Research and new technologies

The next generation of Air Traffic Management systems…

In the 1980s, the European Commission (EC) established a series of 'framework programmes' for research. Each programme lasts about four years, during which time it is updated to reflect the constantly changing nature of scientific and technological research as well as Europe's evolving priorities.

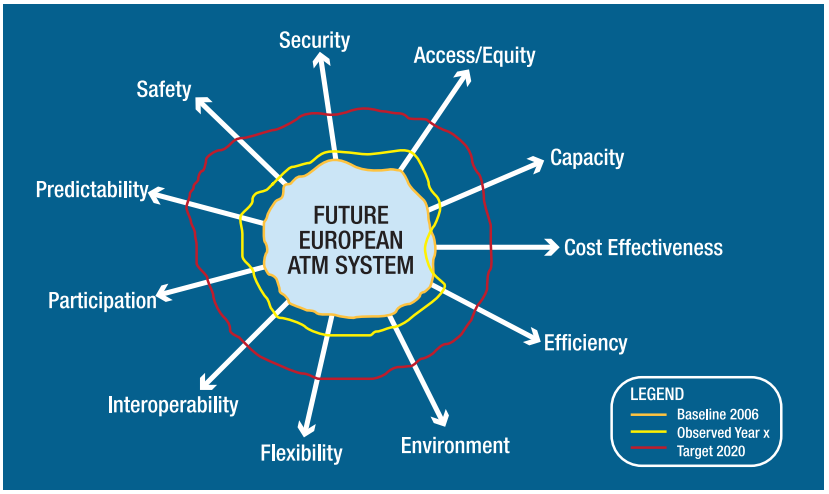
The first framework programme covered the period 1984-1987. The Sixth Framework Programme (FP6) started in 2002, and was extended to cover more than five years. FP6 was launched through a series of calls for proposals and the last projects are now scheduled to end in 2010.

Within the FP6's total budget of €17.5bn, an allocation of €1.12bn was made for 'Aeronautics and Space', which is divided into four research areas for aeronautics (and three for space).

As the FP6 projects were ongoing, the EC supported EUROCONTROL through the TEN-T mechanism for the launch of an aviation industry led project to define and plan the research and implementation requirements necessary for the next generation Air Traffic Management (ATM) system. This was shortly followed by the announcement of the SESAR initiative (called SESAME at first) by the European Commission in July 2004.

The SESAR programme was designed in three phases, leading up to deployment in 2020:

- The Definition Phase (2005-08) has produced the ATM Master Plan, which identifies the technological steps and the modernisation priorities necessary for implementing a new ATM concept;
- The Development Phase (2008-13), with funding of €2.1bn (managed by the SESAR Joint Undertaking), will develop the new equipment and standards to ensure, through the regulatory mechanisms of the Single European Sky, the replacement of existing ground and airborne systems, and promote interoperability with those outside Europe;
- The Deployment Phase (2014-20) will entail the large-scale production, procurement, and implementation of the new ATM infrastructure and of the corresponding aircraft equipment.



The SESAR Definition Phase unfolded at the same time as the FP6 projects (the final calls for proposals) were under development. In 2007, the EC launched a re-alignment process to ensure that the FP6 projects fully contributed to the SESAR goals being developed in parallel with the SESAR Definition Phase. Most FP6 projects contained elements of research that were also relevant to the 2020 timeframe; it was important that FP6 results could bring benefit to SESAR, which has become the single vehicle for long-term ATM modernisation in Europe.

In the SESAR Definition Phase, ATM stakeholders elaborated on the initial political vision of the EC for a more complete and precise set of strategic performance objectives, indicators and targets. This is the SESAR Performance Framework, which is structured around the 11 Key Performance Areas (KPAs), which have also been adopted by ICAO. SESAR has been designed to provide benefits along the axes of all the different KPAs, as illustrated above.

These performance targets form a key input for the development of a SESAR concept of operations for 2020 – another key deliverable of this Definition Phase. This concept focuses on global interoperability with user-driven 4D management of flight trajectories (managing the trajectory profile in three dimensions plus time), as well as on the exchange of all relevant flight information between all airborne and ground partners (creating an intranet of air traffic management), with a view to optimising performance in all areas. This concept has been designed for compatibility with other worldwide initiatives, such as NextGen in USA, in order to ensure global interoperability.

One of the key challenges of the SESAR Development Phase is therefore to provide a concrete demonstration that the concept is feasible, acceptable to the system stakeholders, and that it provides benefits that justify the investment. This is the domain of validation, which is a prerequisite for the industrialisation of the system's various elements.

An evaluation of FP6 projects at the end of the SESAR Definition Phase showed that many activities involved various aspects of validation that could be beneficial to SESAR.

The EC and the partners involved in all Air Transport FP6 projects were therefore faced with the challenge of contributing, by way of convergence, to the overall validation of the SESAR concept.

As a founding member of SESAR and a major contributor to most of the FP6 projects, EUROCONTROL supported the EC in this convergence approach, which commenced at the end of 2007 (as major deliverables of the Definition Phase were published).

Now that the SESAR Development Phase is under way with the deployment of the SESAR Joint Undertaking's work programme, this convergence process is being actively established through direct exchanges between the projects and the SESAR Joint Undertaking.

Of course, all these projects also tackle research issues in a shorter timeframe that will be captured by various ongoing implementation programmes.

The process of convergence for the longer-term components of these projects can be illustrated by the following examples:

Episode3

This project, co-ordinated by EUROCONTROL, brings together leading experts in ATM operational validation from 21 different organisations, including Air Navigation Service Providers (ANSPs), research centres, SMEs and universities. The purpose of EP3 was initially to set up a performance-based concept validation approach. This approach was adapted to prepare for the SESAR concept validation.

Initially, EP3 was going to employ large-scale simulations to emulate real ATC centres, while performing detailed traffic simulations to compute projected performance figures.

Towards the end of the SESAR Definition Phase, it became clear that the relative immaturity of the concept did not support this type of study; the project was therefore re-oriented to investigate more innovative techniques to support the early stages of concept development.

Examples of such techniques are:

- Gaming exercises: to refine the roles of various actors within the collaborative processes envisaged in SESAR;
- Network modelling tools: to simulate the effect of local improvements on the overall network;
- Influence models: to map the impact and interdependencies of the operational improvements needed to achieve the SESAR target concept;
- Prototyping sessions: allowing air traffic controllers and pilots to be presented with elements of the future systems on simplified platforms. This prototyping approach promotes consideration of the concept in iterative steps.

Episode 3 is investigating key parts of the SESAR concept, including (among other things):

- How to balance demand and capacity in a collaborative process on a network level and also for major airports;
- Optimisation of the airport process around aircraft turnaround (all actions from landing to the next flight's take-off on the same aircraft);
- Environmentally-friendly procedures in the 4D trajectory;
- Operability issues linked to the management of 4D trajectories by controllers and pilots, etc.

CATS

This project, co-ordinated by Frequentis, is investigating a specific aspect of 4D trajectory. The study focuses on methods to ensure that all successive air traffic control centres crossed by a particular flight contribute to the on-time arrival of the aircraft. (In today's environment, each centre strives to 'expedite the traffic through its area without consideration of the impact on downstream centres'.)

In this concept, each actor will try to deliver the aircraft to the next centre within a space and time window that has been computed to optimise the network, and ensure the aircraft will be on the block at the prescribed time. The project looks at possible implementation in ATC systems, based on known developments of the aircraft flight management system. The CATS concept could be seen as a possible driver for implementing the SESAR Business Trajectory, and helping – through its assessments – by providing an understanding of the validation required for such complex concepts.

In conclusion

These projects illustrate how the EC, supported by EUROCONTROL and major ATM players, ensures that the long-term research carried out in FP6 is inserted into the broader roadmap for future system implementation, as embodied in the SESAR programme.

Philippe Leplae
FP6 Programme Manager

EUROCONTROL
Centre de Bois des Bordes
BP15
F-91222
Brétigny sur Orge Cedex
France

Tel: +33 (0)1 69 88 75 51
Mobile: +33 (0) 6 27 26 18 58
Fax: +33 (0)1 69 88 78 90

philippe.leplae@eurocontrol.int
www.eurocontrol.int