STRATEGIC GUIDANCE IN SUPPORT OF THE EXECUTION OF THE EUROPEAN ATM MASTER PLAN

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Air transport is an important component of European unity and the European economy. Air Transport contributes 220 milliard to European gross domestic product. Air traffic is expected to more than double for the next 20 years. However, the facilities and procedures used to manage these traffic flows has changed only little and is a fight to keep up with developments. The Single European Sky is the European Union's response to this problem and the Strategic Guidance is response to reach the Single European Sky.

K e y w o r d s: aviation, ATM system, SESAR, Master Plan, technologies

1 INTRODUCTION

European aerospace is a field that has undergone tremendous technological change in the last 50 years. Since the first jet airliner flew (in 1949), commercial aviation has grown more than 70-fold. However, this radical increase is not reflecting in air traffic management where technologies from the 1950s are still used. The European union has chosen to change this by establishing a public-private partnership in which institutions, airports and industry, air traffic control centres combine their resources, experience and skills in one unique European programme: SESAR.

After an intensive preparatory phase, the technical research and development work at SESAR has started to occur first results. The SESAR Joint Undertaking together with its members presented a plan to deliver the first sections of the future European ATM system through annual release. This first Release informs about the commitment of the aviation community to adhere to challenging time schedules. The future of the ATM system through the projekt SESAR will be of benefit for airlines, ANSPs, pilots and controllers, passengers and the environment.

2 THE NEED FOR CHANGE

The need for change is driven by a number of external factors and Europe's intent to adopt a performance based approach in its transition to the future European ATM System.
These external factors can be summarized as follows:

- Traffic Demand
  The main factor driving the need for change in Air Traffic Management is the predicted substantial growth in air traffic over the next 20 years and its increased complexity and density. Traffic patterns may also change significantly. Under these circumstances, optimized shared use of scarce airspace resources by civil and military airspace users will become even more important than today.
- Aircraft Fleet
  The aircraft fleet operating in Europe will be progressively renewed and we will see the size of the fleet grow in proportion with the number of flights. In addition the fleet will include more and more new types of aircraft with different performance characteristics and needs.
- Airport Needs
  Airports are predicted to invest in more capacity, however not as much as the growth in traffic demand. This will lead to an increasing number of congested airports, which will rely on ATM to optimize their airside operations to the maximum extent possible. Some of the demand which cannot be accommodated at major airports will be "driven" to smaller, regional airports which will also continue to grow due to airlines proactively seeking new markets.
- Quality of Service Requirements
  To support their business adequately, airspace users are demanding much higher Quality of Service (QoS) levels, efficiency, flexibility and predictability—than ATM has been able to offer in the past.

- Safety
  In the light of the increased traffic complexity and density, one can expect more accidents and incidents if nothing is done to prevent this. Therefore society is expecting that ATM contributes to substantially increased safety levels, both in the air and on the airport.
- Environmental Performance
  For environmental reasons, aviation is expected to make serious efforts to reduce fuel consumption, noxious emissions and noise. ATM is expected to contribute by optimizing gate-to-gate traffic flows in line with environmental performance objectives.
- Security
  At the same time, we live in a world in which civil aviation faces an increasing risk of security attacks. ATM is expected to play a more active role in preventing civil air traffic from becoming a security risk, and managing the security (self-protection) of ATM services, infrastructure, information and staff. ATM will also need to improve its collaboration with other authorities active in security management.
- Cost Effectiveness
  Airspace users come under increasing pressure to reduce costs to remain competitive. This translates into the need to increase their own ATM capabilities at minimum cost (through investments in aircraft and Flight Operations Centre equipage), to reduce indirect ATM costs (associated with delays, inefficient routing etc.) to the maximum extent possible, and for the ANSPs to significantly reduce the cost of service provision. Studies have shown that in Europe, ATM costs are higher than strictly necessary due to the fragmentation of European airspace and corresponding service provision. The required cost reduction cannot be achieved without addressing the issue of fragmentation as a matter of priority.
- New Technologies
  The availability of technologies—while being an enabler for ATM change—also creates opportunities. As such, the proven use of state-of-the-art technology (in particular Information and Communication Technology, ICT) in other industries acts as a catalyst and driver for changing ATM at a faster pace than in the previous decades. Within this context, the time is ripe to undertake a substantial revision of the methods and paradigms used for managing ATM information.
- Obsolete Technologies
  Technological evolution also leads to technologies and equipment which become obsolete, and are no longer supported by the manufacturing industry. In such cases there is definitively a need for change.
- Human Aspects
  The human is and will remain central in ATM, both in the air and on the ground. In the coming 20 years, the transition to the SESAR Target Concept and the associated restructuring of the ATM system will affect hundreds of thousands of people working in the aviation industry. The magnitude of this Human change process is unprecedented. To guarantee a successful outcome (social aspects, human factors, etc.), Human Performance Management will need to change substantially.
- Global Context
  ATM in other parts of the world is changing also. Aviation is truly global in nature and this requires global interoperability. Europe cannot undertake its ATM upgrade in isolation. Europe has to work with ICAO and other regions to conduct SESAR within the global context. In other words: global change affects European change.
- Institutional Context
  A changing European institutional context will affect ATM change also. SESAR may be able to change the institutional context to some extent to satisfy its own ATM requirements, but one has to expect the opposite also: the forced need for ATM to adapt to institutional changes which take place within a wider policy context (e.g. European transport policy in general).

In conclusion, this section underlines that the need to change and improve ATM is driven by many more factors than just the expected traffic growth [1].

3 SESAR

The Single European Sky ATM Research (SESAR) is the European air traffic control infrastructure modernisation programme. SESAR aims to *develop a new-generation air traffic management system* capable of ensuring the safety and fluidity of international air transport over the next 30 years, while taking forward the Single European Sky. This is set against a background of the liberalisation of international aviation markets under Open Skies agreements. SESAR involves the aviation actors (civil and military, legislators, industry, operators, and users – ground and airborne) in order to define, commit to, and implement a pan-European programme, and to support the Single European Sky legislation. SESAR is a Joint Undertaking involving €2.1 milliard funding from the industry, the European Commission and EUROCONTROL.

The objectives of SESAR are to eliminate the fragmented approach to ATM, transform the European ATM system, synchronise the plans and actions of the various partners, and federate resources. SESAR has three major phases:

- *Definition Phase (2004-2008):* the first phase of SESAR has delivered an ATM Master Plan defining the content, the development and deployment plans of the next generation of ATM systems.
- *Development Phase (2008-2013):* will produce the required new generation of technological systems and components as defined in the Definition Phase
- *Deployment Phase (2014-2020):* seeks to build the new infrastructure on an international scale, both in Europe and in partner countries [2].

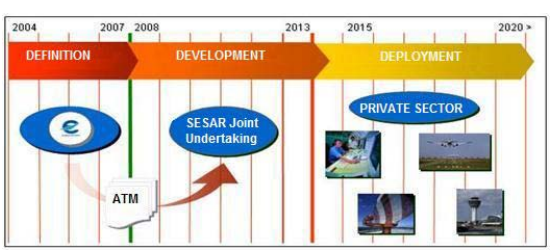

Figure 1 The Major Phases [3]

4 THE STRUCTURE OF THE SESAR PROGRAM

The SESAR programme coprises 17 workpackages. These Workpackages (WP) form the basis in Operational activities, system development activities, System Wide Information Management (SWIM) and Transverse activities.

Operational activities

- WP 4 En-Route Operations
- WP 5 Terminal Operations
- WP 6 Airport Operations
- WP 7 Network Operations
- WP E SESAR Long Term and Innovative Research

System development activities

- WP 10 En-Route & Approach ATC Systems
- WP 11 Flight and Wing Operations Centres/ Meteorological Services
- WP 12 Airport Systems
- WP 13 Network Information Management System
- WP 15 Non-Avionic CNS System
- WP 9 Aircraft Systems

System Wide Information Management

- SWIM – Connecting the ATM world
- WP 14 SWIM Technical Architecture
- WP 8 Information Management

Transverse activities

- WP 16 R&D Transversal Areas
- WP 3 Validation Infrastructure Adaptation and Integration
- WP B Target Concept and Architecture Maintenance
- WP C Master Plan Maintenance [4]

4.1 Four hypothetical scenario for SESAR

Based on the discussions conducted during the workshops, four hypothetical scenarios for the implementation of SESAR in Europe were developed to provide an understanding of the macroeconomic impact of the various assumptions:

- *Scenario A: "No new ATM"* - serves as a base case and assumes that in terms of the Single European Sky, only incremental changes will be implemented to build on existing systems.
- *Scenario B: "SESAR on time"* - assumes that the performance targets described in the ATM Master Plan and investments with them are ramped up according to plan over the period from 2013 to 2025. The difference between Scenarios A and B highlights the full benefits of deploying SESAR as planned.
- *Scenario C: "SESAR de-synchronised"* - assumes the desynchronised (i.e. piecemeal) implementation and adoption of SESAR. This would lead to an extended investment period between 2013 and 2030.
- *Scenario D: "SESAR delayed"* - assumes a 10-year delay in the implementation of SESAR, i.e. that investments and benefits are gradually ramped up over the period 2023 to 2035. [5]

5 STRATEGIC GUIDANCE IN SUPPORT OF THE EXECUTION OF THE EUROPEAN ATM MASTER PLAN

Taking full advantage of existing and newly developed technologies SESAR's target concept relies on 5 key features (see Figure 2).

1. optimal *Trajectory Management*, introducing a new approach to airspace design and management reducing the constraints of airspace organisation to a minimum and the core of the concept introducing the Business Trajectory;
2. *Collaborative planning* which is continuously reflected in the Network Operations Plan: a dynamic rolling plan for continuous operations that ensures a common view of the network situation;
3. full *Integration of Airport operations*, as part of ATM and the planning process, contributing to capacity gains;
4. *New separation modes* to allow for increased safety and capacity;
5. *System Wide Information Management* which is integrating all ATM business related data; an environment connecting all ATM stakeholders, aircraft as well as all ground facilities, supporting CDM processes using efficient end user applications to exploit the power of shared information.

Humans will be central in the future European ATM system as managers and decision makers; controllers and pilots will be assisted by new automated functions to ease their workload and handle their complex decision-making processes.

The concept of operations has an evolutionary approach which aims to deliver the Performance improvements in a phased manner through a number of Service Levels.

The "Strategic Guidance in support of the Execution of the European ATM Master Plan" presents the European ATM Master Plan information from four complementary perspectives. It collectively addresses the key features of the concept and complements the European ATM Master Plan with guidance for deployment. [6]

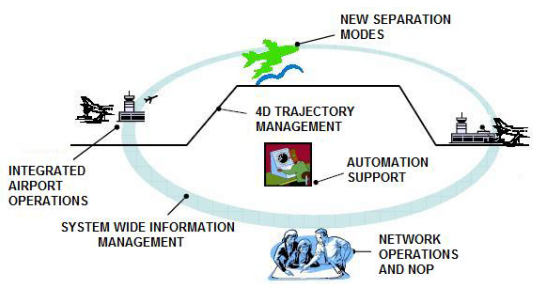

Figure 2. Key features of the evolving SESAR Operational concept [6]

6 THE AIR TRAFFIC MANAGEMENT MASTER PLAN

- The ATM Master Plan is the final result of the SESAR definition phase. It will define the work programme for the implementation of the target concepts. It will also encompass the different deployment strategies, which enable to reach a level playing field over the entire European region, taking into account the

current levels of equipment and already planned investments.

- The Master Plan will also identify the detailed work programme which needs to be undertaken in order to develop the target concepts; it will in particular define consistent "technological and functional packages", which can be intermediate steps to be taken in order to reach the long term target concepts.
- This work programme will specify R&D and validation activities, but also the organisational or regulatory actions which may be needed in order to accommodate changes (for instance, certification of ground systems, identification of "common components").
- The Master Plan will also have detailed cost-benefit analyses, which will enable all actors to:
    - identify the individual funding requirements for all different steps;
    - identify the return on investment for the different individual projects, which will enable for instance supply industry to build its detailed business cases.

6.1 The SESAR Mater Plan

At the highest level, the SESAR Master Plan defines how to develop and deploy the new ATM system.

The new ATM concept

SESAR contributions to the overall Single Sky objectives will come as the result from a completely new approach to air traffic management known as the SESAR concept of operation. Key features are:

1. *Moving from airspace to trajectory based operations,* so that each aircraft achieves its preferred route and time of arrival.
2. *Collaborative planning* so that all parties involved in flight management from departure gate to arrival gate can plan their activities based on the performance the system will deliver.
3. *Dynamic airspace management* through enhanced co-ordination between civil and military authorities.
4. *New technologies* providing more accurate airborne navigation and optimised spacing between aircraft to maximise airspace and airports capacity. *New technologies will be embedded into a harmonised and interoperable technical architecture* whilst supporting the needs of all European regions.
5. *Central role for the human,* widely supported by advanced tools to work safely and without undue pressure. [7]

The Structure of the Master Plan

The ATM Master Plan is build of three elements which provide the necessary set of planning means to ensure the successful implementation of the SESAR ATM Target Concept:

- The "High Level View" - it is the agreed strategic guideline delivered by the SESAR Consortium in the Definition Phase (D5 Master Plan Document).
- The "Planning Area" - it is working material, which contains more detailed information.
- The "Agreed and committed implementation activities" identified by the European Single Sky Implementation (ESSIP) and the set of Local Single Sky Implementation Documents (LSSIP) of the European ECAC States. [7]

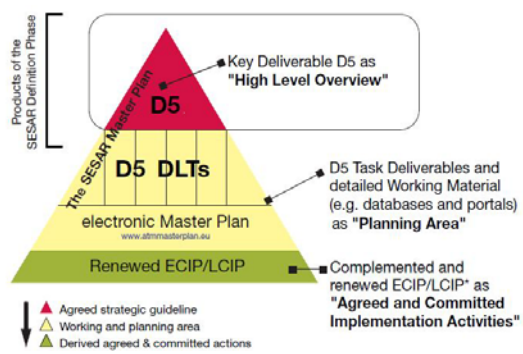

Figure 3. Structure of the Master Plan [8]

7 CONCLUSION

Strategic modelling of air transport development is influenced by external and internal factors - from global trends of ecological standardization, dynamics of tourist development,

and reformation changes within the European context to the limitation at the local level in the sense of insufficient administrative capacities for the necessary restructuring of the air transport sector.

Positive development aspects are reflected in the trend of air traffic growth. In the majority of transition countries the air traffic growth rate is greater than the European average. The medium air traffic forecast in Europe for the period 2008-2014 is at the annual rate of 3.7 percent.

Unfavourable development aspects are manifested in the evaluation of the external costs of air transport with a share of 14 percent, excluding the congestion costs, in the total external transport costs.

The European reform of air traffic management system is targeted to the integration of the European airspace through comprehensive dynamic harmonization programmes. From the safety aspect, strategic development programmes of the European air transport refer to solving problem of airspace fragmentation. In this context ATM regionalization has the objective of effective increase of airspace capacity, following the traffic growth forecast and increase of air transport efficiency. From the economic aspect, the development programmes refer to liberalization of aviation market within the enlarged Europe.

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