reports on prototypes, and testing activities, clinical trials	Horizon 2020 beneficiaries through project reporting	n.a. [new approach under Horizon 2020]	[To be developed on the basis of first Horizon 2020 results]	Yes
	17	Number of joint public-private publications in projects	Number and share of joint public-private publications out of all relevant publications.	Properly flagged publications data (DOI) from relevant funded projects	Horizon 2020 beneficiaries through project reporting; Responsible Directorate/Service (via DOI and manual data input-flags)	n.a. [new approach under H202]	[To be developed on the basis of first Horizon 2020 results]	Yes
	18*	New products, processes, and methods launched into the market	Number of projects with new innovative products, processes, and methods,	Project count and drop down list allowing to choose the type processes, products, methods,	Horizon 2020 beneficiaries through project reporting	n.a. [new approach under Horizon 2020]	[To be developed on the basis of first Horizon 2020 results]	Yes

[34] Clinical trials are IMI specific

		Key Performance Indicator	Definition/Responding to Question	Type of Data Required	Data to be Provided by	Baseline at the Start of Horizon 2020 (latest available)	Target at the End of Horizon 2020	Automated
EVALUATION	NA	Time to inform (TTI) all applicants of the outcome of the evaluation of their application from the final date for submission of completed proposals	To provide applicants with high quality and timely evaluation results and feedback after each evaluation step by implementing and monitoring a high scientific level peer reviewed process	Number and % of information letters sent to applicants within target Average TTI (calendar days) Maximum TTI (calendar days)	Joint Undertaking	FP7 latest know results?	153 calendar days	Yes
	NA	Redress after evaluations	To provide applicants with high quality and timely evaluation results and feedback after each evaluation step by implementing and monitoring a high scientific level peer reviewed process	Number of redresses requested	Joint Undertaking	FP7 latest know results?		
GRANTS	NA	Time to grant (TTG) measured (average) from call deadline to signature of grants	To minimise the duration of the granting process aiming at ensuring a prompt implementation of the Grant Agreements through a simple and transparent grant preparation process	Number and % of grants signed within target Average TTG in calendar days Maximum TTG in calendar days	Joint Undertaking	n.a. [new approach under Horizon 2020]	TTG < 243 days (as %of GAs signed)	Yes
	NA	Time to sign (TTS) grant agreements from the date of informing successful applicants (information letters)		Number and % of grants signed within target Average TTG in calendar days Maximum TTG in calendar days	Joint Undertaking	n.a. [new approach under Horizon 2020]	TTS 92 calendar days	Yes
PAYMENTS	NA	Time to pay (TTP) (% made on time) -pre-financing - interim payment -final payment	To optimize the payments circuits, both operational and administrative, including payments to experts	Average number of days for Grants pre-financing, interim payments and final payments; Average number of days for administrative payments; Number of experts appointed	Joint Undertaking	FP7 latest know results?	-pre-financing (30 days) - interim payment (90 days) -final payment ((90days)	Yes

		Key Performance Indicator	Definition/Responding to Question	Type of Data Required	Data to be Provided by	Baseline at the Start of Horizon 2020 (latest available)	Target at the End of Horizon 2020	Automated
HR	NA	Vacancy rate (%)		% of post filled in, composition of the JU staff [35]	Joint Undertaking	n.a. [new approach under Horizon 2020]		
JU EFFICIENCY	NA	Budget implementation/execution: 1. % CA to total budget 2. % PA to total budget	Realistic yearly budget proposal, possibility to monitor and report on its execution, both in commitment (CA) and payments (PA), in line with sound financial management principle	% of CA and PA	Joint Undertaking		100% in CA and PA	Yes
	NA	Administrative Budget: Number and % of total of late payments	Realistic yearly budget proposal, possibility to monitor and report on its execution in line with sound financial management principle	Number of delayed payments % of delayed payments (of the total)	Joint Undertaking			Yes

NOTES:

18* This indicator, while not compulsory, covers several additional specific indicators requested for more societal challenges by the services in charge.

[35] Additional indicators can be proposed/discussed with R.1 and/or DG HR

TABLE II

Definition of Indicators for monitoring Horizon 2020 Cross-Cutting Issues[36] common to all JUs

	Cross-cutting issue	Definition/Responding to Question	Type of Data Required	Data to be Provided by	Data to be Provided in/to	Direct Contribution to ERA	Automated
2	Widening the participation	2.1 Total number of participations by EU-28 Member State	Nationality of Horizon 2020 applicants & beneficiaries (number of)	Horizon 2020 applicants & beneficiaries at the submission and grant agreement signature stage	JU CAAR RTD Monitoring Report	YES	Yes
		2.2 Total amount of EU financial contribution by EU-28 Member State (EUR millions)	Nationality of Horizon 2020 beneficiaries and corresponding EU financial contribution	Horizon 2020 beneficiaries at grant agreement signature stage	JU CAAR RTD Monitoring Report	YES	Yes
NA		Total number of participations by Associated Countries	Nationality of Horizon 2020 applicants & beneficiaries (number of)	Horizon 2020 applicants & beneficiaries at the submission and grant agreement signature stage	JU CAAR RTD Monitoring Report	YES	Yes
NA		Total amount of EU financial contribution by Associated Country (EUR millions)	Nationality of Horizon 2020 beneficiaries and corresponding EU financial contribution	Horizon 2020 beneficiaries at grant agreement signature stage	JU CAAR RTD Monitoring Report	YES	Yes
3	SMEs participation	3.1 Share of EU financial contribution going to SMEs (Enabling & industrial tech and Part III of Horizon 2020)	Number of Horizon 2020 beneficiaries flagged as SME; % of EU contribution going to beneficiaries flagged as SME	Horizon 2020 beneficiaries at grant agreement signature stage	JU CAAR RTD Monitoring Report		Yes
6	Gender	6.1 Percentage of women participants in Horizon 2020 projects	Gender of participants in Horizon 2020 projects	Horizon 2020 Beneficiaries through project reporting	JU CAAR	YES	Yes

[36] (based on Annex III to Council Decision 2013/743/EU)

	Cross-cutting issue	Definition/Responding to Question	Type of Data Required	Data to be Provided by	Data to be Provided in/to	Direct Contribution to ERA	Automated
		6.2 Percentage of women project coordinators in Horizon 2020	Gender of MSC fellows, ERC principle investigators and scientific coordinators in other Horizon 2020 activities	Horizon 2020 beneficiaries at the grant agreement signature stage	JU CAAR	YES	Yes
		6.3 Percentage of women in EC advisory groups, expert groups, evaluation panels, individual experts, etc.	Gender of memberships in advisory groups, panels, etc.	Compiled by Responsible Directorate/ Service/Joint Undertaking based on existing administrative data made available by the CSC	JU CAAR	YES	
7	International cooperation	7.1 Share of third-country participants in Horizon 2020	Nationality of Horizon 2020 beneficiaries	Horizon 2020 beneficiaries at the grant agreement signature stage	JU CAAR RTD Monitoring Report	YES	Yes
		7.2 Percentage of EU financial contribution attributed to third country participants	Nationality of Horizon 2020 beneficiaries and corresponding EU financial contribution	Horizon 2020 beneficiaries at the grant agreement signature stage	JU CAAR RTD Monitoring Report	YES	Yes
9	Bridging from discovery to market [37]	9.1 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.	Project Office – at GA signature stage he/she will be required to flag on SYGMA. Responsible Directorate/Service (WP coordinator)/Joint Undertaking - via tool CCM2	JU CAAR RTD Monitoring Report		Yes
		9.2 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	Responsible Directorate/Service (WP coordinator)/Joint Undertaking - via tool CCM2	JU CAAR RTD Monitoring Report		Yes
NA		Scale of impact of projects (High Technology Readiness Level)	Number of projects addressing TRL[38] between …(4-6, 5-7)?	Joint Undertaking	JU CAAR RTD Monitoring Report		

[37] This indicator (9.2) is initially intended to monitor the Digital Agenda (its applicability could be only partial)

[38] TRL: Technology Readiness Level

	Cross-cutting issue	Definition/Responding to Question	Type of Data Required	Data to be Provided by	Data to be Provided in/to	Direct Contribution to ERA	Automated
11	Private sector participation	11.1 Percentage of Horizon 2020 beneficiaries from the private for profit sector	Number of and % of the total Horizon 2020 beneficiaries classified by type of activity and legal status	Horizon 2020 beneficiaries at grant agreement signature stage	JU CAAR RTD Monitoring Report		Yes
		11.2 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	Horizon 2020 beneficiaries at grant agreement signature stage	JU CAAR RTD Monitoring Report		Yes
12	Funding for PPPs	12.1 EU financial contribution for PPP (Art 187)	EU contribution to PPP (Art 187)	Responsible Directorate/Service/	JU CAAR		Yes
		12.2 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)	Joint Undertaking Services	JU CAAR RTD Monitoring Report JU annual accounts (part of)		
13	Communication and dissemination	13.3 Dissemination and outreach activities other than peer-reviewed publications - [Conferences, workshops, press releases, publications, flyers, exhibitions, trainings, social media, web-sites, communication campaigns (e.g. radio, TV)]	A drop down list allows to choose the type of dissemination activity. Number of events, funding amount and number of persons reached thanks to the dissemination activities	Horizon 2020 Beneficiaries through project reporting	JU CAAR RTD Monitoring Report	YES	Yes
14	Participation patterns of independent experts	14.2 Proposal evaluators by country	Nationality of proposal evaluators	Responsible Directorate/Service/Joint Undertaking in charge with the management of proposal evaluation	JU CAAR		
		14.3 Proposal evaluators by organisations' type of activity	Type of activity of evaluators' organisations	Responsible Directorate/Service/Joint Undertaking in charge with the management of proposal evaluation	JU CAAR	YES	

	Cross-cutting issue	Definition/Responding to Question	Type of Data Required	Data to be Provided by	Data to be Provided in/to	Direct Contribution to ERA	Automated
NA	Participation of RTOs and Universities	Participation of RTO[39]s and Universities in PPPs (Art 187 initiatives)	Number of participations of RTOs to funded projects and % of the total Number of participations of Universities to funded projects and % of the total % of budget allocated to RTOs and to Universities	Horizon 2020 beneficiaries at the grant agreement signature stage	JU CAAR RTD Monitoring Report	YES	Yes
NA	Ethics	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)[40]	Responsible Directorate/Service/Joint Undertaking	JU CAAR RTD Monitoring Report		
NA	Audit	Error rate	% of common representative error; % residual error	CAS	JU CAAR RTD Monitoring Report		Yes
NA		Implementation of ex-post audit results	Number of cases implemented; in total €million; ´of cases implemented/total cases	CAS	JU CAAR RTD Monitoring Report		Yes

Notes:

* Horizon 2020 applicants - all those who submitted Horizon 2020 proposals

* Horizon 2020 beneficiaries - all those who have signed a Horizon 2020 Grant Agreement

*Responsible Directorate - DG RTD Directorates and R&I DGs family in charge with management of Horizon 2020 activities

*Services -Executive Agencies and other external bodies in charge with Horizon 2020 activities

*Project officer - is in charge of managing Horizon 2020 projects in Responsible Directorate/Service including Executive Agencies

[39] RTO: Research and Technology Organisation

[40] Data relates to pre-granting ethics review. This time span runs in parallel to granting process.