



SESAR
JOINT UNDERTAKING

SESAR

FROM VISION TO REALITY

THE STORY SO FAR

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DELIVERING BENEFITS TO EUROPE AND ITS CITIZENS



Violeta Bulc,
European Commissioner for Transport

Aviation and air traffic management matter for the European economy, which is why the Single European Sky ATM Research (SESAR) project is so important. There are 27,000 flights passing through Europe daily, representing 26 % of the world market. The sector directly employs 2 million European citizens and contributes EUR 110 billion to EU GDP. It ensures that remote areas of Europe can stay connected and benefit from industries such as tourism.

Innovation is a core enabler to ensure that the aviation industry continues to thrive. The SESAR

Joint Undertaking (SESAR JU) is a perfect example of how to effectively pool private and public resources and know-how to achieve progress. As this book shows, in a relatively short time frame, the SESAR JU has created an unprecedented collaborative platform which is delivering deployable solutions.

Further research is planned by the SESAR JU on how to unlock the potential of technology, while Europe-wide deployment is well under way by the Deployment Manager. It is important that we build on this successful approach in the coming years in order to better serve the needs of people and business.

MESSAGE FROM THE EUROPEAN COMMISSION



Henrik Hololei,
*Director-General for Mobility and Transport,
European Commission, and Chairman
of the SESAR Joint Undertaking
Administrative Board*

The SESAR (Single European Sky ATM Research) project plays an important role in strengthening the European aviation sector through the modernisation of air traffic management.

With the advent of the SESAR JU in 2007, and its anticipated move to SESAR 2020, as well as the establishment of the SESAR Deployment Manager (SESAR DM), we now have a coherent chain to define, develop and deploy new technologies

that can contribute to this modernisation endeavour. This value chain is making some real operational and technological contributions to the future of air traffic management.

These changes have been possible thanks to the development of partnerships which link aviation stakeholders in a common desire to improve air transport safety levels, while making it more punctual, more affordable and all with an improved environmental footprint.

MESSAGE FROM EUROCONTROL



Frank Brenner,
*Director General, Eurocontrol,
and Vice-Chairman of the SESAR JU
Administrative Board*

European ATM organisations have a long tradition of research and innovation. However, in the years before the Single European Sky was launched it became clear that the resources needed for all the intended research was not enough and that duplication was hampering the outcomes. A greater focus on modernisation under one roof with validations much closer to real operational environment required a deeper involvement of the broader aviation and ATM industry.

We have come a long way since the establishment of the SESAR JU. We have succeeded in creating a framework for research cooperation which is breaking down 'silos' and bringing together all ATM stakeholders, from airspace users, air navigation service providers, the Network Manager, airports and manufacturers to the military, professional staff associations, research institutes and academia. This framework is clearly paying off as we see more and more performance-driven pre-industrialisation solutions delivered to the community.

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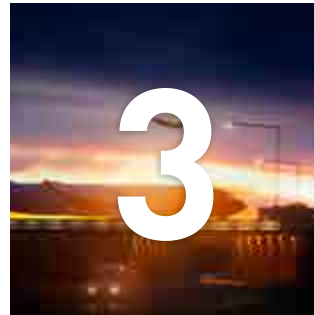
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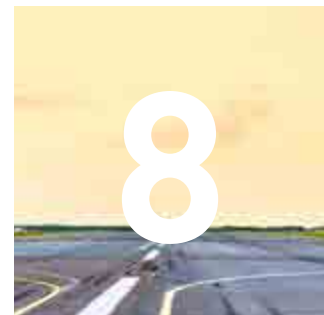
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INTRODUCTION



Florian Guillermet,
*Executive Director,
SESAR Joint Undertaking*

The year 2016 marks the completion of the first phase of SESAR research and innovation and the delivery of technological and operational solutions ready for deployment. It is therefore an opportune time to look back at the road we have travelled together so far to evaluate and build on the achievements for the years to come.

This book captures key moments of the story, including the challenges that triggered the pioneering idea of establishing the Single European Sky and SESAR. More specifically it covers the story of the Joint Undertaking, from pooling public and private resources to defining the roadmap for ATM modernisation and forging ahead the most promising research results into real ATM operations.

This book pays tribute to the 100 companies and 3,000 experts who have dedicated resources to this pan-European partnership. Our members and partners represent the entire value chain, from air navigation service providers, the Network

Manager, airports and airspace users to the military, manufacturing industry, universities and research centres. Each has brought real value to the table. While our institutional founding members have brought the long-term vision, financing and the regulatory authority, our industry members and partners have provided the expertise, innovative spirit and global market outreach. All of this has been kept firmly grounded in reality, thanks to the controllers, pilots, engineers and military staff who have actively contributed to the development, validation and demonstration of SESAR Solutions.

The SESAR story is far from over. Building on the SESAR 1 results, the SESAR JU is moving ahead with its next phase of research and innovation (SESAR 2020) with the commitment of a renewed and broader membership. At the same time, our solutions are moving into deployment. These next chapters will ensure that together we can continue to deliver high-performing ATM for Europe.



THE ATM CHALLENGE

1

Europe is now connected to the world by a vibrant, successful aviation industry which is vital to the economy and society of the continent. It contributes EUR 110 billion to the EU economy each year and is central to the EU's drive to facilitate jobs and growth. The 27,000 flights passing through Europe every day represent 26 % of the world market, and are crucial for the success of the EU's internal market. But to develop and grow, aviation needs an efficient and cost-effective ATM sector on which it can rely to ensure safety, punctuality, cost-efficiency and a continuous improvement in environmental performance in response to society's demand for more air travel.

Europe's ATM system has faced a number of crises over the years. In the final decades of the last century, it was clear that legacy systems in operation were, in many areas of the continent, outdated. Aircraft flew in rigid, narrow corridors, following pathways of ground-based navigation aids which rarely provided a straight line between origin and destination airports. Each country had its own, unique ATM system into which airports were not properly integrated — so even if flights left on time and made good progress in the air they would spend time in holding stacks waiting to be able to land at the destination airport. By the end of the 1980s and 1990s, a boom time for the industry, 25% of all European flights were delayed by more than 15 minutes.



The key challenge then and now has been fragmentation and the need to unite Europe's disparate ATM systems into a single, integrated network. Within Europe there are many different air navigation service providers (ANSPs), each operating different systems under slightly different sets of rules and procedures. Factor in other issues — such as congested airports, airspace reserved for military flights, sometimes extreme weather conditions — and the institutional, technical and political challenges to delivering an integrated European ATM system seemed significant.

A new generation of ATM tools promised to transform the ability of ANSPs and airports to handle a large increase in traffic more safely, more

cost effectively and with fewer delays than ever before. These new technologies heralded the end of the era of air traffic control and the start of a new era of air traffic management — where airspace users decide the best route to fly with the controller responsible for managing the overall air traffic environment to allow this to happen safely. In Europe these newer generations of ATM technology were being introduced — but in a sporadic way; each State had its own idea on how and when new systems should be implemented.

Europe's ATM system remained fragmented and the promise of new technology was frustrated by the different approaches towards implementation by each country.



A SINGLE EUROPEAN SKY

2

‘This summer [2000] will see huge delays once more, from which we all suffer. Every month so far this year delays have been longer than in 1998. We cannot sit back and watch this situation unfold; Europeans expect Europe to come up with genuine answers to their concerns’

*Loyola de Palacio,
Vice-President of the European Commission,
Commissioner for Transport and Energy (1999-2004)*

Europe had to develop the right political measures to ensure that these new ATM tools could be implemented throughout the continent in a coordinated way — but how could this be done? There was plenty of evidence to suggest that Europe could cooperate on ATM issues in specific areas. In March 1996 the Central Flow Management Unit became fully operational, coordinating air

traffic flows across the then 20 Member States of Eurocontrol. Other areas of cooperation included the adoption of the flexible use of airspace (FUA) concept, which offered balanced access to portions of airspace for both civil and military users, as and when they needed it. But these first initiatives were not enough to deal with the increasing delays.



Loyola de Palacio,
Vice-President of the
European Commission,
Commissioner for Transport
and Energy (1999-2004)

‘The Commission proposes, where necessary, to cut through current decision-making difficulties, building on cooperation where this has already proved successful, but offering new mechanisms where it has failed. The approach will involve consultations with stakeholders, such as controllers, airports and airlines. National governments and air traffic service providers will be encouraged to team up to create a smaller number of larger, more efficient, blocks of managed airspace.’

The idea of a Single European Sky was first articulated by former European Commission Transport Commissioner Loyola de Palacio in 1999. She understood that inefficiencies related to fragmentation resulted in non-optimal routes, longer flights, extra fuel burn and higher costs for airlines and passengers. De Palacio set up a high-level advisory group to look at how all sides of the European ATM sector could be brought together around a collective vision of a single European ATM system.

A legislative framework was adopted in 2004, setting the following High-Level Goals for air traffic management:

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



LAUNCH OF SESAR & SESAR JOINT UNDERTAKING

3

‘The philosophy of the Commission’s intervention, from the start, was to say to industry, “We will create the right environment, we will give the means we have and we will guide you, but in the end it will be up to you. After all, it is your business, your investments and you are going to be empowered to run the ATM system.”’

Daniel Calleja Crespo,

*Former Director for Air Transport,
former Head of Cabinet of Commissioner de Palacio and
former Chairman of the SESAR JU Administrative Board*

Turning the vision into reality required an entirely new approach. It would have to be based on a partnership between all stakeholders. States and EU bodies would provide the political and economic leadership but industry — ANSPs, aircraft operators, airports,

and manufacturers — would define and develop the technology and procedures that would be needed to make the vision a reality. Other stakeholders, especially controllers, pilots and engineers, would have a key role to play.

SESAR Ex Com
21st Decision Note - Ref: MGT-0803-001-01-00

We, Representatives of the Global Consortium Members within the SESAR Executive Committee, hereby approve the following D5 document for submission to the Purchaser (EUROCONTROL) of the Project Directorate:

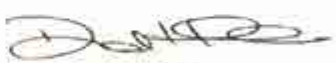
Document D5:
Document No: 015M-0710-001-02-00 (accepted document)
Document Title: SESAR Master Plan

Brussels, April 2008

Thorsten Aschmeier



David Hilton



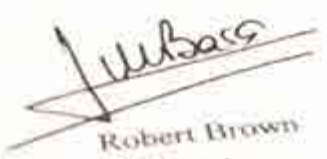
Cristiano Baldoni



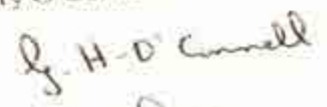
Govert Ho



Jean-Marc Bara



Gerry O'Connell



Robert Brown



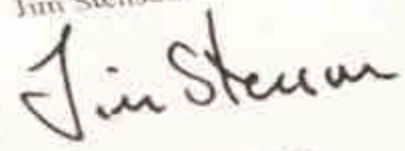
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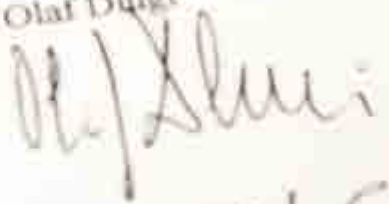
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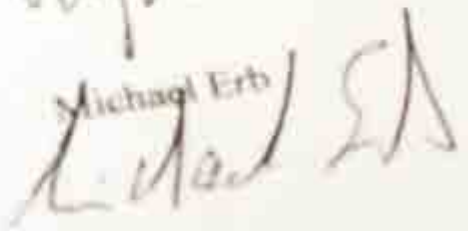


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The high-level advisory group recommended the need to produce an ATM Master Plan. However, it was not enough to have a plan without a parallel strategy for implementing it. So the ATM stakeholders collaborated with the European Commission and agreed that a three-phased programme covering definition, research/innovation and deployment would be needed. In 2004 SESAME, the precursor to SESAR, was launched.

In June 2005 a press conference was held during the Paris Airshow, with Jacques Barrot, then Vice-President and Commissioner for Transport of the European Commission and Víctor Aguado, Director General of Eurocontrol (2001-2007), announcing the launch of the Definition Phase for SESAME. In 2006 an internal competition was organised to give the programme a new name — and SESAR (Single European Sky ATM Research) was the winning candidate.



▶ SESAR IN THREE PHASES

Definition Phase covering the period 2005-2008: EUR 60 million, of which EUR 50 million was EU funded, the rest funded by the industry consortium in charge of the phase;

Development Phase under the responsibility of the SESAR Joint Undertaking (SESAR JU) covering the 2008-2024 period, EUR 2,1 billion corresponding to the SESAR 1 Programme (up to 2016), and EUR 1,6 billion corresponding to the SESAR 2020 Programme (up to 2024). The EU, Eurocontrol and SESAR industrial members each contribute one third to the total funding.

Deployment Phase with estimated costs of between EUR 18 billion and EUR 28 billion, of which approximately 10 % is funded by the EU with the remainder sourced from within the aviation sector. Starting in 2015, the SESAR Deployment Manager, was appointed to deploy the Pilot Common Project — the essential operational changes captured in the Master Plan.

‘It’s been with pride that the Definition Phase was able to organise the large-scale cooperation to deliver the first ATM Master Plan. I believe that one of the key achievements was initiating this momentum and energy within the ATM community towards a common goal. Of course it did not aim at being the final Master Plan, that has since then been updated and improved by the SESAR JU relying on similar cooperative processes.’

Christian Dumas,
Project Director,
SESAR Definition Phase,
and Vice President of
Commercial Aviation
Business Unit,
Inmarsat

The definition phase started in October 2005, under the responsibility of Eurocontrol by a consortium of 30 members associated with more than 20 subcontractors and project associates, ANSPs, airspace users, airports and manufacturers. Together they set out to produce six deliverables

over two years, covering all aspects of the future European ATM system. Of all the deliverables perhaps the most complex, difficult and strategically important was the delivery of a single Master Plan, to be agreed by all stakeholders.



‘The first Master Plan may have been overly ambitious; however, it provided a guarantee to industry that investing in the technology was worthwhile since it would be implemented within an agreed regulatory framework. This is a real strength that comes out of connecting the institutional side with the research, development and deployment.’

Patrick Ky,
Former Executive Director
of the SESAR JU (2007-2013)
and Executive Director
of the European Aviation
Safety Agency



‘The Master Plan is an important milestone in European and global ATM modernisation. With a clear vision and common roadmap, the plan succeeds in connecting performance and technology, thereby offering stakeholders an important tool for preparing their future investment decisions.’

Henrik Hololei,
Director-General,
DG MOVE, and Chair
of the SESAR JU
Administrative Board



‘European ATM is a playing field with many stakeholders with very diverging vested interests. However, they make use of the same airspace and other scarce resources. Eurocontrol has invested significant resources towards the creation and the continued updating of the Master Plan since we believe that it allows European ATM to have one Plan and one direction on the way forward.

Frank Brenner,
*Director General,
Eurocontrol*



► THE EUROPEAN ATM MASTER PLAN

Set within the framework of SES, the European **ATM Master Plan is the European planning tool for defining ATM modernisation priorities and ensuring that SESAR Solutions become a reality.** Both pragmatic and ambitious in its design, the Plan provides a high-level view of what is needed in order to deliver a high-performing aviation system for Europe. It also sets the framework for the related development and deployment activities, thereby ensuring that all phases of the SESAR lifecycle remain connected.

The content of the Master Plan is structured into three levels, allowing stakeholders to view the information that is most relevant for them whether they are executives, planners or those implementing the plan. The original SESAR Master Plan was drawn up in 2008 and a second edition, renamed 'The ATM Master Plan', was endorsed by the Transport Council on 30 March 2009. The plan would form the foundation of the first SESAR research and development work programme (SESAR 1). Since the original document was produced, the plan has been updated twice, in 2012 and again in 2015, in keeping with evolutions in the ATM Landscape.

The Plan is accessible online via www.eatmportal.eu.



‘A roadshow was organised for the Commission and the Executive Director, Patrick Ky, to visit some of the largest ANSPs, airspace users, airports and manufacturers to explain the plan, to discuss how a joint undertaking might work and to ask what their contribution to the venture might be. It became clear there was tremendous motivation from industry to take part. So we asked everyone who was visited to put in writing to the Commission whether they were interested in becoming a member and what their level of commitment might be.

This was not a formal commitment but it gave an indication — especially important as we had to convince the Council — but that it was backed up by European industry.’

Daniel Calleja Crespo

Former Director for Air Transport (2004-2011), former Head of Cabinet of Commissioner de Palacio (1999-2004) and former Chairman of the SESAR JU Administrative Board

'Airlines in particular were concerned that if they invested there would be a return for them down the line. We needed to keep the States on side as well and had to work hard to solve the issue of those States who were members of Eurocontrol but not the EU; they wanted a say on the process and would need a return on their investment.'

David McMillan,
Former Director General,
Eurocontrol

Work was underway behind the scenes to create a body which would bring together the interests of public and private sectors within a single entity to develop the new-generation European ATM system outlined in the Master Plan. But there was no precedent at the time for a true Europe-wide public-private partnership. The initial SES legislation said 'joint undertakings may be set up to coordinate research', but gave no further indication of how this could be done to satisfy all the different partners.

After months of energetic efforts to agree on how private and public interests could be fused within a new type of EU body, on 27 February 2007, Council Regulation (EC) No 219/2007 was published establishing the SESAR JU. Co-founded by the European Union and Eurocontrol, its mission would be to develop the new generation European air traffic management system. Patrick Ky was appointed Executive Director in October 2007, having worked on the project as part of the Commission team since 2004. He was tasked to bring on board the members from both the private and public sectors.



SESAR





Following several months of negotiations, on 8 December 2008, the SESAR JU was inaugurated with 15 pre-selected members composed of airports, ANSPs, ground and airborne systems manufacturers. That same year, the Council regulation was amended transforming the SESAR JU from a Belgian entity to an official EU body. Each of the members were represented in the SESAR JU Administrative Board under the chairmanship of

the European Commission's Director General for Mobility and Transport (DG MOVE) and the vice chairmanship of Eurocontrol's Director General. In 2010 and 2011, Associated Partners would be brought into the fold, bringing the SESAR family to a total of 100 companies and 3,000 experts. The family counted on stakeholders from across the ATM community, from airports and ANSPs to the military, airspace users and the research community.



INTO OPERATION



4

‘The number one achievement, by far, is the partnership approach which the SESAR JU has delivered. It is thanks to SESAR and the SESAR JU that we have been able to make some real technological contributions to the future of air traffic management.’

Henrik Hololei,
Director General of DG MOVE,
and Chair of the SESAR JU Administrative Board

With the establishment of the SESAR JU a ‘competitive dialogue’ was launched in which the SESAR JU consulted industry before announcing how a particular research project should be structured to meet a particular target. Industry replied with a proposal of how it could be done and this would generally become the terms of reference for the research project.

In 2009, the SESAR JU signed with each member a membership agreement (MA) and a multilateral framework agreement (MFA). These governed the relationships between the SESAR JU and the members involved in the implementation of the work programme.

‘The SESAR Joint Undertaking has been extremely successful in building up collaborative mindsets and practices amongst the many actors for ATM transformation. Together, we have demonstrated the great potential to improve European airspace capacity and operational efficiency, defining tangible solutions to make it happen. These solutions are so promising that Airbus and partners have decided to launch the industrial development of Initial 4D aircraft capabilities, to be deployed throughout the European fleets, and beyond.’

Charles Champion,
President,
Airbus Operations SAS, and
Executive Vice President
Engineering

‘The SESAR approach is an excellent and unprecedented example of an intelligent and smart way of doing public-private partnerships. Built up by the key players of European ATM, SESAR has been wisely connected by the European Commission with regulatory instruments for deployment. The results grow day by day. The operational stakeholders have proven their abilities to take responsibility and finally deliver.’

Professor Klaus-Dieter Scheurle,
Chief Executive Officer,
DFS Deutsche Flugsicherung

‘The SESAR JU partnership has been key to some cross-border activities, such as extended arrival management (E-AMAN). A more and more cooperative spirit has progressively developed between the SESAR members and the SESAR JU. This collaborative approach is certainly the most efficient way to deliver together SESAR Solutions that can be implemented in the deployment phase.’

Maurice Georges,
Directeur des Services
de la Navigation Aérienne,
DSNA



‘Apart from providing the appropriate environment for working together, the most important achievement has been to put in practice the adequate machinery to provide proven solutions ready to be deployed once the regulatory and standardisation, as well as the industrialisation processes, are completed for each of them.’

Ignacio González Sánchez,
Director of Air Navigation,
ENAIRE

‘The greatest result has been that we have built an unprecedented industrial ‘consensus view’ in the SESAR JU framework. We aimed to achieve collectively what was not possible individually. That was really the change that the SESAR JU made, in addition to its widely-recognised industrial objectives and standardisation of operational processes for the benefit of the ATM community and its end users.’

Roberta Neri,
Chief Executive Officer
ENAV

‘Working together with SESAR JU and the many other contributing partners is the only way to successfully manage the challenges air navigation service providers are facing: increasing air traffic, reduction of operational costs and ensuring increased safety. The demonstration of the feasibility of virtualisation within ATM in February 2016 was a best-practice example for me.’

Hannes Bardach,
Chief Executive Officer,
Frequentis

‘The opportunities and benefits of improving the flow of air traffic in Europe are substantial. From its inception, Honeywell embraced the vision and supported the collaborative research, technology development and demonstration of SESAR. Driven by our engineers and technologists across Europe, Honeywell is proud of our SESAR contributions to date and is committed to furthering European aerospace innovation in the next phase of the project.’

James Bryson,
President EMEA, Honeywell
Aerospace



www.sesar.eu

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‘SESAR is the most ambitious European ATM modernisation project that has ever been undertaken. In partnership with many stakeholders, including the major ANSPs in Europe, the results of the SESAR JU are strengthening systems such as iTEC (interoperability through European collaboration), thereby contributing to the deployment of SESAR. Above all, the SESAR collaboration has enabled the entire European ATM and aviation industry to take a global leadership position to provide innovative and interoperable solutions.’

Rafael Gallego,
Director General,
Indra

‘The established collaboration with the other stakeholders allowed (the SESAR JU) to properly consider airspace users’ needs to fly the future Single European Sky, taking into account air navigation service providers’ expectations as well as the ground and airborne system capabilities’ evolution in terms of synchronisation and interoperability in one overall integrated approach.’

Leonardo-Finmeccanica,
(member of the SESAR JU
through former Selex ES and
Alenia Aermacchi)

‘One of the key elements for succeeding with huge technology shifts within ATM has been the cooperation with other stakeholders within the programme and its objectives to eliminate the fragmented approach to European ATM. Since NATMIG is also focusing on applied research it has been very important to work both with the manufacturing industry, ANSPs and airspace users to develop concepts and technology which fit the end user the best way.’

Aage J. Thunem,
Executive Vice President,
SINTEF,
on behalf of NATMIG

‘SESAR has helped to channel individual efforts into a more collective approach, which has helped to drive progress in modernising Europe’s airspace. Time-based separation and the cross-border arrivals management system at Heathrow, and a new point merge arrivals system for London City are all examples of SESAR Solutions that we have deployed into our operations and that are already delivering benefits for customers.’

Martin Rolfe,
Chief Executive Officer,
NATS

‘Before SESAR, results from research rarely made their way into production due to complex relations between stakeholders and a lack of standards and acceptance across borders. Coming to the end of SESAR 1 I see an ATM landscape where the community works together delivering sustainable results that are implemented and deliver benefits, such as Remote Towers which LFV is now operating — SESAR is a European success.’

Olle Sundin,
Director General,
LFV, on behalf of the
NORACON consortium

‘It is a significant achievement of the SESAR JU that the European ATM sector has started to act as a ‘community’ in the best sense of the word. In all, SESAR 1 has been a successful programme which has introduced and harmonized valuable innovations into airport operations — such as “Follow-the-Greens” and airport operations centres — as well as improving the overall integration of airports within the ATM network. ’

Gérard Batistella,
Single European Sky
Director, Groupe ADP,
on behalf of the SEAC
Consortium

‘The SESAR JU facilitates alignment of European industry, accelerating the development of solutions for cross-border challenges. The experimentation and validation efforts conducted within SESAR have been critical to reducing risk and moving Europe closer to the vision of a Single European Sky. It is fair to say that without the SESAR JU, the operational improvements achieved in recent years could not have materialised in the same time frame.’

Jean-Marc Alias,
Vice President in charge of
ATM Business, Thales



‘One of the biggest benefits of SESAR 1 has been to connect exploratory research with the industrial context. In earlier framework research programmes there might have been a connection between theoretical research in a laboratory environment with operational users like pilots or air traffic controllers assessing the viability of exploratory research. However these were individual programmes and not connected to more strategic research initiatives’

Professor Peter Hecker,
Technische Universität
Braunschweig, and former
Chair of the SESAR JU
Scientific Committee





► INNOVATION DAYS

SESAR Innovation Days and the Young Scientist Award are key mechanisms for bringing the scientific committee and industry together, and for encouraging fresh thinking in the ATM domain. Launched in 2011, these annual events provide industry with a pool of expertise and give academia a tangible focus for research efforts.

A PIPELINE TO INNOVATION

The agreements between members and the SESAR JU have resulted in the establishment of a 'pipeline to innovation', comprised of three distinct strands which currently work in parallel with one another. The pipeline aims at moving ATM performance-enhancing, operational-focused research swiftly from the laboratory into the real world, with checks and balances at each stage to show that the cost-benefit analysis remained positive and an advance in one area did not compromise progress elsewhere. Under SESAR 2020, the aim is to see a flow between the strands of the innovation pipeline.

1. Exploratory research

Perhaps one of the most innovative aspects of the SESAR JU was the decision to run exploratory research side by side with industrial research. In doing so, the partnership has sought to push the boundaries of our knowledge and understanding of what is possible in the future ATM system. At the heart of this endeavor have been the 40 exploratory

research projects, 20 PhD projects and three networks, which have led to the creation of a strong body of knowledge in SESAR 1 that is now serving the ATM community beyond the framework of SESAR. The transfer and further application of this knowledge has been made possible through the annual SESAR Innovation Days and the Young Scientist Award.





‘SESAR is a vital part of making the Single European Sky a reality. It has resulted in a real impetus to advancing both the technology and the ATM operational concept. The collaborative approach with the involvement of a wide range of stakeholders has been a major part of SESAR’s success.’

Frank Brenner,
Director General,
Eurocontrol

2. Industrial research and validation

SESAR defines the content of the desired improvements along with their scope and objectives and these are then translated into operational and technical specifications. When this work is complete, validation exercises can start. Since its establishment, the SESAR JU with its members have put in place a validation structure across Europe comprising simulation platforms, commercial flights, dedicated airport test-beds, air traffic control centres and the network management systems. Exercises have not been limited to a specific location, but have been used to test multiple environments irrespective of where the physical validation is held. To date,

over 350 validations have taken place, where pilots, controllers, engineers and other operational staff have worked with SESAR projects to put more than 60 solutions to the test. Solutions undergo a maturity assessment where a set of criteria are applied to ensure that they are ready to move to the next level. A yearly validation process, called the SESAR release process, has focused on activities that can deliver performance-driven and operationally-focused, pre-industrial SESAR Solutions. Results oriented, the programme has created check points throughout the release process to confirm that the validation exercises are correctly executed and leading to the desired results, namely over 90 industrial prototypes and 60 solutions ready for industrialisation.







3. Demonstration activities

As early as 2008, the SESAR JU managed the European side of the Atlantic Interoperability Initiative (AIRE), a collaboration between the European Commission and the US Federal Aviation Administration (FAA). The programme showed that it is possible to fly more environmentally-

friendly trajectories with commercial flights using current technologies. Taking place over six years, the AIRE Programme ran some 33 AIRE projects and flight trials including transatlantic flights with partners from across the aviation value chain. An estimated 80 % of the concepts demonstrated during AIRE are now in operation.



Building on the success of AIRE, the SESAR JU launched 24 demonstrations in 2012 and 2014 to show how SESAR Solutions could bring benefits in an operational setting broader than that of the validation exercises. These demonstrations have amounted to over 30,000 flight trials, and have addressed all flight phases. They have involved a wide range of operational experts, from airports, air traffic control centres, airlines, business aviation and general aviation organisations. The fact that so many ATM actors have been eager to participate is proving invaluable for accelerating the operational acceptance and the subsequent industrialisation of SESAR Solutions.







SESAR demonstrations have also been used for initial fact-finding purposes. In 2013 the SESAR JU selected nine projects to demonstrate the feasibility of integrating drones or remotely piloted aircraft (RPAS) of varied sizes into non-segregated airspace. All the demonstrations were successful with one project — CLAIRE — succeeding in executing the first European flight by an RPAS in totally non-segregated airspace controlled by controllers on their

normal shift — that is not under a specially-created trial control team. This achievement represents a significant landmark for RPAS integration and the cooperation between operator, ANSPs and national authorities was exemplary. The findings from these projects have been fed into the definition of an RPAS activity research programme, which will be addressed in the next phase of SESAR research and innovation SESAR 2020 (2016-2024).

BUILDING PARTNERSHIPS

A man and a woman are sitting at a desk in a control room, looking at a large map overlay on the screen. The man is pointing at the map with his right hand. The woman is looking at the camera. The map overlay shows a network of lines and nodes, with various labels and symbols. The background is a control room with multiple computer monitors and a large map overlay on the wall.

5

In addition to the core of the SESAR JU membership, further relationships have been developed with individual and representative bodies of airspace users, airports, the military, manufacturing standards and trade associations, EU bodies working in parallel areas — such as space and wider aeronautical research organisations — social partners and regulatory bodies.

‘This spirit of partnership, of working together with a common goal in mind, is now part of our DNA and will be the key for the success of the entire SESAR project.’

Patrick Ky,

*Former Executive Director, SESAR JU (2007-2013) and
Executive Director of the European Aviation Safety Agency*

‘You can have ideas, you can establish a concept of operations, but you have no guarantee that this is actually feasible or at least that there is some potential behind it if you don’t talk to partners. At the end of the day airspace users, airports and ANSPs have to invest to implement these changes and that’s where engaging them early on has been so critical.’

Florian Guillermet,

Executive Director, SESAR JU



***‘In a complex space like the airport, everything is connected
and every communication and decision has a consequence.
From the very beginning, SESAR has been working to empower airports
effectively as ground coordinators — an ambition fully shared
and supported by us at ACI EUROPE.’***

Olivier Jankovec,
Director General,
ACI EUROPE

Integrating airports into the SESAR programme has been a major focus of the SESAR work, with a significant portion of resources dedicated to developing solutions tailor-made to operations at and around airports. In 2008 the SESAR European Airports Consortium (SEAC) became a member of the SESAR JU. The consortium is composed of Europe's ten busiest airports, which have provided valuable contributions to the programme.

Broadening cooperation to non-hubs, since 2010 the SESAR JU has been working with ACI EUROPE, which represents over 450 airports in 44 European countries handling 90 % of Europe's commercial air traffic. This relationship has focused on integrating small to medium-sized airports into the programme and winning the support of airport operators across Europe, through roadshows and technical review workshops.



Engaging all categories of civil airspace users, from commercial airlines and business aviation to general aviation and rotorcraft, has been a priority for SESAR from the beginning. In September 2009, the SESAR JU signed partnership contracts with Air France, KLM, Iberia, Lufthansa Group (including SWISS and LCAG), SAS Scandinavian Airlines, TAP Portugal, NOVAIR, along with a consortium coordinated by the European Business Aviation Association (EBAA) — including Netjets Europe and Dassault Aviation — as well as IATA and the International Aircraft Owners and Pilots Association (IAOPA). Several months

later the SESAR JU signed a framework contract with the European Low Fares Airlines Association (ELFAA), securing the participation of three ELFAA airline members: EasyJet, Ryanair, Jet2.com and Flybe. The aim was for aircraft operator technical experts to work with SESAR projects to ensure that their specific needs are well taken into account. Later in 2012, framework contracts were also signed to further include DHL, European Helicopter Association (EHA), EL AL, Turkish Airlines and TUIFLY, thus further enhancing the Airspace User expertise and ensuring representatives from all relevant airspace user categories.



‘The SESAR project is a key pillar of the Single European Sky project and arguably the one that will deliver the greatest benefits to airspace users. Technology has always driven the industry and there is no doubt that the SESAR project will provide the next driver for air traffic management efficiency improvements. The role of ERA and the airspace users in general has been essential to help drive the project in the right direction and as we move to the next phase with SESAR 2020, that role remains as important as ever.’

Simon McNamara,
Director General,
European Regions Airline
Association

‘Our members have succeeded in achieving some quick wins, such as performance-based navigation and arrival management, as well as improving the performance of airports and their integration into the network. Also green demonstrations have been important for airspace users. At the same time, we have made some significant progress on some fundamental enablers in relation to information management, typically how to improve the interoperability between different ground systems and between these systems and the aircraft. Work is ongoing but we expect to see these solutions implemented in the coming years.’

Giancarlo Buono,
Regional Director Safety and
Flight Operations, Europe,
IATA

‘IAOPA Europe supports the SESAR High-Level Goals of improved safety, lower ATM costs and reduced environmental impact, improved airspace and airport access. In this framework, SESAR is helping to shape the future environment for airspace access and safety, as well as for airports. IAOPA Europe will continue to support the next stage of evolution, SESAR 2020, and is proud to be involved in developing new methods of improving the safety of general aviation flights.’

Martin Robinson,
Regional Vice-President
IAOPA

‘Collaboration with all stakeholders has been at the forefront of achieving the integration of rotorcraft-specific needs in the future Single European Sky. Acceptance of the rotorcraft community (RC) in current and future operations relevant to ATM was a key challenge, as we were involved late in the programme. It was only through collective efforts that we were able to raise the stakes for RC. Achievements have been felt through the recognition of RC as an individual airspace user, and the inclusion of RC specific aspects in the 2015 ATM Master Plan.’

Elisabetta Dalla Benetta,
Executive Director,
European Helicopter
Association

‘Lufthansa Group has been involved in SESAR Joint Undertaking R&D activities during the past decade with more than 70 experts and providing more than 350 different contributions to more than 90 (out of 300) different projects including large scale demonstrations. We have learned that airline expertise is essentially required in ATM R&D activities. Lufthansa Group is fully committed to SESAR and the work of the SESAR JU with the strong expectation that tangible and measurable operational improvements will become reality.’

Kay Kratky,
Chief Executive Officer
Austrian Airlines, formerly
in charge of Operations
and Hub Frankfurt and
board member of Lufthansa
German Airlines

‘Air France increased its involvement in the SESAR Development Phase from 2009 onwards, providing operational staff — including pilots and flight dispatchers — as well as experts in on-board technology, performance and financing. Air France believes SESAR is needed to modernise Europe’s ATM system. The key drivers have been to move from national ANSP planning to harmonised European ANSP planning, to move from a technology-driven approach to a performance-driven approach, to define European ATM standards and to promote interoperability with other ATM programmes, such as NextGen.’

Laurent Renou,
Head of ATM/CNS/SESAR
Unit, Air France



'The SES political goals have always been a real aspiration for easyJet, as they align well with our corporate vision to bring more affordable and flexible fares to our passengers. EasyJet has started to see the real value and true potential of SESAR and therefore fully supported the SESAR Joint Undertaking in defining the future requirements by addressing airline needs and aircraft capabilities. The SESAR JU has sought to bring order to the fragmented system and contribute to the achievement of the SES political goals. Without the commitment and direction of the SESAR JU and its dedicated members, we would still just be in discussion mode.'

Francis Richards,
ATM Manager
EasyJet

'Billions of euros have been invested in SESAR and great strides have been made towards defining the technological changes and synchronisation required to achieve the SES High-Level Goals through updates to the ATM system. However, implementation of the necessary changes to allow the SESAR project realise its full potential has been slow due to a lack of will from some Member States and ANSPs who appear content to maintain the status quo. The original date for the High-Level Goals is consequently off-track and it remains a serious challenge to ensure the implementation of the SESAR changes to deliver the SES goals as soon as possible. Ryanair is committed to supporting the SESAR project and calls on all stakeholders to help deliver the major improvements needed and for continued investment to modernise the European ATM system.'

Michael Hickey,
Chief Operations Officer
Ryanair



‘The implications of Single European Sky (SES) and its technological pillar, SESAR, are considerable for the military. Our Member States have therefore entrusted the EDA to connect the military with each other as well as the European Institutions; to develop ways to engage Europe’s military in the SES initiative; and to assist our Member States in accessing EU funding for technological initiatives from the SESAR programme. The constructive relationships with the SESAR JU and the SESAR Deployment Manager are of utmost importance to achieve our mission.’

Jorge Domecq,
Chief Executive,
European Defence Agency

Military fleets in Europe consist of around 11,000 aircraft and form the biggest ‘airline’ operating in European airspace. It was vital that military aircraft operator interests be recognised and in 2011 the Military Engagement Plan for SESAR (MEPS) enabled the structured participation of national military experts in all relevant aspects of the SESAR programme.

This has been further facilitated with the increasing involvement of the European Defence Agency (EDA) in the SESAR JU. The EDA now plays a key role in facilitating the coordination of military views on ATM, between EDA Member States, NATO, Eurocontrol and others. The EDA established the Military Implementation of SESAR Programme (MIOS) in 2014.



‘SESAR has always involved us [staff]; we were involved at the administrative board level and at the work package level — and we have been able to make some changes to ideas that industry were proposing and that we thought were outdated.’

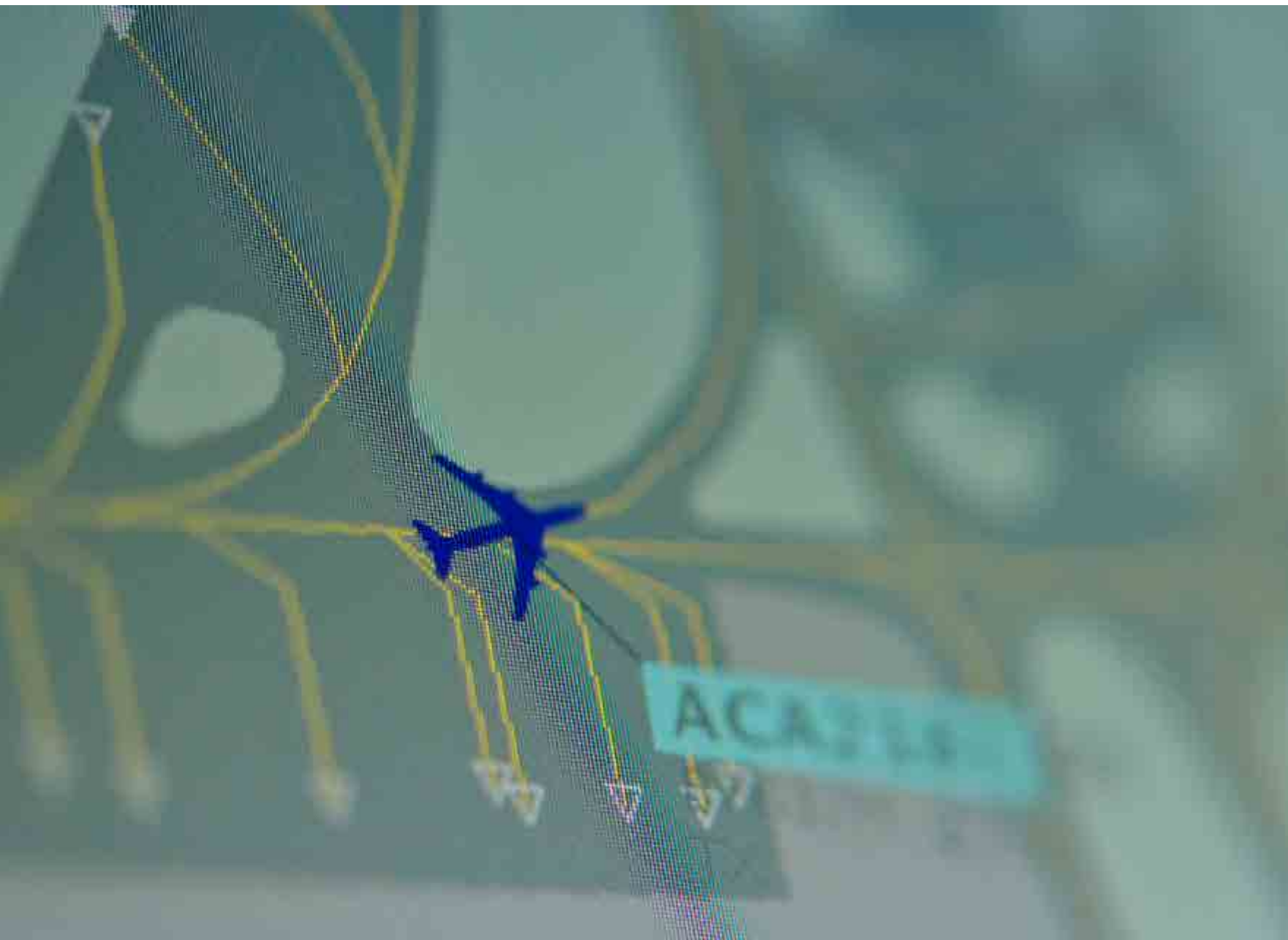
Marc Baumgartner,
SESAR/EASA coordinator
and former President and
CEO of IFATCA

‘Stakeholders and engineers understand that our involvement, especially in validations, is essential to achieve the right outcomes, understanding that the contact with reality can best be provided by everyday users.’

Michele Altieri,
SESAR Focal Point,
the Air Traffic Controllers
European Unions
Coordination (ATCEUC)
organisation

Representatives of controllers, pilots and ATM engineering professional associations have been involved via International Validation teams (IVTs) to give their input into the relationship between the human and automation throughout the development phase. The SESAR JU has collaborative agreements with five professional staff associations: Air Traffic Controllers European Unions Coordination (ATCEUC),

International Federation of Air Traffic Controllers’ Associations (IFATCA), European Cockpit Association (ECA), International Federation of Air Traffic Safety Electronics Associations (IFATSEA) and the European Transport Workers’ Federation (ETF). This has given the SESAR JU a pool of 90 licensed and operational controllers, pilots and engineers from across the EU to work within the IVTs.



‘The relationship between SESAR and EASA has become more concrete with the implementation of SESAR Solutions. We need to continue to educate ourselves in what we should expect from each other — because we live in two worlds which do not necessarily work together on a regular basis.’

Luc Tytgat,

Director, Strategy and Safety Management Directorate, European Aviation Safety Agency, formerly Head of the Single Sky Unit at the European Commission and Director of the Pan-European Single Sky Directorate at Eurocontrol

Cooperation with the European Aviation Safety Agency (EASA) took effect in January 2011, kick-starting many years of fruitful cooperation. EASA began to contribute in a number of areas - including impact analysis of new concepts on rulemaking, oversight and certification activities; advice on methodologies for the acceptable elaboration of safety deliverables; reviews of safety deliverables and issue of opinions; and the assessment of certification criteria of future systems/services derived from SESAR concepts.

National authorities have also been important stakeholders with whom the SESAR JU works closely, particularly through the Single Sky Committee and EASA ATM Thematic Advisory Group, as well as through the National Supervisory Authorities (NSA) coordination platform. The SESAR JU has leveraged the expertise of some 80 NSA experts through memoranda of understanding established with 17 national authorities from 13 States. The results of assessments made by authorities through their participation in validation exercises are integrated in SESAR deliverables. These have also been used for the elaboration of regulatory overviews of several SESAR Solutions.



‘The cooperation between EUROCAE and the SESAR JU has been vital for the development of standards and the recognition of some of these standards as Acceptable Means of Compliance (AMC). These are essential steps toward the completion of industrialisation and deployment.’

Christian Schleifer-Heingärtner,
Secretary General,
EUROCAE

It was clear from the very start that SESAR Solutions would have to be developed within a framework of regional and global interoperability. So standardisation has been a key element in the research activities of the SESAR JU, which is why the partnership works closely with EUROCAE. The cooperation has allowed for both organisations to have a shared view of SESAR standardisation needs. It has also enabled the development of standardisation material, paving the way towards industrialisation activities.

Satellite-based communication services are also an important part of the future ATM system. The SESAR JU and the European Space Agency (ESA) have worked together on the evolution of satellite communications whereby ESA staff participated in SESAR projects and the SESAR JU contributed directly to ESA's Iris Expert Group. This has allowed for technical coordination between the ESA, SESAR JU and other stakeholders, for example on the development of SESAR datalink

requirements using satellite communications in support of 4D trajectory operations. Satellite-based navigation also forms a key enabler for SESAR and Europe's Galileo and EGNOS satellite infrastructures in the GNSS context will support many of SESAR's operational improvements through the positioning and timing capability they deliver.

The SESAR JU has worked in close coordination with the European Union's Clean Sky research programme on greener aviation. The focus of this collaboration has been on specific areas of common interest such as gate-to-gate aircraft operational improvements for fuel and environmental savings, environment metrics/modelling and the Clean Sky technology evaluator work, aircraft systems in support of SESAR trajectory-based operations and Clean Sky Systems for Green Operations. This collaboration ensures that Clean Sky and SESAR activities remain aligned.

A close-up, low-angle shot of a person's hand holding a black telephone receiver to their ear. The person's face is partially visible in profile on the right side of the frame. The background is a blurred city street scene with a rainbow visible in the upper left. The text "WHAT WE HAVE ACHIEVED TOGETHER" is overlaid in white, bold, sans-serif capital letters on a semi-transparent blue background.

**WHAT WE HAVE
ACHIEVED
TOGETHER**

6

‘SESAR should be used as a case study for effective, ambitious pan-European, horizontal projects, with a powerful multiplier effect for further projects. SESAR has already proved that it is ideally fit for purpose not only for technological integration but also as a ‘facilitator’ of integration in other areas.’

Jacek P. Krawczyk,

*President, Employers’ Group of the European
Economic and Social Committee, and EESC
rapporteur for aviation*

Thanks to an enduring public-private partnership, the SESAR JU has succeeded in making significant progress in ATM modernisation over the last eight years. Success has many guises, but ultimately it comes with the delivery of 50 or more operational and technical solutions for uptake by industry.

Addressing all phases of the flight, these solutions have been validated in real-life operations and in some cases are already in operation or are in the pipeline for implementation, either locally or through the Pilot Common Project.



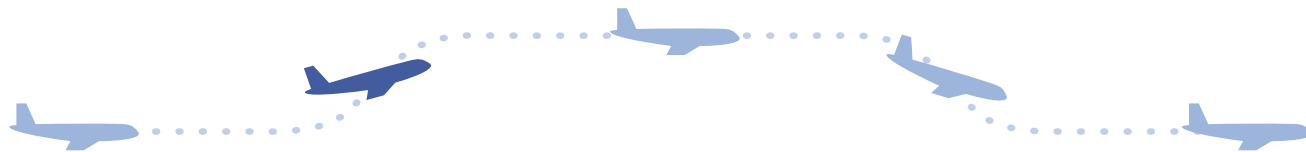


PRE-DEPARTURE PLANNING

SESAR Solutions, like digital integrated briefings, are supporting pre-flight planning, whereby pilots can receive up-to-date aeronautical information about the flight — weather conditions, runway status — in an easy-to-read and flexible electronic format.

The user-driven prioritisation process (UDPP) solution enables airlines to plan departure flights according to operational or commercial requirements. Paris-CDG airport took a decision to implement the solution following its participation in the SESAR D-FLEX demonstration project.

Airport-collaborative decision making - providing a coordinated capability which balances the business priorities and strategies of all airport stakeholders — has been taken to a new level with the development of airport operations centres (APOC); SESAR validations have shown how these centres can improve efficiency at both regional and large airports and, initial APOCs have been opened at Paris Charles de Gaulle and London Heathrow airports.



AT THE AIRPORT

Airport safety net validations have shown the benefits of the integration of surface routing data allowing the system to monitor the information and alert the controller when inconsistencies are detected. This solution highlights potential conflicts much sooner than the current practise of relying on surveillance data to trigger an alarm. This solution is planned for synchronised deployment across Europe, in accordance with the Pilot Common Project.

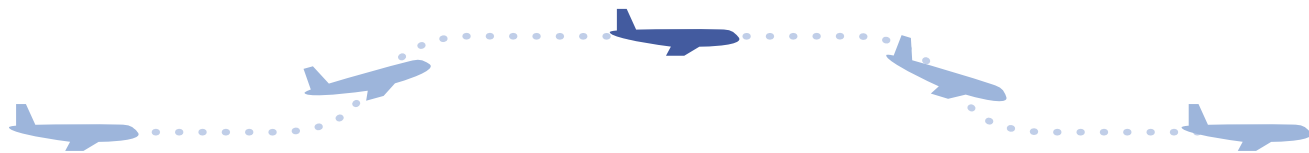
Remote tower services (RTS) validation exercises in Norway, Sweden and Germany have shown that RTS are safe and cost-effective, enabling smaller airports to ensure continuity of operations and provide services on demand at single airports. In 2014, the world's first RTS opened for business in Sundsvall, serving Örnsköldsvik airport over 150 km away. SESAR is also delivering RTS solutions to serve two low-density airports or as a contingency tower.





‘There have been many important achievements in SESAR so far — but of particular significance, I believe, for the long-term success of the project were the two i4D demonstration flights in 2012 and 2014. The successful outcomes of these trials clearly show the benefits of joining forces in modernising ATM in Europe.’

Matthias Ruete,
Former Director General,
DG MOVE, and former
Chairman of the SESAR JU
Administrative Board



IN CRUISE MODE...

SESAR JU has delivered a number of Solutions advancing the free route airspace concept, whereby airspace users can choose to fly their preferred route or the most direct route between origin and destination airport, unconstrained by fixed airways, saving time, fuel burn and emissions. Free route airspace is to be made available across the whole of Europe's upper airspace, in accordance with the Pilot Common Project.

In 2012 and again in 2014, SESAR conducted the world's first initial four-dimensional trajectory management (i4D) flight trials. These make use of the flight management system and communication capabilities of the aircraft and ground systems to share and integrate data, and optimise the aircraft trajectory in all four dimensions. This enables a more efficient and predictable handling of flights. Its synchronised deployment is planned in accordance with the Pilot Common Project.





PREPARING ARRIVALS

Extended arrival management (E-AMAN) allows for the sequencing of arrival traffic much earlier than is currently the case, by extending the AMAN horizon from the airspace around the airport to further upstream. By sharing AMAN data between ANSPs via SWIM (the aviation intranet) arrival management can be coordinated between neighbouring ANSPs. 2014 saw the implementation of Europe's first SWIM-enabled service with an E-AMAN validation exercise which became fully operational at London Heathrow in November 2015 and will be deployed across Europe in accordance with the Pilot Common Project.

In 2014, a new and more efficient arrival solution at a high altitude was put in place at Paris-CDG airport for integrating inbound flights using a point merge system, with a merge point located approximately 40 nautical miles from the airport. Using existing ground and airborne equipment, SESAR validations showed that the solution enabled the management of more continuous descent flights, even during heavy traffic periods.





LANDING

Ground-based augmentation systems (GBAS) augment global navigation satellite system (GNSS) derived positions by sending the positioning corrections to aircraft for precision approach and landing. While GBAS CAT I approaches have been in operation in Europe for several years, in 2013, SESAR members reached a major milestone — a first CAT III approach enabled solely by GBAS. Assuming that standardisation and regulation progress as planned, the entry into service of GBAS Cat II/III can now be expected in the 2018 -2019 timeframe.

Time-based separation (TBS) replaces current distance separations with time intervals to adapt to weather conditions. SESAR validations have demonstrated that TBS allows up to five more aircraft to land in an hour in strong wind conditions, while reducing holding times by up to 10 minutes. The solution has already seen an early implementation at London Heathrow, while synchronised deployment across Europe is foreseen in accordance with the Pilot Common Project.





► PILOT COMMON PROJECT

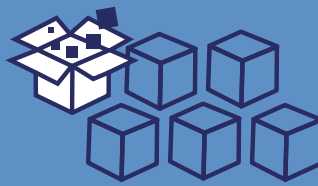
In June 2014, the European Commission adopted a Regulation for the implementation of the Pilot Common Project (PCP), the first set of ATM functionalities. The PCP aims to ensure a timely, coordinated and synchronised deployment of SESAR. The functionalities captured in the PCP are derived from SESAR Solutions and comprise the following:

- E-AMAN and performance-based navigation in the high-density terminal manoeuvring areas;
- Airport integration and throughput;
- Flexible airspace management and free route;
- Network collaborative management;
- Initial system-wide information management;
- Initial trajectory information sharing.

+350

validations


+30,000
flight trials

+60

technical & operational
solutions

+3,000

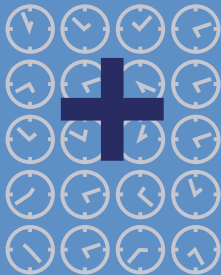
ATM
experts

In a nutshell

- ✦ Pre-industrial research
- ✦ Operationally-focused
- ✦ Results-oriented

+100
companies

+90
prototypes



+20
million
hours of work

+60

research
organisations
Universities/SMEs/
research centres

‘SESAR is a pioneering initiative and has involved good work by the SESAR Joint Undertaking in leading such a huge and complex research programme. It is satisfying to see that many solutions have been delivered by the SESAR Joint Undertaking and that SESAR deployment is now taking place in Europe.’

Jeff Poole,
Director General,
Civil Air Navigation Services
Organisation (CANSO)

‘SESAR has been a true European success story. It is a crucial project to develop the latest technologies not only to support the Single European Sky but also to support the competitiveness of EU aerospace and the ATM manufacturing industry in the global civil aviation market. It is also a crucial programme to contribute to the decarbonisation of air transport.’

Jan Pie,
Secretary General,
AeroSpace and Defence
Industries Association of
Europe

Together the partnership has conducted some 350 validations, 30,000 flight trials and invested 20 million hours to ensure that our results meet the operational needs of those who must use them afterwards. Thanks to this intensive work, the SESAR JU and its members have been able to deliver more than 90 industrial prototypes as well as over 60 new or improved operational or technical solutions. These solutions provide all the material needed for stakeholders to deploy them, from the operational and technical specifications,

to the supporting regulatory, environmental, safety and human performance assessments.

By taking a holistic look at ATM, the solutions delivered offer improvements in a number of specific key performance areas: increasing capacity in airports, airspace and in areas of the network which are most saturated; increasing predictability; and lowering fuel consumption and emissions. These improvements also aim to decrease air navigation services costs.

DELIVERING BENEFITS TO EUROPE AND ITS CITIZENS

SESAR

SECURITY

• 100% reduction in the number of accidents

COST EFFICIENCY

• 10% reduction in the cost of operations

CAPACITY

• 10% increase in the capacity of the system

ENVIRONMENT

• 10% reduction in CO2 emissions

INNOVATION & COMPETITIVENESS

• 10% increase in the number of patents
• 10% increase in the number of jobs
• 10% increase in the number of jobs

SAFETY

• 100% reduction in the number of accidents

PASSENGER EXPERIENCE

• 20 minutes shorter turn-around times
• 10kg in fuel savings per passenger
• EUR 15 in fuel savings

OPERATIONAL EFFICIENCY

• 10% increase in the number of flights
• 10% increase in the number of flights
• 10% increase in the number of flights

‘SESAR has created the change in European ATM that demonstrates its ability to deliver benefits and deployable solutions. Today, we can proudly say that SESAR has both challenged and made a positive contribution as to how R&D in ATM is done in Europe. For me, it has been a great honour to have been part of that journey. SESAR has provided a steady stream of innovative tools, ensuring that the European aviation industry stays competitive and sustainable.’

Siim Kallas,
Former Vice-President,
European Commission, and
Commissioner for Transport
and Mobility

Ultimately it is Europe and its citizens who benefit from the delivery of these solutions. For passengers, the results of the SESAR JU’s work will mean fewer delays, shorter flight times, more affordable tickets — and all with a reduced carbon footprint. Thanks to SESAR, for a typical roundtrip between London and Rome, passengers will have an extra 20 minutes of free time to spend at home or work, shorter flight times (10 kg less fuel burnt per passenger) and savings of EUR 15 on an airline ticket. There is also good news for Europe’s economy, in key areas of jobs, growth, competitiveness, mobility, digitisation and innovation.

The solutions in the PCP alone, to be deployed between 2015 and 2024, are expected to deliver approximately EUR 12.1 billion worth of performance gains for some EUR 3.8 billion investment. Looking beyond to 2035, and subject to a timely and coordinated deployment of solutions, the SESAR project could potentially generate annual recurring benefits to the aviation sector of between EUR 8 billion to EUR 15 billion per year.



'A study on the macro-economic benefits of SESAR indicates that many thousands of new jobs will be created and, at the same time, some 50 million tons of CO₂ could be saved. For passengers SESAR will mean shorter distances flown and potentially cheaper ticket prices as reduced fuel burn will bring down airline costs and increase competition. SESAR is also contributing to new developments in aviation, such as drones, ensuring that we have done sufficient research on the safe integration of these vehicles into civil airspace.'

*Jackie Foster,
Member of the European
Parliament,
European Conservatives
and Reformists Group*

European business will lose out if rivals in North America, the Middle East and Asia — also investing heavily in better air traffic management — increase their global connectivity and access to fast-growing markets at the expense of European companies. The current European ATM system is complicated and expensive. We have real congestion challenges in some Member States, where we need urgent runway capacity to meet the current and forecast demand for new airline services. We need the political will to keep Europe moving forward and that means implementing the Single European Sky and its technology pillar SESAR without delay.'

Jackie Foster,
Member of the European
Parliament,
European Conservatives and
Reformists Group

In addition to its core research activities the SESAR JU has also played an important role in providing expertise in a number of key ATM areas. In 2013, in response to a mandate received by the European Commission, the SESAR JU proposed the content of the PCP initiative, outlining the main steps and drivers required to ensure the practical deployment of performance-driven and operationally-focused SESAR Solutions. Also in 2013, the European Commission formally mandated the SESAR JU to define areas for future ATM drone R&D activities in full alignment with the European roadmap for the safe integration of civil drones into the non-segregated ATM environment in Europe as of 2016. This resulted in drone research being integrated into the SESAR 2020 programme.

SESAR JU experts have also played a pivotal role in developing the communications, navigation and surveillance (CNS) Roadmap, which provides a detailed vision of the European infrastructure evolution described in the ATM Master Plan for the short, medium and long term. To support the future system, the SESAR JU commissioned a study setting out the elements needed to introduce a holistic approach to cyber-security and to develop a comprehensive response to cyber threats, which includes a roadmap for increasing the maturity of cybersecurity and cyber-resilience processes within the SESAR JU's research and innovation (R&I) in preparation for SESAR 2020.



Maintaining outreach and engagement with the ATM community on progress made by the partnership has been a key factor to this success. Over the years the SESAR JU has established a strong presence at important ATM events, such as the World ATM Congress.

These have provided important opportunities for the SESAR family to present the latest results and connect with the broader ATM community, with demonstrations of cornerstone elements, such as system wide information management (SWIM), i4D, and solutions such as E-AMAN.



► AND THE WINNERS ARE...

With 300 projects and a workforce of 3,000 experts, it has been critical to keep the SESAR Family engaged and motivated. Mindful of this, the SESAR Project Awards were created to recognise excellence within SESAR and to pay tribute to the hard work and commitment of the partners involved. Held every year since 2011, the awards distinguish exemplary project management, collaboration and innovation in industrial research.



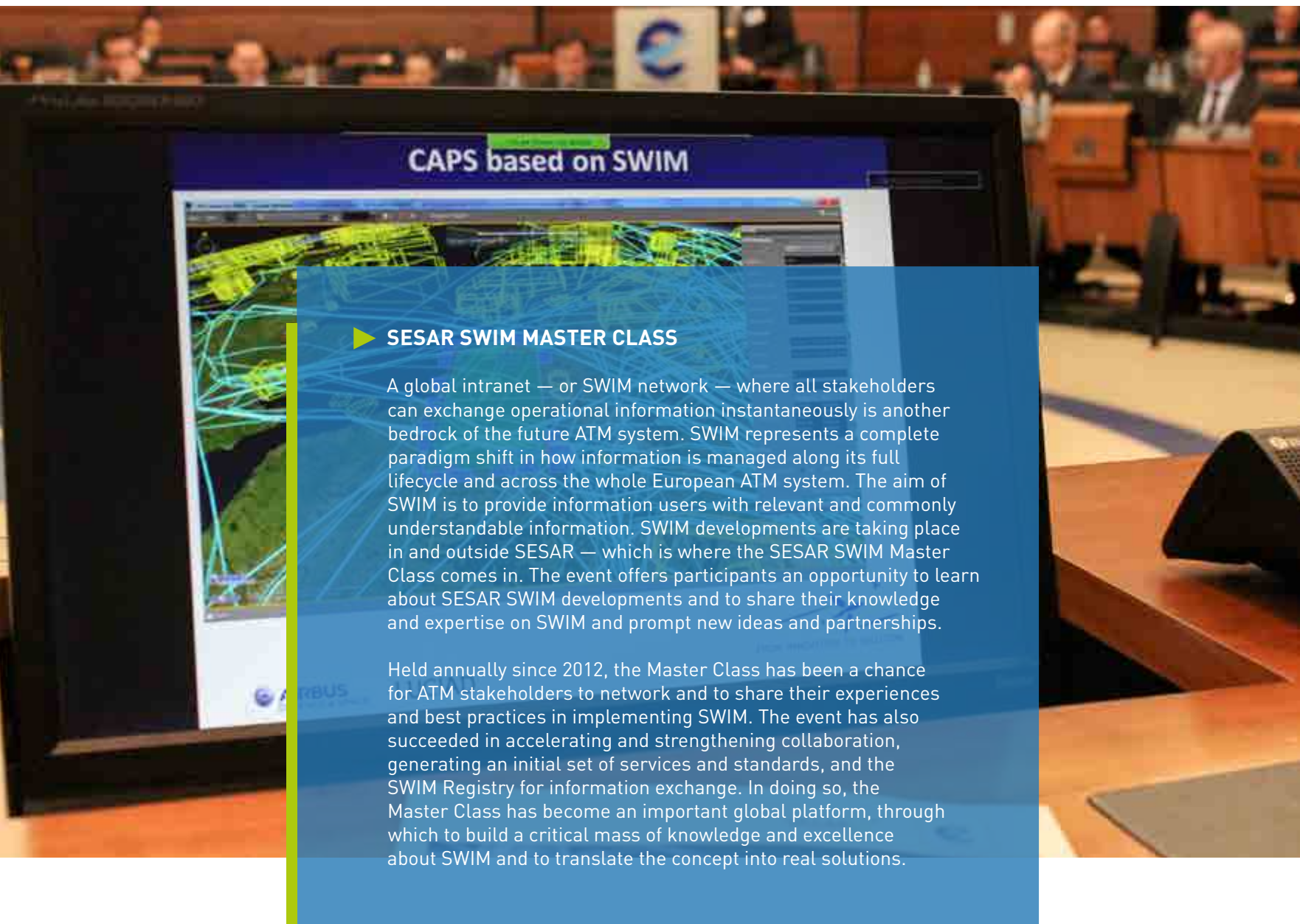




More recently, the partnership has launched a series of SESAR Solution Workshops, which have proved an excellent way for stakeholders to see SESAR Solutions in action, take home best practices and encourage the take-up of the solutions.

Meanwhile participation in events such as Aerodays and the TEN-T Days have ensured that the broader European aviation and transport actors are fully aware of the latest SESAR developments.





CAPS based on SWIM

► SESAR SWIM MASTER CLASS

A global intranet — or SWIM network — where all stakeholders can exchange operational information instantaneously is another bedrock of the future ATM system. SWIM represents a complete paradigm shift in how information is managed along its full lifecycle and across the whole European ATM system. The aim of SWIM is to provide information users with relevant and commonly understandable information. SWIM developments are taking place in and outside SESAR — which is where the SESAR SWIM Master Class comes in. The event offers participants an opportunity to learn about SESAR SWIM developments and to share their knowledge and expertise on SWIM and prompt new ideas and partnerships.

Held annually since 2012, the Master Class has been a chance for ATM stakeholders to network and to share their experiences and best practices in implementing SWIM. The event has also succeeded in accelerating and strengthening collaboration, generating an initial set of services and standards, and the SWIM Registry for information exchange. In doing so, the Master Class has become an important global platform, through which to build a critical mass of knowledge and excellence about SWIM and to translate the concept into real solutions.



SESAR IN THE GLOBAL ARENA

7

‘With the need to provide guidance on how to evolve the air navigation system and to attend to the needs of the developing aviation industry, the (European ATM) Master Plan provides a mature indication on how the global system should evolve, mainly in areas of high-density traffic, which will contribute to the evolution of the ICAO Global Air Navigation Plan (GANP). Suffice it to say that the work of ICAO has benefited greatly from the work of, and the input from, SESAR.’

Stephen Creamer,
Director, Air Navigation Bureau, ICAO

Since the outset, the SESAR JU has been committed to and focused on global interoperability and harmonisation, recognising these as vital prerequisites for a smooth and seamless transition towards a modernised global ATM system. While regional differences may require different solutions, there are some issues where interoperability can only be achieved through the adoption of standards and common reference frameworks at a global level.

Mindful of this, the EU and the SESAR JU have developed strong ties with countries working on major new ATM infrastructure improvement programmes and discussions are continuing to add to this list. Since 2010 the Commission and the SESAR JU have signed memoranda of cooperation with countries such as Brazil, Mexico, USA, Japan and neighbouring states in the Mediterranean region. A further SESAR JU agreement was signed with Singapore in 2012 and cooperative arrangements with China are under discussion.



'From the very beginning we understood the importance of harmonizing NextGen and SESAR and recognized the value in using these programs to lead the world in global modernization.

We have come together to solve the key challenges necessary to make unprecedented advances in aviation efficiency, capacity, and safety. Of particular note is our collaboration on datacom, SWIM, information exchange models, 4D operations, and emissions reduction trials. Our accomplishments will endure for years to come.'

Jim Eck,
Assistant Administrator for
NextGen, Federal Aviation
Administration (FAA)

‘Looking back to the beginnings of SESAR and NextGen, I could not have imagined a more important time in history for the U.S. and Europe to collaborate on the evolution of aviation. It was essential that we work closely together to ensure our solutions and ensuing products would be properly harmonized. Collectively, we met every challenge we faced, and as we continue to move from development into implementation, the successes of NextGen and SESAR are very evident for our flying customers.’

Teri Bristol,
Chief Operating Officer,
FAA

Of particular significance has been the EU-US Memorandum of Cooperation for SESAR-NextGen cooperation for global interoperability. NextGen is the parallel ATM research work under way by the US Federal Aviation Administration (FAA). In December 2014, the NextGen and SESAR JU published a first edition of a ‘State of Harmonisation’ document providing a high-level summary of the current state of progress towards achieving harmonisation and the necessary level of interoperability between the two programmes. This approach to harmonisation has ensured that modernisation and advances in air navigation systems worldwide can be made in a way that supports global cooperation, clear communication, seamless operations and optimally safe practices.



SESAR

SESAR

Plan
trafi

résumé

实现欧洲空

概况

LA HOJA DE RUTA PARA LOGRAR
Plan maestro

Resumen ejecutivo

الجدول الزمني الأوروبية

إصدار سنة 2015

The SESAR JU has also actively supported the work of the International Civil Aviation Organization (ICAO) to strengthen interoperability and has acted as a vehicle — in collaboration with the European Commission, EASA, Eurocontrol — for Europe to support ICAO's developments, industry standardisation bodies and international cooperation. In particular, SESAR research activities supported the development of ICAO's Global Air Navigation Plan (GANP) with the

Aviation System Block Upgrades (ASBUs). Europe's contributions to this global framework were significant and the plan was approved at ICAO's Twelfth Air Navigation Conference (ANC 12) and endorsed by the ICAO 38th General Assembly. As a result of this active support, a clear mapping was made between the ASBUs and the 2012 edition of the European ATM Master Plan. The Master Plan continues to provide a source of inspiration for the evolution of the GANP.





TOWARDS THE FUTURE

8

‘We will accomplish the Single European Sky through technology, through the new air traffic control systems of SESAR. The services and underpinning technologies should be designed keeping in mind the 600 million passengers flying over Europe each year. Passengers should benefit from safety, comfort and affordable tickets. A more efficient air traffic management system can deliver this.’

*Marian-Jean Marinescu,
Member of the European Parliament,
Group of the European People’s Party (Christian Democrats)*

In June 2014 the EU Council of Ministers adopted the extension of the SESAR JU to 2024 in recognition of the need to foster research and innovation in ATM beyond the organisation’s original mandate of 2016, as well as in appreciation of the ability of the SESAR JU partnership to respond to evolving business needs and fast-track technological and operational improvements in Europe’s ATM system.

Although SESAR 1 activities draw to a close in December 2016, the SESAR JU has already put in place the continuation of its activities with SESAR 2020. Building on the results achieved to date, SESAR 2020 focuses on areas of the ATM value chain where the greatest performance gains can be attained. These areas address the need to better integrate airports into ATM, develop further advanced air traffic services, optimise network services and enable the necessary infrastructure.



'Thanks to SESAR, we are developing and deploying cutting-edge operations and technologies for European and global aviation. We all know that a top-notch ATM system is vital for the achievement of the Single European Sky, and SESAR research and innovation projects are vital to reach that objective. I am confident that with a renewed and evolved partnership, the SESAR 2020 work programme will deliver even more outstanding and timely results than before and drive our ambitious agenda forward.'

Henrik Hololei
Director General, DG
MOVE, and
Chair of the SESAR JU
Administrative Board

‘New concepts are desperately needed for the future congested airspace in Europe. SESAR 2020 provides an excellent basis to continue the successful partnership between ATM research and innovation as well as industry in order to shape the future ATM system of Europe in line with Flightpath 2050.’

Rolf Henke,
Chairman,
the Advisory Council for
Aviation Research and
Innovation in Europe
(ACARE)

The SESAR 2020 industrial activities will benefit from a contribution of EUR 500 million from the European Union’s Horizon 2020 research and innovation programme. Specific funding amounting to EUR 85 million is earmarked for longer-term research activities particularly designed to attract universities, public institutions, small and medium-sized enterprises and industry.

SESAR 2020 will retain its founding members, the European Union and Eurocontrol, and in March 2016 the SESAR JU announced the full SESAR 2020 membership team — including 19 organisations, comprising the original SESAR JU membership plus five new entities. The renewed SESAR JU membership and capabilities will allow for a continuity of work, as well as provide a fresh impetus to SESAR’s industrial R&I activities.



‘What is being implemented through the SESAR Deployment Manager today is the result of more than eight years of intense research and innovation work performed by the SESAR JU. By early 2016 we have 84 implementation projects underway by 45 partners already running in 23 EU Members States and two neighbouring States. All this is the true demonstration of Europe’s ATM industry’s willingness to invest in modernisation and meet the Single European Sky challenges.’

Massimo Garbini,
Managing Director,
SESAR Deployment
Manager

In December 2014 the European Commission appointed the SESAR Deployment Alliance — a partnership of the A6 ANSP alliance, the A4 airlines group and the SESAR-related Deployment Airport Group (SDAG) European Economic Interest Group (EEIG) — to the role of SESAR Deployment Manager (SESAR DM). Its job is to manage the synchronised deployment of the first set of SESAR Solutions, captured in the Pilot Common Project.

In March 2015, the SESAR JU and the SESAR DM signed a Memorandum of Understanding to provide a platform upon which to build cooperation for the smooth and timely delivery and deployment of SESAR Solutions to the ATM community. A critical factor for success is the exchange of information to support the industrialisation phase, to ensure effective bridging between R&D and deployment and to facilitate interoperability.





So what has been the legacy of the SESAR 1 programme? A huge body of work which has delivered solutions already transforming the performance of Europe's ATM system and it is something of a technical, procedural and, most importantly, cultural significance for collaboration on ATM research and innovation.

As the 2015 European ATM Master Plan clearly indicates, the landscape of ATM and aviation is evolving and needs to be supported by continued research in ATM technologies and procedures and an institutional framework of partnerships by all stakeholders to ensure that change can be managed in a safe, efficient, cost-effective and environmentally responsible way.

SESAR JOINT UNDERTAKING — KEY MILESTONES





2007

February

- ▶ SESAR JU created under European Union Law

October

- ▶ Appointment of the Executive Director

2008

February

- ▶ Start of negotiations with 15 pre-selected members

May

- ▶ Public release of SESAR Master Plan

November

- ▶ AIRE demonstration contracts signed

December

- ▶ Adoption of the amended Council regulation recognising SESAR JU as a Union body

2009

March

- ▶ Endorsement of the European ATM Master Plan by the Council

June

- ▶ SESAR JU signs working agreements with 16 partners and technical programme kicks off

September

- ▶ Major airlines, business & general aviation, associations participate in SESAR

December

- ▶ First SESAR projects start research and development

2010

January

- ▶ 3,000th contributor working on SESAR

April

- ▶ AIRE: first complete (gate-to-gate) transatlantic flights

May

- ▶ First 100 SESAR projects in execution

July

- ▶ Associate partners join SESAR family

September

- ▶ AIRE 2010/11: Successful start of new green aviation trials

November

- ▶ EASA and SESAR seal cooperation



2011

March

- ▶ SESAR Release 1 published
- ▶ EU-US Memorandum of Cooperation in aviation research signed

August

- ▶ Eight consortia join SESAR as new Associate Partners

October

- ▶ ATM Master Plan Update officially kicked-off

November

- ▶ First SESAR Innovation Days

2012

February

- ▶ The world's first 4D Flight successfully validates the capability of the aircraft system to comply with time constraints

June

- ▶ Initial SESAR airport operations centre (APOC) goes into operation at Paris Charles de Gaulle

October

- ▶ European ATM Master Plan 2012 adopted
- ▶ Release 1 Results published

November

- ▶ Demonstration activities, including second phase of AIRE, are launched
- ▶ First live SWIM demonstration

December

- ▶ First SESAR SWIM Master Class Awards
- ▶ Second SESAR Innovation Days

2013

February

- ▶ The European ATM Master Plan 2010 wins prestigious IHS Jane's air traffic control (ATC) award
- ▶ Successful live demonstration of SWIM at the World ATM Congress in Madrid

June

- ▶ Nine demonstration projects are launched on the safe integration of civil remotely piloted aircraft systems (RPAS) in the European ATM System

October

- ▶ EU transport ministers agree on SESAR JU extension
- ▶ Release 2 Results published

November

- ▶ Third SESAR Innovation Days

December

- ▶ Second SESAR SWIM Master Class Awards

2014

March

- ▶ Second successful i4D flight trial from Toulouse to Copenhagen

June

- ▶ SESAR JU mandate extended until 2024

July

- ▶ **Call for Expression of Interest for candidate members to participate in the SESAR 2020 programme**

September

- ▶ 18 SESAR Large Scale Demonstrations launched
- ▶ RPAS Definition Phase starts

November

- ▶ Initial SESAR APOC opens for business at London Heathrow

December

- ▶ Third SESAR SWIM Master Class Awards
- ▶ Fourth SESAR Innovation Days
- ▶ Kick-off of European ATM Master Plan review campaign

2015

February

- Results published of 18 completed SESAR demonstrations

March

- SESAR JU and SESAR DM sign a Memorandum of Understanding
- Launch of first SESAR 2020 call for exploratory research projects.
- NextGen-SESAR State of Harmonisation published
- VDL Mode 2 Measurement, Analysis, Testing and Simulation study launched
- **First SESAR 2020 call for exploratory research projects launched**

April

- SESAR JU member, LFV, inaugurates the world's first Remote Tower Services

October

- Live flight trial by an unmanned aircraft in controlled and unsegregated airspace

November

- Cyber-security study published

December

- First 2020 industrial research call published
- Clean Sky and SESAR JUs sign a Memorandum of Cooperation (MoC)
- 2015 edition of the European ATM Master Plan published
- Fourth SESAR SWIM Master Class Awards
- Fifth SESAR Innovation Days

2016

March

- SESAR JU membership renewed with 19 entities

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