



# sesar magazine

## Editorial

The challenge of the paradigm shift in ATM is slowly but surely being realised. This is not just a dream. It is becoming reality. The first insights can already be seen in SESAR Release 1. On 10 February, for example, the world's first initial 4D trajectory live trial took place. In 2011, remote tower operations were tested in Sweden, Germany carried out Short Term ATFCM Measures trials and work on the integrated controller working position has advanced. We will continue the process with Release 2 this year, and you can find more about its planned activities in this magazine.

It is clear to me and to everybody in the aviation sector that SESAR means a change for the better. But this change will not come free of charge. Serious investment will be required from ANSPs and airspace users. We have demonstrated the economic benefits to be expected from SESAR and we have shown, through the Release structure that we can deliver.

In a recent communication, the European Commission repeated its commitment to SESAR and the Single European Sky and will propose incentive measures to implement the new technologies. Detailed deployment roadmaps for each user group will be included in the updated ATM Master Plan.

We're working on a smooth transition process, and, most importantly, on an interoperable system. With the upcoming 12<sup>th</sup> ICAO Air Navigation Conference, the UN organisation for civil aviation will determine the policy and priorities for air traffic management as well as communications, navigation and surveillance (CNS) for the next decade. ICAO member states are invited to consider an update of the ICAO Global Air Navigation Plan (GANP) and the updated European ATM Master Plan directly fits into that.

ATM modernisation is a challenging and ambitious goal, and the SESAR JU and its members are on the way to achieving it.

**Patrick Ky**  
Executive Director, SESAR JU

## Focus on: SESAR Releases 1 and 2

# SESAR Releases: advancing ATM modernisation



Airbus A320 test aircraft performing the world's first I-4D flight © Airbus 2012

**After the successful introduction of Release 1 in 2011, the SESAR JU's administrative and programme committees approved its plan for Release 2. With the innovative Release approach, the effort will thus also in 2012 lie on validating early achievements in an operational environment for the benefit of passengers, airlines, controllers**

**B**uilding on the achievements of Release 1, but with more emphasis on coherency with the overall SESAR programme, Release 2 gives priority to exercises which will demonstrate that, assuming successful validation, industrialisation of the projects is feasible in the short-medium term. "We are aiming for more concrete results with direct benefits for users", says Florian Guillermet, SESAR JU Deputy Executive Director Operations and Programme.

The SESAR Joint Undertaking together with its 16 members will concentrate on four main areas of operational improvements: airport platform safety, airborne operations, ATC operations and network management. After the successful world's first I-4D flight (see here below) on 10 February 2012, SESAR members will further advance the synchronisation of airborne and ground profiles.

Improving capacity is one of the main goals of the SESAR programme and consequently, Release 2 will also tackle aspects such as improved flexible use of airspace or a user driven authorisation process where airlines can swap take-off times. These validated procedures will be the first step towards collaborative decision making. To make sure that the new developments are fit

founding members



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Image from the remote tower trial in Sweden © SAAB

for purpose, airspace users will be deeply involved in the Release 2 validation exercises. While they are of increasing relevance to the overall SESAR programme, Releases form only a part of the R&D efforts of the Joint Undertaking and its members. Begun as an innovative way of pushing forward potentially early improvements to the European ATM system, the Release process is now proving itself as a useful way of focussing the energy of the many participants on achieving practical results. Releases 3 and 4 will continue to make a vital contribution, with increasingly complex live exercises testing the elements that will make up the future European ATM system.

### Release 1: a successful start

The SESAR Release 1 programme ended in February, concluding a significant milestone in the SESAR effort. Release 1 encompassed 25 validation exercises ranging from the development of green, efficient terminal airspace operations to the initial 4D trajectory, end-to-end traffic synchronisation and collaborative network management.

During the year 2011, validation activities were carried out across Europe to test SESAR solutions in an operational environment (e.g. through live trials). They included for example the world's first initial 4D flight, an exercise to validate Short Term ATFCM Measures (STAM) or a

three week long operational validation trial campaign on remote and virtual towers. One year into the Release process, it is evident that this new system has brought benefits in terms of focussing energy on the continuous introduction of new solutions, which are validated in an operational environment with the participation of all ATM stakeholders.

#### The world's first I-4D flight

The first four-dimensional trajectory management (I-4D) validation exercise took place on 10 February 2012, when an A320 test aircraft flew from Toulouse to Copenhagen and Stockholm and back. It was the culmination of months of preparation between SESAR partners, including aircraft, avionics and equipment manufacturers as well as air navigation service providers.

4D is no more just a concept but living. Associated with appropriate Datacom, RNP, CDA and TBO, the ANSPs and the aircraft manufacturers will now be able to deliver outstanding new performances to the airlines.

**Eric Stefanello, CEO, Airbus ProSky**

I-4D represents a key element in the transition from constrained flights in the current ATM system to optimised flights in the future Single European Sky. I-4D operations establish far in advance a sequence for aircraft converging on a merging point in a congested area. After coordination between the ground systems and the aircraft, each aircraft is allocated a



time slot for its arrival at a merging point, and in compensation is allowed to fly its optimum profile up to that point, without any vectoring instruction from the controllers.

Following the I-4D flight in Maastricht was very exciting. It was great to see the downlinked trajectory on our controller working position. First time we saw air and ground technologies working together and give a complete picture synchronised between our ATC system and the aircraft: ADS-C gave us the FMS trajectory (with a warning when the ground trajectory was not consistent with the FMS trajectory), CPDLC allowed us to uplink route clearances and time constraints, and through enhanced Mode S we immediately observed the Mach number changing as the aircraft reacted to comply with the time constraint. Great! Thanks to all who made this happen together with us, and our team in MUAC who worked very hard to get there.

**Peter Hendrickx, Head of Operational & Airspace Systems, Eurocontrol MUAC**

## Interview with Florian Guillermet

As the SESAR JU Deputy Executive Director Operations and Programme, Florian Guillermet is responsible for the definition and execution of the SESAR programme. Here, he explains how the system of Releases allow the benefits of the €2.1 billion SESAR effort to be introduced to European ATM at the earliest opportunity.



*How does the Release process benefit the overall SESAR programme?*

The benefits of the Release process are twofold: firstly, it provides a direct relationship between SESAR and the future ATM system, and secondly, it changes how we run research and development in the ATM domain. The Release process brings benefits in terms of focussing the energy of all of the different stakeholders and contributors. Basically, we've moved from fragmented R&D to a far more focussed approach.

*Has Release 1 been a success?*

Absolutely. It has given us a lot of really useful experience as well as concrete results. Although it was sometimes limited in scope, results are being delivered in several areas, mainly with airports and TMA operations, exchange of information, network

management and 4D trajectory management. It will be formally concluded in February, and the final results assessed during April and May.

*How would you describe the differences between Release 1 and Release 2?*

Release 1 was essentially a bottom-up exercise in which we worked on a number of specific validation activities. Our strategy for Release 2 is to take advantage of this experience, so that our ability to deliver Releases is on a better track. We're also undertaking a wider scope of activities from a more 'top-down' perspective. For example, we will look into new procedures which will allow airspace users to swap take-off times through collaborative decision making on the day of flight. Such a swap might be useful in case of a 'significant' demand - capacity mismatch.

*What happens after Release 2?*

With Releases 3 and 4 we plan to further build on the long-term top-down approach, working from the ATM Master Plan, so that we get more flow from innovative research through to industrialisation. The objective is to have Releases totally integrated with the SESAR programme, and connected to business needs for our stakeholders.

We have also launched a call for proposals for Integrated Flight Trials and Demonstration Activities. We want to further demonstrate Release outputs in real life operations.

## Focus on: SESAR Releases 1 and 2



The team during the STAM validation exercise © Eurocontrol

Starting from Toulouse, the Airbus A320 test aircraft flew through the Eurocontrol Maastricht Upper Area Control Centre (MUAC) airspace where the airborne and ground systems agreed on a first time constraint at a merging point close to Copenhagen airport. The flight then continued into Danish airspace to demonstrate an optimised descent to Copenhagen. After reaching the first merging point, the aircraft climbed to a cruise level from which it negotiated a second time constraint at a merging point close to Stockholm Arlanda Airport. The flight then descended into Swedish airspace in a fully optimised way to the second merging point and landed at Arlanda.

The trial successfully verified the automated 4D data exchange between aircraft Flight Management System (FMS) and ground automation systems through datalink. It also aimed to validate how information is displayed to the controller and the pilot as well as the impact on their operations.

### Short Term ATFCM Measures (STAM)

Balancing demand with available capacity is a key element of SESAR and on 8-10 November 2011 a live trial, the outcome of which was described as "beyond expectation" was carried out to validate the Short Term ATFCM Measures (STAM) exercise.

The trial was part of the overall dynamic Demand Capacity Balancing (dDCB) project which aims to find ways of smoothing out traffic bunching leading to demand peaks and sudden extra workload for controllers.

Cooperation between the involved airlines, FMPs and the Network Manager was excellent.  
**Othmar Schnabel, DFS.**

London, Reims and Maastricht Flow Management Positions (FMPs), 11 airlines and the Network Manager took part in the STAM exercise. "Cooperation between the involved airlines, FMPs and the Network Manager was excellent", said SESAR project manager Othmar Schnabel (DFS). "In one instance, the application of nine short-term ATFCM measures reduced the initial regulation delay from 810 to 99 minutes. This is very promising". The trials also demonstrated better traffic prediction. Results of the trials will now be carefully analysed, and consideration is being given to the operational implementation of these working methods in the course of 2012-2013.

### Remote and virtual tower project

SESAR's remote and virtual tower projects conducted a three week long operational validation trial campaign in autumn 2011. Twelve Swedish air traffic controllers participated in these SESAR validations at the remote tower facility in Malmö by shadow mode. They monitored all day-to-day live air and ground traffic at Ängelholm airport, 100km away, testing the latest updates to the concept and its technologies during daylight, dawn, darkness, CAVOK and LVP conditions.

The image is now pretty impressive!  
Initial feedback from controllers participating in the trial.

Pending the final results of the exercise, the initial feedback from the controllers on the virtual out-of-the-window view is that the "Image is now pretty impressive". The National Supervisory Authority of the Netherlands also participated in the exercise, and identified a certain number of areas of improvement including the need to mitigate big contrast differences between ground and sky or when facing the sun.



Patrick Ky speaking at the Master Plan update kick-off event in Brussels.

# Updated Master Plan: focus on SESAR deployment

Providing a simpler, more readable and useable updated European Master Plan which takes into account recent changes in the aviation sector, is the aim of the SESAR JU's ongoing Master Plan update campaign. Started in October 2011, the first draft document will be available for consultation in March 2012.

On 30 March 2009 the European Union Transport Council endorsed the first European Air Traffic Management Master Plan. It provided a roadmap for the development and deployment of the SESAR Definition phase outcome and for the first time presented all elements of European air traffic management together in a single document.

The Master Plan was always designed to evolve, and now, three years later, the first major update is being undertaken, with the all-important emphasis on deployment of the future European ATM system.

Launched in Brussels in October 2011, the updated Plan is urgently required to respond to the rapidly changing air traffic situation, as well as to take account of recent developments in ATM technology. "Since the adoption of the current Master Plan, important parameters have changed. We're updating the Plan, carefully taking into account these latest developments", says Denis Koehl, SESAR JU Senior Military Advisor in charge of the update campaign.

## Deployment synchronisation

The first SESAR Master Plan brought European ATM stakeholders together to produce and validate a document representing a common view of the future of European ATM. This remains a central theme and the update will call for a "stakeholder-specific approach", meaning that by the time it is published, each participant should "know what the Master Plan means for them, what is expected from them and how it will affect them," says Patrick Ky, Executive Director

of the SESAR JU. He stresses the need for total stakeholder involvement in the update process, but adds that while "not everybody will agree with everything, there will be no-one at the end who can say they were not consulted."

When updating the Master Plan, the SESAR JU follows three core principles: to produce a simpler, more readable and useable document; to apply a pragmatic, stakeholder-specific approach; and to deliver results in a timely and efficient manner. Performance linkages will be introduced to ensure that individual components in the Plan contribute to the overall performance of the future ATM system.

Another focus of the update is the synchronisation between deployment dates for different stakeholder groups. "The main idea is to motivate all SESAR stakeholders to think about the deployment of improvements," says Patrick Mana, Programme Manager at the SESAR Joint Undertaking. "The Plan will propose ideas for deployment from the stakeholder point of view. By synchronising the introduction of SESAR's solutions, we expect a maximisation of performance benefits and consequently of the value of investment."

The global financial crisis came about after the first Master Plan was published. The update now aims at ensuring that the measures make good business sense. "The Master Plan is the living link between development activities and deployment decisions," says Ky. "We cannot afford any more to deploy systems without a clear and validated impact assessment."

Proposals for deployment of the initial measures are already being considered. "We're looking at things like traffic synchronisation, enhanced runway throughput, integrated surface management, trajectory management, enhanced network management and dynamic capacity demand balancing and integrated airport management," says Koehl. "These have the priority, but they rely on important enablers such as information management, communications, navigation and surveillance, datalink, and so on."

## Update process

The first part of the update campaign was carried out by ECAC experts. It focussed on a total review of technical information contained in the current ATM Master Plan and performance needs were evaluated for all operational environments such as airports, en-route and TMA operations. Safety, cost-effectiveness and flight efficiency targets were also addressed in the overall network context.

The second part of the campaign took place between January and March and focussed on the development of the high-level Master Plan (so called Executive level) document. Four draft versions are planned, the third of which will be released by end of February for informal consultation by stakeholders. The document has three main parts:

**Performance View:** An updated Strategic Objective reviewed by the European Commission's Single Sky Committee, restating the 2005 objectives of a three-fold increase in ATM capacity, safety performance increased by a factor of 10, a 10 percent reduction in emissions and a halving of ATM costs to the user. This section also contains Strategic Performance Needs, a series of non-binding requirements to be used as the basis for the deployment view.

**Deployment View:** This is the main part of the document, focussing on around 10 "Essential Changes" to SESAR Step 1, which bring significant performance benefits. Each Essential Change has an overview detailing the system changes for each stakeholder group. This chapter also contains the links between the ICAO Aviation System Block Upgrades and SESAR changes at the level of Operational Focus Area.

**Business View:** Providing an overview of the costs and associated benefits for each stakeholder group.

The updated Plan will be subject to approval by the SESAR JU Administration Board before the summer. It will then be used as a reference document for the ICAO's Twelfth Air Navigation Conference (ANC 12) in Montreal in November, where it will represent the European input to ICAO's Global Air Navigation Plan.

# AIRE<sup>1</sup>: from testing to proof

Major reductions of carbon dioxide emissions along with significant fuel burn savings and lower approach noise have been achieved during the second successful round of AIRE projects. Now an international benchmark for the use of existing technology to achieve early environmental benefits, AIRE is showing that multinational partnerships, interoperability and collaborative decision making can make a real difference.

The AIRE (Atlantic Interoperability Initiative to Reduce Emissions) initiative was launched by the European Commission and US Federal Aviation Administration (FAA) in 2007 and the European element is managed within the SESAR programme. 24 successful projects have now been concluded in the first two years, and the conversion rate of projects into routine day-to-day operations exceeds 80 percent.

With AIRE, we revolutionise the way we do business in the North Atlantic.  
Larry Lachance, NAV Canada

The initiative is of great value and benefit to all the participants, in particular to the airlines who profit directly from having the tested solutions implemented on a daily basis and the ANSPs that can provide what the users request. "We are revolutionising the way we do business in the North Atlantic", said Larry Lachance, NAV Canada mentioning the opportunities brought by the ENGAGE and Rlong projects, led by NATS, in the North Atlantic "It has been a really exciting and positive project for us, and has created a lot of interest throughout our respective businesses. Brilliant!", said Mark Watson, NATS project manager for the same projects.

The 2010/2011 round also provided useful input to SESAR projects, helping to identify the kind of difficulties likely to be experienced in delivering operational improvements into the European ATM system.



*"What is surprising is that throughout the AIRE programme, the projects are based on existing airborne technology which is not necessarily being used because people are not yet aware of their benefits. We're encouraging people to use it and to achieve cultural change as a result",* said SESAR JU environment officer Alves Rodrigues.

Through green flight procedures, savings of 2% of fuel burn can be achieved for the A380.

The 2010/2011 AIRE programme has continued the success of the 2008/2009 cycle, which contained 1,152 flight trials and demonstrated the value of optimising surface, terminal and oceanic procedures. The latest cycle was significantly expanded to include 9,000 flight trials and more ambitious projects in additional locations, and more partners.

AIRE Projects are structured through a validation plan organised around one or several ATM domains – surface, terminal and oceanic/en-route operations and "gate-to-gate". Within each domain, a given project envisages several specific operational areas where trials can be conducted to improve fuel and airspace usage, reduce CO<sub>2</sub> emissions, and sometimes noise.

#### AIRE projects in 2010/11

The latest cycle involved 13 airlines, 14 air navigation service providers and 10 industry partners and was divided into four Lots. Lot 1 was for projects dealing with surface movements, Lot 2 terminal projects, Lot 3 en-route/oceanic and Lot 4 gate-to-gate projects. Additionally more than 40 operators benefited from the demonstrations as participation was not exclusive.

Some remarkable results have been achieved: in Lot 1, for example, a collaborative decision making (CDM) exercise at Vienna airport carried out by Austrian Airlines and Austrocontrol revealed potential fuel savings of 1,200 tons a year, simply by introducing new taxiing procedures. And in Lot 4, the Airbus A380 Transatlantic Green Flights project showed that taxiing the giant aircraft to the take-off point using two engines instead of four could save 360kg of fuel per flight, equivalent to 1.2 tons of carbon dioxide.

The same Green Flights project carried out an en-route trajectory optimisation exercise with an Air France A380 flying between New York and Paris. The trial took advantage of the high optimum cruising level of the aircraft to deviate the flight from the Oceanic Track System to take advantage of actual wind conditions. The result: a 600kg fuel saving, amounting to 2 percent of the fuel burn for the transatlantic portion of the flight.

In the Prague terminal manoeuvring area, annual fuel savings of more than 2,000 tons were estimated for the Airbus fleet of Czech Airlines as a result of introducing more efficient flight profiles using Continuous Descent Approach (CDA) techniques. More than 200 CDAs were performed during the exercise.

A project involving the UK's NATS, NAV Canada and Air France found that greenhouse gas emissions could be cut by up to

1.2 million kg a year through the direct application of reduced longitudinal separation minima in the North Atlantic, which has one of the world's busiest oceanic traffic flows. Air France conducted a fuel burn analysis for 47 occasions in which the reduced minimum was applied to their flights as a means of enabling oceanic step climbs when they would have otherwise not been possible. British Airways and United Airlines also provided data on the benefits.

Optimising flight trajectories between Paris-Orly and Toulouse in both lateral and vertical planes by using improved ATM procedures obtained potential fuel savings of 320kg per flight per day for the return flight, equivalent to 3,500kg of carbon dioxide. And the Paris-Point à Pitre Transatlantic Green Flights project showed that optimising flight profiles bought up to 3,000kg fuel savings per flight.

In the USA, AIRE is coordinated by the FAA's Office of Advanced Technology Development and Prototyping as part of the Next-Gen International Air Traffic Interoperability Programme.

SESAR's target is a reduction of the environmental impact per flight by 10%.

The introduction of best practices during all phases of flight at the earliest stage is showcasing new environmentally friendlier procedures in both the USA and Europe. It is also helping the SESAR and NextGen programmes to find ways of improving interoperability on transatlantic routes – an essential element of the air traffic management world of tomorrow.

#### The next stage

The next stage in the AIRE campaign has already been taken in the form of a Call for Proposals from the SESAR JU for "Integrated Flight Trials and Demonstration Activities" covering the period 2012 – 2014. AIRE is an important part of the overall SESAR programme and is expected to contribute to the first blocks of the SESAR Concept of Operations by demonstrating the environmental benefits of four-dimensional trajectory-based operations.

Major improvements in aviation's environmental footprint are a key element of SESAR, with a target of a 10 percent reduction in the impact of each flight. Thanks to AIRE, partners are addressing quickly the existing inefficiencies and understanding better the necessary improvements and challenges behind achieving this target.



<sup>1</sup> Executive summaries of the AIRE projects so far are available at: [www.sesarju.eu/aire](http://www.sesarju.eu/aire)

## Member's profile

# Honeywell in SESAR: Advancing ATM in the heart of Europe

Honeywell Aerospace is focused on delivering exceptional technology development and engineering support to the SESAR programme. Executed by engineers mainly based in Brno, Prague and Toulouse, the Honeywell contribution to SESAR revolves around the airborne systems work carried out under the leadership of Airbus in SESAR's WP 9. Honeywell is also participating in a number of operational work packages, from airport surface (WP 6) to en-route (WP 4), and systems work packages defining air-ground communication, navigation and surveillance systems (WP 14 and WP 15).

In partnership with Airbus, NORACON, Eurocontrol's MUAC, Indra, and Thales, Honeywell has delivered the SESAR-ready flight management system that played a central role in the recent successful flight test of initial 4D (I-4D) trajectory planning. I-4D requires the aircraft to arrive at a defined waypoint within 10 seconds of a time specified in a contract between the flight crew and air traffic control.

By providing flight predictions based on the latest uplinked weather information, the FMS supports the pilot in assessing the feasibility of an arrival time proposed by ATC. Once the time is accepted by the pilot, the FMS regulates the speed of the aircraft to meet the specified arrival time constraint, responding immediately to unexpected headwinds for example. The new function can be accommodated in existing FMS boxes via a software upgrade.

Honeywell technologies applied in other work packages include its Traffic Alert and Collision Avoidance System (TCAS), a new airborne multi-constellation GNSS receiver, the SmartPath Ground Based Augmentation System (GBAS) and the SmartView Synthetic Vision System (SVS).

Honeywell's SmartTraffic already provides an overview of other traffic in the vicinity of an aircraft. In SESAR, Honeywell has developed an upgraded SmartTraffic version of the TCAS it produces for the Airbus A320 family that supports interval management, enabling one aircraft to maintain a specified interval behind another with an accuracy of plus or minus five seconds.

In this concept, which will be validated together with Airbus and Air Navigation Service Providers (ANSPs) in the SESAR programme, the controller builds arrival sequence using ADS-B information on aircraft speed and position, then data-links a clearance to merge with the arrival queue and maintain a separation of typically 90 seconds behind a designated target aircraft. The developed system provides suffi-

cient performance to support the controller and flight crew in their tasks. The result is not only an extremely regular arrival sequence with reduced in-trail separation but reduced workload for both controller and pilot.

To provide the accurate positioning data required for such procedures, the new GNSS receiver developed in Brno will work with both GPS and Galileo for enhanced reliability and precision. The GNSS receiver in the SmartPath GBAS is already demonstrating accuracies of well under one metre, and by transmitting correction signals to the aircraft it supports precision approach procedures in low visibility conditions to reduce delays and cancellations caused by bad weather.

One of the most elaborate research tools at Brno is a cockpit simulator with a combination of mainline and business aircraft avionics and technologies to enable quick prototyping of new features. Already certified on high-end business jets, the SmartView SVS uses the terrain database from Honeywell's Enhanced Ground Proximity Warning System to generate a synthetic view of the world outside.

In the context of SESAR the company is working to integrate that synthetic view with an infrared image of the real world and a layer of symbology to give the crew the information they need to fly the aircraft. The resulting Combined Vision System (CVS) should enable aircraft to take off and taxi in any weather conditions even at airports without ILS or GBAS. It should also support low visibility approaches: the aim is to certify it for approaches to a decision height of 100 feet at unequipped airports.

To help provide the high performance required for the future data exchanges between aircraft and ATC, a Honeywell-led team is also developing a new airborne terminal to operate with the European Space Agency's Iris satellite communications system. A single software-reconfigurable box, the satellite terminal will support time-critical voice and data com-





munications required by the future air traffic management system.

In addition, Honeywell is involved in projects improving the display of improved weather data transmitted from the ground to the cockpit, data link improvements to make taxi and departure clearances more efficient, and the development of runway and taxi alerts for the pilot to make airport operations safer.

Honeywell leads the SESAR Air/Ground SWIM project, whose objective is to tailor information sharing between airborne and ground systems, considering the very specific constraints of the airborne segment (mobility, safety and security constraints, bandwidth, legacy communication means, etc.). Air/Ground SWIM is a key element of the future ATM system, making it possible to enhance the avionics processes using more accurate weather and aeronautical information and informing all relevant entities, including airline operations centres and airports, about in-flight route changes.

## SESAR in depth

# Beyond 2020: WP-E brings “blue sky” SESAR research

The Single European Sky story will continue long after the SESAR JU delivers its results at the end of the decade. Long-term thinking is now being applied through the WP-E programme to find out what future innovations in ATM may be possible. The first WP-E Innovation Days conference, held in Toulouse, pointed the way forward.

Creating a unified air traffic management system for Europe poses one of the biggest international research and development challenges the continent has ever seen. At its helm, the SESAR Joint Undertaking (JU) is responsible for bringing the technology elements of the system to maturity by 2020. The way it does so is through a number of dedicated work packages that attack specific problems, each of which has to produce results within an agreed timescale.

But one workpackage, workpackage E (WP-E) does not completely fit into this picture. Here, there is no specific deadline, because it is targeted beyond the nominal 2020 SESAR timescale and deals with non-mainstream, highly innovative long-term research projects bringing both further evolution as well as radical new ideas to SESAR; leading to even greater ATM performance and stakeholder benefits.

The idea is to bring the best brains Europe has to bear on some of the ATM technology issues which will arise in the years following deployment of the current SESAR operations and technology. By definition, WP-E concentrates on exploratory research and by definition only in some cases are the potential applications and tangible benefits clear. This work will prepare the ground for applied research and development,

leading to further advances in ATM that become necessary as traffic continues to increase and costs as well as environmental constraints change.

WP-E research will explore novel, unconventional (and perhaps high risk) areas, involving new technologies, concepts or ideas. It will also seek to apply existing methodologies and techniques in new ways, potentially applying scientific disciplines that have not previously been brought to bear in air traffic domains, thus attracting a rich seam of skilled and innovative researchers to ATM.

### WP-E Thematic Programme

In February 2010 the SESAR JU published the first WP-E Thematic Programme, for those wishing to participate in long-term ATM research activities. The four themes contained within it reveal the brainstorming approach that is being taken: Legal Aspects of Paradigm Shift; Toward Higher Levels of Automation in ATM; Mastering Complex Systems Safely; Economics and Performance. These themes have already initiated 18 Research Projects, two very successful Research Networks with their own specialised conferences, around

## SESAR in depth

400 global participants and 25 PhD activities, with another Research Network being established during 2012.

Pulling together all of the diverse ideas and range of participants for WP-E is done through a joint event, the SESAR Innovation Days, the first session of which was held between 29 November and 1 December last year, in Toulouse. Hosted by L'Ecole Nationale de l'Aviation Civile (ENAC), the event gathered some 140 representatives from academia, research centres and industry.

"Long-term research is an integral part of the SESAR programme," SESAR JU Executive Director Patrick Ky told the conference. "Days like this illustrate the SESAR partnership. I am very pleased to see the highly interactive dialogue taking place between students, professors, industry and research institutes."

WP-E is seen by the SESAR JU as a catalyst for the creation of a healthy, ongoing ATM research capability. It will also make provision and provide funding for research activities not currently planned within the mainstream of SESAR development workpackages.

Long-term research is an integral part of the SESAR programme.

Patrick Ky, SESAR JU Executive Director

### WP-E Research Networks and Research Projects

The WP-E success is based on two elements: Research Networks, and Research Projects. Research Networks are a key driver, as they bring together research groups, providing a structured way to build research knowledge, competence and capability to serve the industry in the long term. Each Research Network comprises members and participants from academia, research centres, industry and SMEs that share common expertise and interest in a relevant air traffic management or transportation domain. The networks are organised in accordance with at least one of the Research Themes.

During the conference, the Alias WP-E project was presented. Described as a "challenging and innovative project focussing on the legal implications of automation in complex socio-technical systems", this network will provide a structured way to establish a body of research knowledge, competence and capability that will serve the operational scenario in the long term. A key part of its approach is the launching of an ATM Legal Research Network during 2012 and the conference was used to great effect to generate further interest and to promote this launch.

Another key research network is Higher Automation Levels in ATM (HALA!), which has been established to spearhead long-term, innovative ATM research in pursuit of the SESAR 2020 vision and beyond. HALA! activities were launched on 3 September 2010, in Barcelona. The network organised and launched the first International Conference on Application

and Theory of Automation in Command and Control Systems – ATACCS'2011, in Barcelona from 26-27 May and a successful Summer School in Seville from 11-14 July 2011. Both the Summer School and the second ATACCS conference will be running again in 2012, with ATACCS'2012 being hosted by Imperial College, London, from 29-31 May.

ComplexWorld is the Research Network for the theme 'Mastering Complex Systems Safely', bringing together researchers from academia, research establishments, industry and SMEs that share common interests and expertise in the field of Complexity Management. It provides them with a structured way and stable forum for the development, exchange, and dissemination of research knowledge from outside of ATM and considers how complexity science can be applied as the ATM system exhibits characteristics that make it suitable to be analysed from a Complexity Science approach.

Sponsoring of PhDs is an essential part of the SESAR Research Network activity, bringing a stronger commitment from universities, as well as attracting new scientists into the ATM field. Cooperation between networks is expected to lead to outcomes that have a lasting and widespread impact on ATM research across Europe.

Research Projects allow more focussed research on future challenges or topics and include the opportunity to explore innovative ideas and potential applications; if they bear early fruit, they can have potential for application in the short term. The projects generate scientific knowledge which increase the understanding of ATM issues and demonstrate the potential of novel technologies, methods or concepts. Periodic calls for proposal are issued, the proposals are reviewed by independent experts who ensure a balanced representation from industry, research and academic communities, leading to selection and award if justified. During 2012, further calls for additional projects to join the SESAR research portfolio will be issued.

The research being pursued through the WP-E process of networks, PhD's and projects will attack the boundaries of ATM technology, preparing the way for future advances that will ensure Europe's Single Sky remains a world-beating example of ATM achievement.

### References for more information:

[www.sesarju.eu/programme/workpackages/wpe](http://www.sesarju.eu/programme/workpackages/wpe)

[www.hala-sesar.net/](http://www.hala-sesar.net/)

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## SESAR in depth

# SESAR – ready for the General Aviation / Rotorcraft community?

SESAR's vision for airspace users has been understandably focused on scheduled airlines, to whom the majority of the benefits will accrue. In 2010/11, the SESAR JU asked a group of General Aviation (GA) and Rotorcraft representatives to review its Concept of Operations (ConOps) and identify issues of particular concern needing further work to ensure access and equity for those user groups. By *Julian Scarfe*

**A**irspace users are a diverse group, including the military, sport aviation, business aviation, private aviation, flight training, and a plethora of commercial activities that are often lumped together under the heading of 'aerial work', like aerial photography, pipeline inspections, helicopter emergency medical services etc. Add unmanned aerial vehicles to the mix and it gets even more complex. GA and Rotorcraft users have some characteristics that make it more difficult to fit in with the SESAR ConOps:

- Trajectories are often unknown in advance for operational reasons, and even if they are, the feasibility of flying a particular trajectory will only be known in the air. For example, it might be in cloud and the aircraft/pilot might not be able to accept that.
- GA users and small corporates don't have the operations infrastructure of many airlines. It's often just the pilot and his smartphone.
- Operations may be conducted in remote areas at low level, challenging the concept of always being 'online' with SWIM.
- Most such operations are single-pilot, making it more difficult to work in a new information-rich environment.

But most of all, SESAR is likely to require more avionics, which means weight, space, and cost. For aircraft that fly several sectors a day with hundreds of fare-paying passengers, the cost-benefit sums for such an investment looks very different from that of a light aircraft that flies a couple of dozen times a year, particularly if avionics costs are inflated by limited numbers of manufacturers and hefty certification costs. So, is SESAR a threat to the GA and rotorcraft community?

## General aviation / rotorcraft involvement in SESAR

The GA/rotorcraft community are engaged with the SESAR JU and the SESAR programme in a number of ways. IAOPA participates in the SESAR Development Phase as a representative of General Aviation airspace users and are regularly involved in the review of critical SESAR deliverables ensuring the GA perspective is appropriately managed. In 2011, SESAR



Julian Scarfe (second on the right), a director of PPL/IR Europe, which is a member of Europe Air Sports and works closely with the International Council of Aircraft Owner and Pilot Associations (IAOPA).

JU asked a group of GA and helicopter representatives to review its Concept of Operations and identify issues of particular concern needing further work to ensure access and equity for those user groups. As well as updating its ConOps and work programme to reflect the recommendations, SESAR JU plan to commission a number of studies on particular topics, including traffic awareness systems, cost-effective datalinks and 4D navigation for GA. General Aviation has options as to how it responds to the simultaneous threat and opportunity of the Single European Sky, and particularly SESAR.

## Critical developments

On the positive side for GA and Rotorcraft, some of the emerging new technologies and procedures have the potential to revolutionise the way we fly. Data communications may advance to a level that makes it easy to get the information we need in the air – compare that to the current state of affairs where switching off the smartphone before take-off shifts us 20 years back in IT history. Navigation technologies may make it as easy to fly a glideslope into a farm-strip or hospital helipad as it currently is for a 747 to do so into Heathrow. And cockpit display of other traffic long before it is visible to the eye may make it easier to detect and avoid other airspace users.

To make sure that GA and Rotorcraft are not excluded from the SESAR vision, there are a number of critical developments to be seen through:

ADS-B, the **surveillance** technology that enables that electronic visibility, needs to be thought through for typical GA and Rotorcraft operations and aircraft. Currently, such equipment is based on the powers and ranges appropriate to ATC surveillance needs, whereas FLARM, an uncertified device based on

the same principles, demonstrates what can be done for light aircraft collision avoidance. We all need to be using compatible systems.

As information for air traffic control moves from voice to digital data, we need an affordable and practical **communications** datalink that allows GA and Rotorcraft to take part in SWIM. The current datalink for the airlines is VDL Mode 2, which is the medium over which Controller Pilot Data Link Communications (CPDLC), i.e. ATC clearances transmitted as text messages, is being deployed. In a world where bandwidths a thousand times higher are available on a small, light, power-efficient mobile phone, you'd be forgiven for thinking that convergence on such standards are not great news for GA. We need better, more cost effective technologies from SESAR.

**Navigation** is probably an area in which GA has remained closest to commercial aviation capabilities, thanks to GPS. Nevertheless, to fly 4-dimensional trajectories will take some sophisticated avionics to be introduced and standardised. Of more concern is that airliners tend to use BaroVNAV systems, which use pressure altitude inputs to determine the vertical profile. While GPS is quite capable of accurately sensing geometric height, and indeed Space Based Augmentation Systems like EGNOS are delivering instrument approaches with near-ILS accuracy, interoperability with BaroVNAV remains a challenge. Finally, it remains to be seen whether future multi-constellation GNSS (with GLONASS and Galileo) will satisfy requirements for continuity if there are major outages – the plan is that airliners would continue navigating using their INS or DME-trilateration systems, but no such cost-effective systems yet exist for GA.

# Preparing for ANC/12

The aviation community is preparing for the 12<sup>th</sup> ICAO Air Navigation Conference (ANC/12) in November this year. 1,500 participants from around the world are expected to participate to this event which will bring important decisions for the future of air traffic management (ATM).



Since the last ANC in 2003, ATM policies, procedures and technologies have advanced considerably. ANC/12 will determine the ICAO policy and priorities for ATM and communications, navigation and surveillance (CNS) for the next decade; one key element will be an update of the ICAO Global Air Navigation Plan (GANP).

At the core of the ICAO Secretariat's thinking is the "Aviation System Block Upgrades" (ASBU) concept, a set of technical domains for which objectives for performance improvements are identified, with associated ICAO provisions (e.g. standards), and various timeframes established for their development.

"The next Air Navigation Conference will be crucial for the future of ATM. And while the preparations are at full speed, we do not forget to listen to and take into account the needs of the different States. At

ANC/12 the aviation community must be united in order to together take decisions on modernisation timelines and roadmaps," says Christian Schleifer, President of the ICAO Air Navigation Commission.

ICAO estimates that around €90 billion will be invested in ATM modernisation in the next decade. To ensure consistency with ongoing programmes such as SESAR or NextGen, the Block Upgrades system is largely inspired by the work done in Europe and the US respectively. "ICAO forms the global basis for the safe increase in air traffic. ATM renovation on a global scale is a must and I count on SESAR and NextGen as the cornerstones of the upcoming ANC/12", says Schleifer.

Because of the importance of developing the European ATM system under the Single European Sky, the European Commission decided to coordinate the inputs of the Member States and stakeholders

in order to present a consolidated and coherent European view. SESAR's work on the ATM Master Plan update will also influence this key ATM event and will serve as the European link to the global framework for interoperability.



The draft ASBUs were presented at ICAO's Global Air Navigation Industry Symposium (GANIS) in September 2011 (see here the common European stand).

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