SESAR

THE ROADMAP FOR SUSTAINABLE AIR TRAFFIC MANAGEMENT

# European ATM Master Plan

EDITION 2

## EXECUTIVE SUMMARY - **AIRPORT OPERATORS**

OCTOBER 2012

Updated with SESAR's first developments

founding members

EUROPEAN UNION

EUROCONTROL

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**INTRODUCTION:**
**What is the European ATM Master Plan?**

Within the Single European Sky (SES) initiative, the European ATM Master Plan (Master Plan) is the agreed roadmap driving the modernisation of the Air Traffic Management system and connecting SESAR[1] 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 (SJU) which is responsible through EU Council Regulation for the maintenance of the Master Plan.

This 2012 edition of the Master Plan embeds major updates which mark a clear distinction compared with the initial document:

- it takes benefit of the first results achieved by the SESAR Programme to prioritise a set of essential changes that either provides significant performance benefits and/or forms a pre-requisite towards the implementation of the target concept;
- it prepares for the SESAR deployment phase, developing stakeholder roadmaps which provide a temporal view (up to 2030) of the ATM Technology Changes required and updating the Business View, providing a basis for timely and synchronised deployments;
- it promotes and ensures interoperability at global level, in particular in the context of ICAO.

**PERFORMANCE VIEW:**
**What are the performance needs and targets?**

Air traffic has not evolved in line with the forecast underpinning the 1st edition of the Master Plan. Although there are still considerable uncertainties regarding the near future, the consensus economic forecasts are for a resumption of near-trend growth in the medium-term and it is on this basis that the Master Plan is developed.

The proposed SES strategic performance objectives presented in this document provide a practical expression of the SES high-level political goals, in terms of measurable Key Performance Indicators (KPIs), and are based on the best current estimation of traffic growth. The SES performance-driven approach focuses on the four Key Performance Areas (KPAs) of environment, cost-efficiency, safety, and capacity/quality of service.

SESAR contributes to meeting these SES strategic performance objectives and drives R&D activities towards the achievement of a set of validation targets.

1 As part of the Single European Sky initiative, SESAR (Single European Sky ATM Research) represents its technological dimension. It will help create a “paradigm shift”, supported by state-of-the-art and innovative technology. The SESAR programme will give Europe a high-performance air traffic management infrastructure which will enable the safe and environmentally friendly development of air transport.

**DEPLOYMENT VIEW:**
**What is required to be deployed to achieve performance needs and targets?**

The transition towards the target Operational Concept follows three complementary Steps. Step 1, Time-based Operations is the focus of the current Master Plan and progresses through Step 2, Trajectory-based Operations to Step 3, Performance-based Operations. Step 1 starts from the Deployment Baseline consisting of operational and technical solutions that have successfully completed the R&D phase and have been implemented or are being implemented.

As shown in the figure, the Master Plan identifies essential operational changes for Step 1 which should establish the foundations for the subsequent steps while responding to the performance needs. These changes are grouped in 6 Key Features that describe the main strategic orientations and are the means to deliver performance to achieve the performance goals. The civil-military dimension is an integral part of these operational changes.

**How and when will it be deployed?**

The operational changes are enabled through improvements to technical systems, procedures, human factors and institutional changes supported by standardisation and regulation.

The human element remains pivotal to the success of SESAR, and in ensuring that SESAR delivers the benefits expected in environment, cost efficiency, safety, and capacity. The SESAR concept of operations will drive changes to the procedures being used by all stakeholders, and in particular will start to modify responsibilities between technology, controllers and flight crew. This needs to be supported by relevant regulatory changes.

The Master Plan includes roadmaps of the identified changes per stakeholder group ensuring that their deployment is planned in a performance driven and synchronised way (e.g. between ground and air deployments) to maximise the benefits achieved.

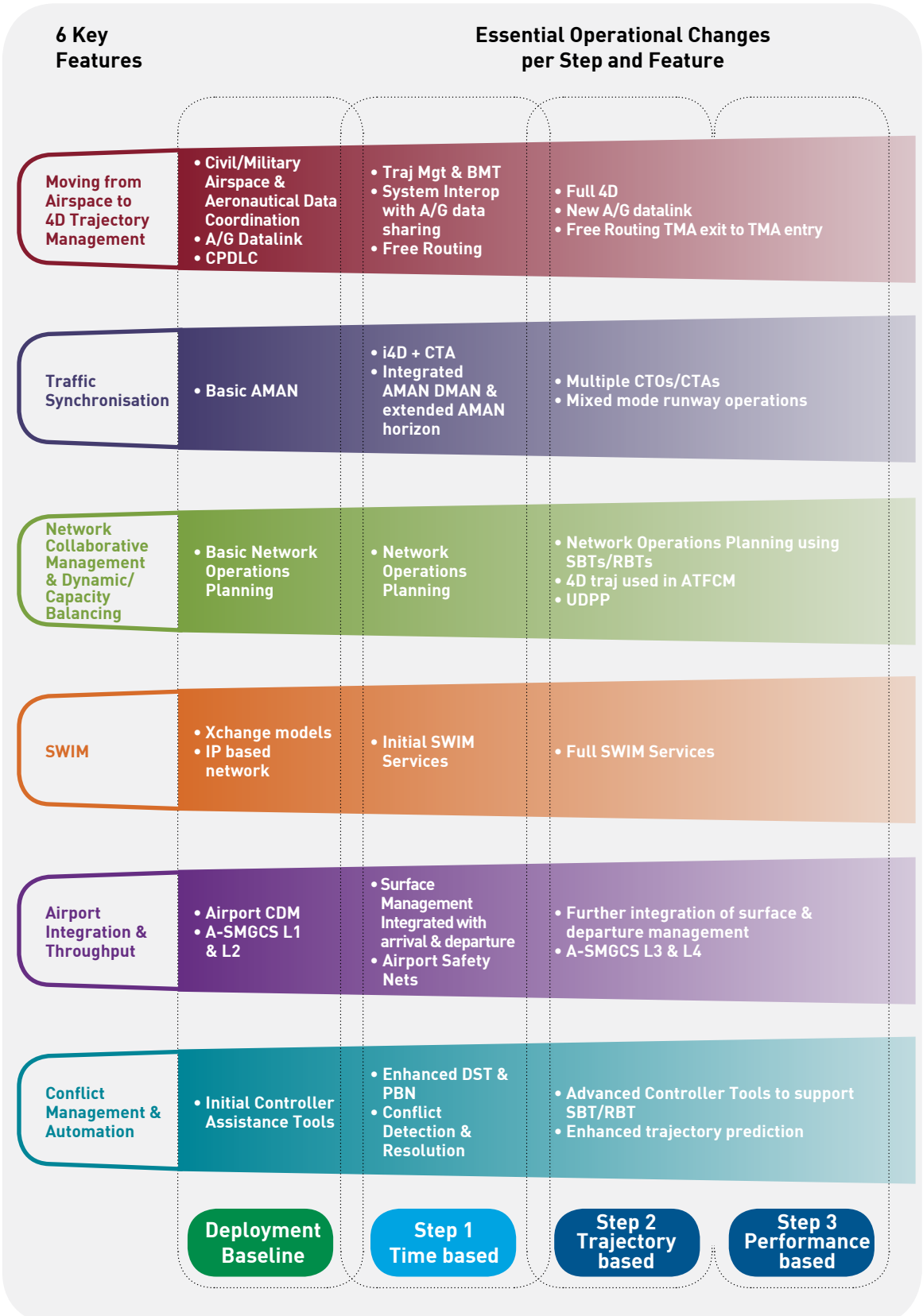
**BUSINESS VIEW:**
**What are the costs and the benefits?**

The SESAR programme is a key contributor to the achievement of the Single European Transport Area[2] and enables smart economic growth for Europe. SESAR will provide an effective remedy to air transport capacity bottlenecks, fills gaps in the air traffic management system, enables significant reduction of $CO_2$ emissions, increases safety, and reduces overall costs. SESAR benefits all European stakeholders and extends beyond the air transport industry.

The Business View is a high level view, which does not replace the need for dedicated stakeholder business cases and cost benefit analyses. Mature solutions, supported by business cases containing a clear quantification of the deployment performance expectations will be the outcome of validation. Pending the validation of the assumed benefits, the approach has been to consider the monetisation of the performance validation targets as a first indication of potential benefits.

Investments required to implement the changes described in the Master Plan for all 3 Steps have been estimated to be between 23 and 32 Bn€ for civil stakeholders for the period 2014-2030. These include investments for Deployment Baseline, Step 1 and Step 2. While estimates of the investment required in the shorter term (Deployment Baseline and Step 1) have been recently updated, the costs for Step 2 correspond to estimates provided during the Definition phase. The investment cost for Step 2 will be reviewed once the technologies and functions supporting this step mature. No further cost assessments have been performed by the Military, earlier estimated to reach 7 Bn€. For Scheduled Airlines, taking into account the investments required for Step 1, SESAR is estimated to create a direct net positive impact of at least 5 Bn€ in the 2014-2030 period provided timely and synchronised deployment is achieved. To this value it is necessary to add other benefits such as those from delay avoidance and flight cancellation savings. In addition, Deployment Baseline and Step 1 will establish the basis on which Steps 2 & 3 will be deployed and thus bring further benefits.

2 White Paper 2011: Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system – EC COM(2011) 144 final


6 Key Features
Essential Operational Changes per Step and Feature
Moving from Airspace to 4D Trajectory Management
• Civil/Military Airspace & Aeronautical Data Coordination
• A/G Datalink
• CPDLC
• Traj Mgt & BMT
• System Interop with A/G data sharing
• Free Routing
• Full 4D
• New A/G datalink
• Free Routing TMA exit to TMA entry
Traffic Synchronisation
• Basic AMAN
• i4D + CTA
• Integrated AMAN DMAN & extended AMAN horizon
• Multiple CTOs/CTAs
• Mixed mode runway operations
Network Collaborative Management & Dynamic/ Capacity Balancing
• Basic Network Operations Planning
• Network Operations Planning
• Network Operations Planning using SBTs/RBTs
• 4D traj used in ATFCM
• UDPP
SWIM
• Xchange models
• IP based network
• Initial SWIM Services
• Full SWIM Services
Airport Integration & Throughput
• Airport CDM
• A-SMGCS L1 & L2
• Surface Management Integrated with arrival & departure
• Airport Safety Nets
• Further integration of surface & departure management
• A-SMGCS L3 & L4
Conflict Management & Automation
• Initial Controller Assistance Tools
• Enhanced DST & PBN
• Conflict Detection & Resolution
• Advanced Controller Tools to support SBT/RBT
• Enhanced trajectory prediction
Deployment Baseline
Step 1 Time based
Step 2 Trajectory based
Step 3 Performance based

The investment figures should be taken with caution as underlying figures had a very high variance, in particular for Airport Operators and Regional Airlines. They may not be applicable to all sub-categories of stakeholders. In addition, whereas for airborne investments, up-to-date cost estimates from manufacturing industry were available for the ANSP investments this was not the case. There is a need for more detailed analysis of the cost of SESAR to ANSPs and of its integration in ANSP investment cycles. Cost inputs from the manufacturing ground industry will be important for this analysis.

The time lag between the upfront SESAR investments by the different stakeholders and the full realisation of benefits will present a risk to SESAR deployment. The risk is to create a last-mover advantage whereby each stakeholder would wait until all others have proceeded with SESAR investments. This should be addressed through the effective implementation of SESAR Deployment governance and incentive mechanisms.

This second edition of the European ATM Master Plan outlines the essential operational changes and technological changes that are required to contribute to achieving the SES performance objectives, preparing the Master Plan to become a key tool for SESAR deployment and providing the basis for timely and coordinated deployment of the efficient technologies and procedures.

The Master Plan provides the best actualised view on the products, technologies and operational procedures, which can be further industrialised and deployed in order to satisfy the needs of the European citizens.

## Airport Operators' Perspective

The latest forecast of traffic growth expects a doubling of IFR movements between 2010 and 2030 in Europe. All these aircraft movements need airports at which they start and finish their flights and are able to manage arrivals and departures in satisfactory conditions. Already a number of European airports are operating at or close to their operational limits and the environmental and political environment is demanding more efficient operations from the current infrastructure. Airport expansion is a long-term solution only and is becoming increasingly rejected by the local community and political bodies. As a result, airports need to find ways to get more from their existing facilities.

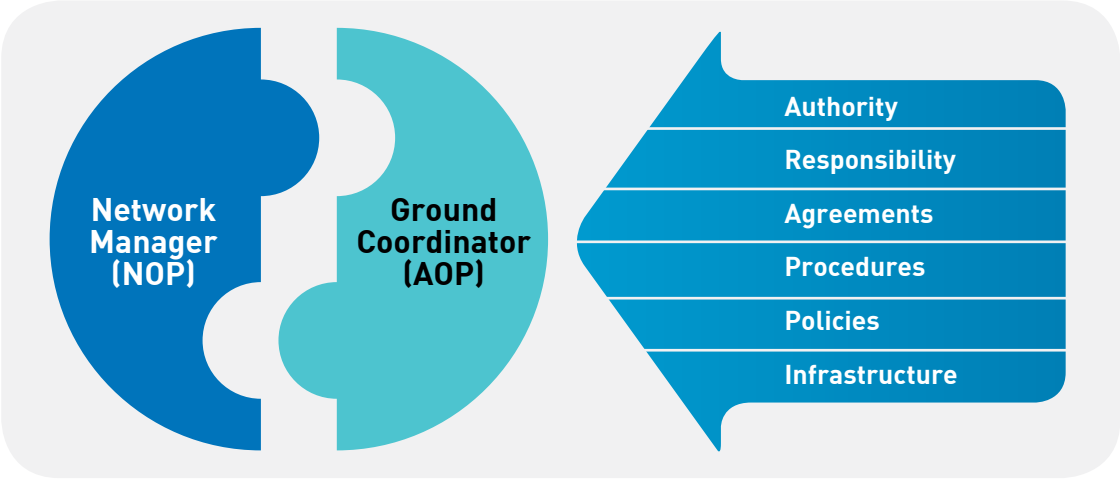
At the same time economic pressures are driving margins down for airlines and hence airports, so business growth needs to be achieved through efficiency and strict performance management.

**Needs for Airports and the Air Traffic Management Network**

The SESAR vision is the inclusion of the airport segment of flight into the ATM network. The airport vision is that this segment has to be fully integrated into the whole ATM network and be a strong and collaborative partner in the delivery of performance. This can be seen in the airport's role as the Ground Coordinator, using collaborative procedures to engage with airport stakeholders and thus as the point of contact for the Network Manager. It is only through collaboration that the needs of the European ATM stakeholder community will be realised.

Therefore, moving from (local) Airport Collaborative Decision Making (A-CDM) to the integration of airports into the ATM network is a viable element in this concept. This can be done by linking the Airport Operations Plan (AOP) with the Network Operations Plan (NOP) and this is expressed by the identification of the "airport transit view" which is corresponding to and closing the loop with the well-known airborne trajectories.

**AOP-NOP integration**




Since there are limited possibilities to extend physical resources at airports, better predictability and stability in planning the day of operations is needed, combined with the optimised use of existing resources to delay the need for financial investments in additional physical airport resources or where political and environmental constraints prevent airport expansion. Due to these limits, airports are also fully oriented to a common goal of global ATM network efficiency.

This will be achieved through a number of Flight Segments Services which, when fully integrated, allow a continuous learning cycle of behaviour across all airport stakeholders. The solution will be scalable in order to permit its implementation across the broadest possible spectrum of airport environments present in Europe.

The main elements of these Business Services are:

**Airport Operations Plan:** a local information sharing platform integrated with the Network Operations Plan. This service extends the timeframe of focus beyond the current A-CDM concept to address pre- and post-tactical operational timeframes. The service also captures landside, passengers, baggage and cargo operations as key performance drivers for the airport, whereas current A-CDM only covers airside i.e. aircraft operations.

**Airport Performance Monitoring:** addresses the multi-aircraft / pan-airport environment and incorporates the planning timeframe. Current A-CDM predominantly focuses on single aircraft operations on the day or execution only. The airport performance monitoring activity will also provide warnings and alerts to airport stakeholders against key performance indicators and trigger levels agreed collaboratively with the airport stakeholders through an airport performance steering activity.

**Airport Performance Management:** taking proactive, collaborative performance decisions based on the multi-aircraft / pan-airport status. Current A-CDM predominantly focuses on tactical management of single airport operations. Proactive performance management at an airport will address the performance areas of predictability, safety, flexibility, capacity and environment.

**Post Operations Analysis**: Driving a Continuous Learning Cycle through analysis of the observed performance, causes of change and management decisions taken. The results of this analysis are then incorporated into improvements to the airport performance monitoring and airport performance management functions via the airport performance steering activity.

The specific developments addressing the airport Key Performance Areas (KPAs) are:

- **Predictability:** performance prediction tools allowing optimisation of the operation such as coupled AMAN-DMAN; inclusion of variable taxi times derived from the A-SMGCS routing system with consideration of real-time traffic; time-based arrival separation;
- **Safety:** development of additional safety nets; A-SMGCS to provide routeing and guidance for aircraft and ground vehicles;
- **Flexibility:** extension of the collaborative procedures developed in the current A-CDM concept into a full performance management process through the Airport Operations Centre;
- **Capacity:** optimal use of the available resources through optimised braking; demand and capacity balancing; improved weather resilience including de-icing management and reclassification of LVP; flexible and dynamic use of wake vortex separations;
- **Environment:** through planning and management of operations against the plan, movements in the airport environment can be sequenced ahead of time resulting in 'just-in-time' operations thereby eliminating non-optimal holding and queuing.

These KPAs are the pillars of the SES which is implemented with ambitious targets of efficiency improvement, each actor needing to interact with the others to obtain the best results. To support this improvement in operational efficiency, accurate and reliable data exchange between all concerned partners is needed and should be achieved through System Wide Information Management (SWIM).

**DEPLOYMENT VIEW**

**Existing initiatives**

Airports have experienced constraints in their operations for some time. It was therefore in their interest to engage in numerous activities regarding airport capacity while improving safety. Several airports have launched airside capacity enhancement initiatives, assured implementation of the European Action Plan on the prevention of runway incursions and, last but not least, implemented A-CDM while supporting the respective Memorandum of Understanding between ACI Europe, EUROCONTROL and CANSO.

**Deployment description**

The ATM Master Plan builds on these elements. To support synchronised deployment of SESAR developments, roadmaps for all stakeholder groups were developed.

These include:

- Controlled Time of Arrival: links into A-CDM arrival information and hence improves ground management efficiency and arrival information;
- Extended AMAN Horizon: links into A-CDM arrival information and hence improves ground management efficiency and arrival information;
- Integrated AMAN-DMAN: considers the impact of arriving and departing traffic;
- Airport safety nets: provide airports with high level of system and procedures to minimise the risks of taxi incidents or even accidents;
- Airport Operation Centre (APOC): is the core of the new ATM concepts at airports, hosting the collaborative decision team for the whole airport management. This organisation should be implemented by integrating successive enhanced airport functions.

The implementation of these enhancements will depend on different airport characteristics while the level of demand compared to the available capacity will be the major factor. Operations where demand is constantly above 95% of the available capacity drive the need for operational improvements in order to manage predictability and stability.

To assure the critical link to other ATM participants (e.g. airspace users, ANSPs, Network Manager and ground handlers) with different business cultures, more sophisticated coordination with a move from isolated operational businesses to a communicated and collaborative approach is needed.

Global interoperability shall be assured through the involvement in ICAO's initiative to enhance Air Traffic Management (as known as "Aviation System Block Upgrade").

**BUSINESS VIEW**

Airports only make huge investments if the business case is positive, even if not from a purely financial perspective but at least for operational aspects which give competitive advantage like reduced minimum connecting times or satisfying conditions for passengers using the airport facilities. In case of negative business cases or low traffic with limited investment capacity, airports are less likely to make the investments and then other financing or funding mechanisms need to be found.

- Certain systems/tools are needed at many airports for network (=whole system) benefits:
  - independent of benefit at local airport
  - others are only implemented if local benefit exists
- In the case where there are no local benefits incentives, possibly have to be developed to motivate airport operators to implement the tools and systems required and NSAs to influence airports to implement the tools and systems required.

**RISKS**

A number of risks related to the implementation of the ATM Master Plan have been identified. From the Airport Operators' point of view, the most critical concerns are:

- Delays in the implementation of the Deployment Baseline. (MP risk 6)
- The Environmental objective is not reached. (MP risk 3)
- Failure to manage Human Performance (Human Factors, Competency and Change Management) issues in the development and implementation of the ATM Target Concept. (MP risk 13)
- Complexity of new processes leading to a risk if they are not well controlled and validated (especially in the case of the new tools which will automate many functions). (Additional risk)

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