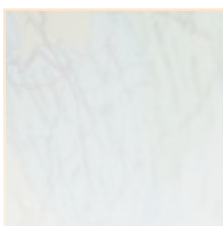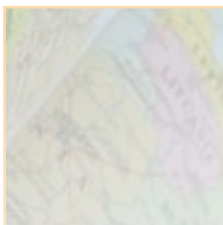European University Institute

ROBERT SCHUMAN CENTRE FOR ADVANCED STUDIES

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Making effective use of technology in SESAR deployment

Editors: Matthias Finger, Nadia Bert, David Kupfer

Highlights

The 6th Florence Air Forum focussed on the upcoming Deployment Phase of the EU's Research Program for Air Traffic Management SESAR. Some of the most relevant decision makers and leading experts came together to discuss the issue: among others Florian Guillermet, Director of the SESAR Joint Undertaking, Frank Brenner, Director General of Eurocontrol, Maurizio Castelletti, Head of Unit Single European Sky of the European Commission, and Prof Kenneth Button, Aviation expert and advisor of FSR Transport for Air Transport and Aviation.

Technology is the key element of a more unified European ATM System which is the cornerstone of the overarching goal of building the Single European Sky (SES). This is a crucial moment for all stakeholders of the SES: after years of research and massive investments by both tax payers and industry in the SESAR program the right governance of the deployment phase may now be decisive for the success of the technologies that have been developed. It is a delicate process because agreeing on how to deploy touches upon many interests in the SES system. This became apparent also in the discussions at the Air Forum, which could benefit from the presence of representatives of some of the most important stakeholders including Unions, Air Navigation Service Providers, Airlines, Regulators, ATM-Industry, EASA and the Military.

The first part of the discussion focussed on the interests at stake in the SESAR Deployment phase, whereas the others looked at the governance model, focussing especially on the new Deployment Manager which will be nominated in 2014 by the European Commission to deal with managing the deployment process.

Which governance for SESAR deployment?

Comment of MATTHIAS FINGER | FSR-Transport Director

The Single European Sky (SES) was from the very beginning a political project that would need substantial support from the technological side to become a reality. Thus, technological innovation is a central pillar of the SES. The programme that facilitates the corresponding research is SESAR (Single European Sky Air traffic management Research). In spite of its relatively big budget, SESAR was never really contested, as everybody was convinced that it would deliver results benefitting both the European ATM system and the industry. While the research programme has been successful and technology is no longer a barrier to a more unified ATM system, the political progress has, however, lagged behind. With the so-called Pilot Common Projects six ATM functionalities are now at a stage where they could be deployed. Yet, on the political side there is not enough agreement between the involved parties to allow a large scale, cross-national deployment that would deliver the benefits of these technologies.

The SESAR project was divided into a definition, a development and a deployment phase. While the first two phases unfolded with few problems, the transition from the development to the deployment phase has been far from smooth, owing in particular to complicated interactions among the numerous involved stakeholders.

And the stakes are high. Apart from the taxpayer, manufacturers have also invested heavily: 700 million of SESAR's 2.1 bn € budget is made up of industry contributions and only a successful deployment would prevent these from being lost. In many cases, airlines will also need to invest to equip airplanes with new technology. Furthermore, and as new ATM technologies become ready for deployment, they will confront the realities of air traffic control and controllers. Especially the influential unions and other staff representatives will have to be convinced of the new ATM technologies' usefulness.

To recall, the structure of actors in the SES is complex: not only the industry, airlines and air traffic controllers but also Member States, Air Navigation Service Providers (ANSPs), Functional Airspace Blocks (FABs), Eurocontrol and the military will have to be involved in the process. It is clear that conflicts will inevitably ensue and will have to

be managed, thus raising the question of the governance of SESAR deployment.

Which role for the Commission? Which role for industry?

The idea that currently underlies the deployment phase is to give industry, i.e., the operational stakeholders, a central role in SESAR's deployment phase. There are first the manufacturers, who have crucial operational knowledge, but who also have a clear conflict of interests, given that they are developing the very technologies to be deployed. Airlines and ANSPs are likely to play a key role in managing deployment, yet they also display diverging interests. Bearing in mind the complexity of the issues, along with the large amount of possible technical pitfalls, it is of course advisable to give industry a central a role in SESAR deployment.

Yet, the question remains as to the role of the Commission. To recall, the Commission played a leading a role in both the definition and in the development phases. Can it "let go" in the deployment phase and rely on industry self-regulation alone? What happens if something goes wrong? Who will take the responsibility? Who will step in? Let us not forget that, in aviation, the Commission has always relied on other bodies, mainly Eurocontrol and EASA. In doing so, it was able to build up its political weight in spite of its relative lack of technical expertise and personnel. Throughout the SESAR programme the Commission has had significant influence on the main ATM research and development projects, notably thanks to the so-called SESAR Joint Undertaking. However, during the deployment the SESAR-JU will no longer be in the driver's seat. The main challenge will be to bring the developed technologies into use and to avoid costly failures because of lack of coordination and political steering.

In short, a decision making structure is needed that allows for making optimal use of the stakeholder's expertise without being biased towards their interest. Only this can avoid scenarios where the combined powers of sovereign states and incumbent service providers lead to an overall failure as happened in the "data-link case".

The Deployment Manager, the key to successful SESAR deployment

To somehow overcome all the above-mentioned difficulties, the Commission has invented the concept of a so-called Deployment Manager. Yet, both its organisation and its accountability are still unclear. What is clear, however, is that its institutional role will be unique. The Commission has launched a call and soon the winning consortium will be announced.

On paper, at least the division of labour is clear: while the Commission (with its advisory bodies) will remain in charge of defining the "common
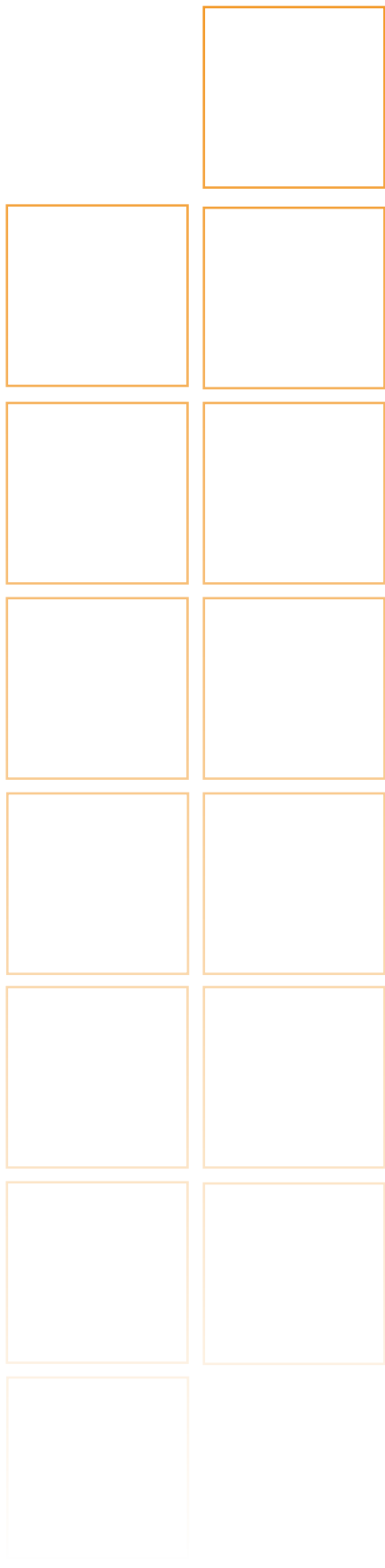
projects" (the policy level), the Deployment Manager will preside over "how to deploy" (the management level). In other words, the selected industry consortium will be in charge when it comes to implementing the different SESAR projects (implementation).

The vagueness of the Deployment Manager's task description may well allow the Commission to pass difficult (political) decisions on to the "management level", such as the question of the level of deployment. Indeed, the optimal geographical level of deployment of each ATM functionality will be one of the most crucial decisions the Deployment Manager will have to make. This means nothing less than how fragmented or unified the European ATM system will ultimately be. There are of course different types of functionalities and not all of them require centralized deployment; yet, in many cases, central deployment would bring significant efficiency gains.

Most SES technologies and innovations already exist, but they are not yet used because they require a high degree of coordination, and even harmonization, which is not easy to achieve within the current fragmented institutional system. Building the deployment phase on a solid governance architecture, and, most importantly, overcoming the national sovereignty barriers that are hindering the application of existing technologies, will be the challenge not only for the Deployment Manager but also for the Commission, which is ultimately responsible for delivering the SES.

6th Florence Air Forum, Summary of discussions

One of the key observations that emerged from the 6th Florence Air Forum is that up until now SESAR could be considered the least controversial element of the Single European Sky because of its widely acknowledged potential benefits. However, this may not hold true for the deployment phase of SESAR in which the future scenario of a performance based ATM system is put into practice.

While the SESAR research agenda has been harmoniously agreed, the deployment of the developed technologies gives rise to challenging questions and conflicting demands. Many of the potential issues that will likely remain conflictual were discussed by the different stakeholders involved.

Entering the deployment phase: which are the interests at stake in the Single European Sky?

What is at stake for ATM staff? It was pointed out that "the human factor" remains a central focus in the development of new technologies. Nevertheless concerns remain regarding the implications that technologies would have for employees. Different stakeholders joined the discussion on how they see the future of the human in the system. It was for instance pointed out that, unlike other industries, the level of automation is still relatively low in ATM. What level of automation in ATM is desirable is a question that poses many far reaching questions, including legal issues when it comes to liabilities[1].

From the perspective of SESAR, the strategy is not to replace humans by automation but to support them to the best extent possible by the use of automation. How this can be achieved was part of the discussion; from the staff perspective it is crucial to observe whether technical novelties may increase the workload or change the working conditions in another way, for instance by increasing the need for collaboration with other control centres. Therefore, expert air traffic controllers need to be involved in all stages of the process to ensure not only that the solutions will be socially acceptable but also that they will be practicable and improve the working conditions without overburdening the air traffic controllers. To ensure this the social dialogue should be further strengthened in all phases of deployment.

A remaining challenge is however to guarantee this form of inclusion not just on the European but also on the national and regional (FAB-) level. In terms of creating redundancies there was the view that the SESAR or at least the Pilot Common Projects would change the nature of the work and the training of Air Traffic Controllers, but not create redundancies and layoffs. This is supported by impact assessments that were made by SESAR JU. Another point of view was, however, that, looking at the history of technological progress, it seems unlikely that innovation in ATM would not eventually lead to reducing the number of work places in this sector.

What is at stake for Small and Medium Sized ANSPs? In spite of the changes in recent years the ANSPs do not operate like a business mainly because of the strong presence of states insisting on keeping their autonomous air surveillance. An approach to bridging this obstacle has for some time been the proposals for exchange of data and the related central provision of flight data[2]. For supporters of this approach, it could provide a way to introduce cross border competition in the field of data provision. It would also allow ANSPs to reduce their infrastructure costs, as the storage and collection of data by every individual centre creates costs that can be avoided.

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1. See also the documentation of the ALIAS workshop, 1.10.14 – 2.10.14, Florence

2. See also the documentation of the 4th Florence Air Forum "Consolidating the Single European Sky: From Physical to Virtual"

Trails and Tribulations of Introducing Technology Change

KENNETH BUTTON | GEORGE MASON UNIVERSITY

Introducing new technologies is almost always challenging. In the context of introducing new infrastructure to a complex network industry this can be particularly so. The problem is that this can seldom be done efficiently in a piecemeal manner, but for the full benefits to be created requires a system wide adoption. In the case of a network like air traffic control (ATC), where it is not possible to close down the system while the new technology is put in place, the transition costs both to network providers and users can be considerable. It normally entails overlaps and duplications of systems for periods with the sub-optimal use of both during this period. And, of course, these problems are compounded when there has to be a coordinated approach involving both private actors and the public sector.

These challenges are clear as the shift from radar to satellite systems are taking place in both the United States (NextGen) and large parts of Europe (Single European Sky). There have been delays and uncertainties in the financing of the systems along with unforeseen technical challenges that have led to delays and higher than anticipated costs. The situation has not been helped in Europe by the multilateral nature of the initiative and in the United States by the scale of commercial airline activity and the large amount of general aviation traffic. The needs of the military in both regions have also posed problems. All these general sorts of problems are not uncommon when there are significant technology shifts involved, but there are ways to anticipated and minimize them.

One of the underlying problems, and the one focused on here, is the difficulty of transition with limited information. Quite simply, there has been little analysis of either the starting point or the end target. This for example, is one of the reasons for the difficulties in Europe in the introduction of the functional airspace blocks (FAB) as a sort of halfway house to bringing better overall coordination of national ATC systems by linking groups of ATCs. These intra-European regional groups have been difficult to form and exhibited few improvements in performance.

The lack of a clear picture of the starting position, particularly in Europe upon which we focus, stems back to a paucity of information about the performance of the existing systems a decade or more ago. While there has been considerable improvement in this with the inception of the annual EUROCONTROL ATM Cost-Effectiveness Reports and also periodic comparisons with the US Federal Aviation Administration's system, the short time period covered and the limited amount of economic analysis that have been conducted hardly provides a clear picture of either the absolute efficiency of the existing system or of individual, national ATCs within it. Added to this, the uncertainty of both the final architecture of the Single European Sky, along with its ultimate cost both to users and to the European tax-payers, let alone the benefits, makes any assessment, either in economic or system engineering terms, almost impossible.

It is difficult to track and evaluate an optimal pathway for technology change without a clear idea of what the costs and benefits of that change are, and without any real idea of what paths of change are available and at what cost. The deployment phase of the SESAR component of the Single European Sky initiation, for example, has seen States agreeing on developing technologies costing billions of Euro but with no clear strategy regarding how to to deploy them in a harmonized and efficient way. The NextGen initiative has similar intrinsic problems but in a different context, here the challenge is to set appropriate initiative and provide the incentives for the aviation sector to adopt the on-plane elements of satellite based air navigation systems. In both cases there have been delays and uncertainties.

Without any clear idea of the economic efficiency of the initial situation relating to the radar based ATC system, the costs and benefits of various options for simply up-grading and "tweaking" that system, and the costs and benefits of various alternatives and paths of transition to a satellite based system it is difficult to see how any genuine appraisal of a Single European Sky can be conducted. It basically becomes an act of faith, with an almost inevitable capture by powerful interested parties. The challenges of appraisal are even more acute when there seems to be little way of evaluating the various, almost ad hoc, movements along the transition path associated with, for example, the implementation of SESAR; there is, de facto, no counterfactual against which to compare performance.

Does this mean that the Single European Sky, or indeed NextGen, should not have been initiated? Of course not. What it does mean is that rather more systematic assessments are needed as to its economic costs and benefits in the fullest sense of elements of, for example, SESAR and in the evaluation of the timing of various individual increments to changes in the larger ATC system that it entails.

without prescriptive top down instruments for the

It became clear that while supporting new technologies in general, some ANSPs do not feel sufficiently involved in SESAR decision making. The SESAR deployment phase was described as a black box: while the vision for a future European ATM system was defined by the SESAR program, the transformation of the baseline system to the future system does not appear to be clear. The Deployment Manager will not be able to include all ANSPs. However the investments will need to be made on the sides of the national service providers, therefore a way needs to be found to take them along more closely in the future.

What is at stake for the Military? The focus of SESAR is the civilian air traffic however from the outset it was clear that many R&D topics potentially have an impact on military operations. Many SESAR solutions deal with the question on how to organize airspace usage between civilian and military flight and how to avoid unnecessary detours because of restricted military areas. But also the financial concern of the Military is not to be underestimated. The Military is airspace user, ANSP as well as airport/airbase operator and regulator at the same time. The re-equipment of military fleets affects them in the same way as commercial airlines. It will be crucial during the deployment phase for the Military to have enough flexibility to ensure an optimal representation in the decision making process. Through the European Defence Agency the Military has increased its efforts to be involved in the SESAR program and they now face the challenge to increase these efforts as the first projects move towards deployment.

Should we even look at "stakeholders"? An opinion stated was that anything can be argued for by referring to a specific group of stakeholders and that it would be more conducive to look at "stockholders" instead. In this view "stockholders" in ATM are those who finance the system, namely airspace users through route charges and taxpayers. In spite of being an important "stakeholder", incumbent ANSPs clearly have an interest to maintain a business model that is profitable for them but not efficient on the whole. Therefore from an efficiency perspective the "stockholders'" view should be taken into consideration more strongly.

As far as the overall costs and benefits are concerned some questioned some established arguments, when answering the ultimate question of who is going to win and who is going to lose from SESAR deployment. For instance airlines would probably not gain as much as they expect. This is because cost reduction in ATC gives no competitive advantage to any airline but reduces the operational costs for all in the same way. In a competitive environment the benefits would eventually be passed on to the customers. Another point of view was brought up by manufacturers: some of them have already heavily invested in SESAR and now express concerns about the success of the deployment phase, which will decide on the usefulness on the investments made.

Another argument often mentioned to support reforms is that they could trigger a macroeconomic effect contributing to the big goals of promoting growths and jobs. It was argued that even though the SES and the SESAR program are often mentioned in this context, the real legitimation derives entirely from the capacity increases it can achieve. It was pointed out that the scientific evidence for the further reaching economic stimulation would be weak.

Integrating all stakeholders in the process whilst maintaining a functional organisational structure will be the major challenge of the governance of the deployment phase. This issue was addressed in the following session.

Which Governance Structure for SESAR Deployment?

The Deployment Manager: Clearly in the centre of the discussion was the role of the soon to be appointed Deployment Manager. Here on many instances the

role of the industry was underlined. The governance structure adopted by the Commission supposedly allows for an "industry-led deployment under the direction of the Commission". How this would work out in practice was however questioned from several sides. The Deployment Manager should be located in a three tier structure between the 'policy level' where the Commission (advised by several stakeholders through the SES committee) is in charge and the 'implementation level' where the manufacturers are in charge as part of their consortia. The Deployment Manager is however a new body and its real workings and also the degree of its success are something that can only be seen in the future. One question that remained open was how the performance of the Deployment Manager could eventually be measured. It was also criticised that certain crucial decisions that should come from the political level will be passed on to the Deployment Manager who will then also have to take the blame in the event of a failure of a certain project.

Addressing accountability: The core function, the main expectation that all actors have towards the Deployment Manager, is the organisation of the involvement of all relevant actors. These are however many, and such a process faces several obstacles. For one the number of organisations involved has to be limited to allow a functional decision making process. This leads to some actors expressing concerns on whether their interests would be represented in the process. Another issue is the involvement of the industry. On the level of the Deployment Manager the manufactures for obvious conflict of interest reasons will not be part. Yet their contribution also at this stage is crucial as was pointed out. One difficulty for the industry lays in the nature of the information that companies would have to share with the Deployment Manager as these are highly classified and business relevant. A question addressed was furthermore how a satisfactory internal working of the Deployment Manager could be achieved. The Deployment Manager should be made up of a consortium that includes ANSPS, Airlines and Airports or organisations that represent these.

An idea that was presented is to apply the concept of "Collaborative Decision Making" to the organisation of the Deployment Manager. This concept is exercised in the management of emergency situations at airports and could at least theoretically be applied at a larger scale in an activity like the one of the Deployment Manager.

Another issue that was raised is the restriction to informed decision making on SESAR related questions by the political level. According to some the "data-link" failure was the result of insufficient information about operational difficulties on the part of the political decision makers.

Different notions towards the nature of ATM could be identified; it was mentioned by some that it has to be considered a common good rather than a service that is part of a business value chain.

From the theoretical side the argument was made that when looking at the unique instrument of the Deployment Manager the theory of management of common resources should be applied rather than the traditional approach of market rules and government direction.

Between centralization and national sovereignty: What future Business Model for ATM?

The Commission approach to reforming ATM has been strongly focused on "performance" since the SES 2 package. This is a strategy to handle a contradictory situation. In the SES there has always been a broad consensus that capacity and efficiency of the European airspace needs to be increased yet almost no compromises could be achieved in terms of consolidating control centres. Performance indicators and their supervision are therefore used as a governance tool to achieve results

Further readings

SESAR Joint Undertaking, European ATM Master Plan Edition 2, September 2012

Within the Single European Sky initiative, the European ATM Master Plan is the agreed roadmap driving the modernisation of the Air Traffic Management system and connecting SESAR research and development with deployment. It is the key tool for SESAR deployment, providing the basis for timely, coordinated and efficient deployment of new technologies and procedures. The first edition of the European ATM Master Plan was endorsed on 30 March 2009 and adopted on 12 June 2009 by the SESAR Joint Undertaking which is responsible through EU Council Regulation for the maintenance of the Master Plan.

European Commission, SESAR Governance – Explanatory Memorandum, June 2014

The purpose of this European Commission memorandum is to clarify how the Management and Implementation levels of the SESAR deployment governance are going to be established. This document is an update of an earlier version of the memorandum which was distributed at the occasion of the public workshop "SESAR Deployment framework partnership" held on 4 April 2014 at Sheraton Brussels Airport Hotel.

Turner, Aimee, European Data Link crippled by ATN capacity showstopper, airtrafficmanagement.net, June 30, 2014

The Data Link case is an often referenced incident where a lack of coordination lead to a pre mature equipment of airplanes with a technology that couldn't be deployed eventually. This comment gives some background information of the Data Link failure on the blog airtrafficmanagement.net.

Sherry, Lance, Modernizing the U.S. Air Navigation Service, RSCAS Working Paper, 2014

This Paper by Lance Sherry provides a good comparison to the current challenges in SESAR deployment by outlining the US example for modernizing Air Navigation Services (ANS): the modern Air Navigation Service, also known as Air Traffic Control (ATC), is one of the largest networked socio-technical systems developed and operated by human-

kind. The ANS ensures safe and efficient flight operations 24 hours a day, 365 days a year across continents and oceans for upwards of 15 million flights per year. Since Air Navigation Service Providers (ANSP) operate under the legal framework of a public utility (or quasi-public utility) and are subject to a range of externalities, productivity improvements and modernization initiatives are not efficiently driven by market forces and require government mandates. This paper describes the ANS modernization initiatives underway in the United States. The enabling technologies, concepts-of-operations, and challenges to modernization are discussed.

Baumgartner, Marc and Finger, Matthias, European air transport liberalization: Possible ways out of the single European sky gridlock, Utilities Policy, 2014

This article presents the gradual liberalization of European air transport, especially its most recent problems in the case of the Single European Sky (SES). Indeed, after successfully liberalizing airlines and, to a certain extent, airports, the European Commission has embarked on the process of creating an SES. The article describes the process and the main actors. It focuses in particular on the identification of the various actors' interests, and explains the current gridlock of the SES as a result of conflicting objectives among the main players, which include, among others, the member states and the European Commission. A way out of this gridlock may reside in a novel approach to unbundling different types of services, and introducing competition in some of these services.

Florence School of Regulation Transport Area, 6th Florence Air Forum Summary: Making Effective Use of Technology in SESAR Deployment

The present document summarises the content of the presentations delivered during the 5th Florence Air Forum, offering short summaries of each presentation, and illustrating the main points made and matters treated.Presentations were delivered by representatives of different types of stakeholders, who discussed the following issues and initial questions:

- The potentials of SESAR-deployment
- Entering the deployment phase: which are the interests at stake in the Single European Sky?
- The SESAR joint undertaking: which governance structure for deployment?
- Between centralization and national sovereignty – what future business model for ATM?

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