

2013



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SESAR Release





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SESAR explained

The **SESAR programme** is the operational and technological answer to Europe's ATM challenges.

Embedded in the EU's ambitious Single European Sky initiative, the aim of SESAR is to ensure the modernisation of the European ATM system by coordinating and concentrating all relevant research and development efforts with a view to harmonising implementation.

Created to manage the development phase of this ATM modernisation programme, the SESAR Joint Undertaking is a €2.1 billion public/private partnership bringing together 3,000 experts to deliver tangible, deployable solutions to the ATM world.

Partnership, sustainability and user orientation are the founding principles of the SESAR Joint Undertaking's work approach.

Derived from the European ATM Master Plan, the work programme covers projects extending from 2009 to 2016. Solutions will become available for deployment by industry following SESAR concept validation results, published through an incremental Release process. Gradually, the ATM system will thus evolve towards full performance-based operations. For more information, visit: www.atmmasterplan.eu

Figure 1: The link between Releases and the ATM Master Plan



SESAR Releases: bridging R&D and deployment

SESAR is a performance and delivery oriented research & development (R&D) programme. As part of it, the Release approach is a systematic effort to validate mature SESAR solutions in an operational environment and to prepare their deployment. As such, it allows for early improvements in the current Air Traffic Management (ATM) system but, more importantly, promotes a more results-oriented approach to R&D.

A Release comprises a selection of solutions that have been through a systematic validation process, reaching the stage in a concept's lifecycle where a proposed solution has successfully passed through 'pre-industrial development and integration' testing, and is thus ready for industrialisation.

The SESAR Release programme includes one Release per year, starting with Release 1 in 2011, followed up by Release 2 in 2012. This brochure introduces the 19 Release 3 exercises planned for 2013.

Through the incremental introduction of the solutions developed and validated in Releases, the aviation community will benefit from improvements in ATM efficiency early on:

- **Airlines** will see savings through improved routings, as well as reduction in operating costs through increased punctuality.
- **Air Navigation Service Providers (ANSP)** will provide a better quality of service at a lower unit cost for airspace users, thanks to better integration, improved human/machine interfaces for controller working positions, enhanced controller tools and advanced working procedures for the better organisation of the controller team.
- **Airports** will be more integrated in the overall ATM system, benefiting from advances in technology to increase capacity, optimise operations and provide quality service, even under adverse network and/or weather conditions.
- **Passengers** will profit from improved punctuality and shorter flight duration.
- **Suppliers** and **manufacturers** will become more competitive internationally, as innovations and technological advances are gradually deployed. Today's R&D helps produce tomorrow's technical standards, increasing the potential customer base worldwide.
- Furthermore, the **environment** will benefit through fewer emissions thanks to shorter and more efficient routes and lower noise pollution as a result of improved procedures.

03 Delivering SESAR solutions

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The SESAR Programme relies on a set of priority areas that answer the needs of the ATM industry, as outlined in the European ATM Master Plan. Six Key Features have been defined to capture the operational improvements and technical enablers required to deliver SESAR's contribution to the Single European Sky Strategic Performance Objectives. The Release approach provides the framework and process to validate, in an operational environment, all selected operational improvements and technical enablers, and thus pave the way for the incremental introduction of new technologies and procedures.

The 6 Key Features are:

- 1. Traffic synchronization;**
- 2. Airport integration and throughput;**
- 3. Moving from airspace to 4D trajectory management;**
- 4. Network collaborative management and dynamic capacity balancing;**
- 5. Conflict management and automation; and**
- 6. System Wide Information Management.**



1. Traffic Synchronisation

'Traffic Synchronisation' covers all aspects related to improving arrival/departure management. It aims to achieve an optimum traffic sequence resulting in significantly less need for air traffic control (ATC) tactical intervention, and the optimisation of climbing and descending traffic profiles.



2. Airport Integration and Throughput

'Airport Integration and Throughput' aims at achieving a full integration of airports into the ATM network, ensuring a seamless process through Collaborative Decision Making. Airports will contribute to achieve SESAR performance goals through the increase of runway throughput and improved surface movement management.



3. Moving from Airspace to 4D Trajectory Management

'Moving from Airspace to 4D Trajectory Management' entails the systematic sharing of aircraft trajectories between various participants in the ATM process to ensure that all partners have a common view of a flight and have access to the most up to date data available to perform their tasks. It enables the dynamic adjustment of airspace characteristics to meet predicted demand with minimum distortions to the aircraft trajectories.



4. Network Collaborative Management and Dynamic/Capacity Balancing

'Collaborative Management of the ATM Network' relies on successive phases of operation planning from long to medium and short term. In this context, all involved ATM stakeholders progressively share more and more precise data to build a common traffic and operational environment picture called the Network Operations Plan (NOP). This NOP is updated in real time to reflect any changes in ATM operations. The NOP also covers military activity, taking full account of the needs of mission trajectories and military airspace demands.

Throughout the lifecycle of the flights, the traffic demand/available capacity is monitored by the different ATM actors. When an imbalance occurs, capacity shortfall scenarios are collaboratively agreed and implemented. When required, the Aircraft Operators submit the revised user-preferred trajectories, integrating the ATM constraints.



5. Conflict Management and Automation

'Conflict Management and Automation' aims at substantially reducing controller task load per flight through a significant enhancement of integrated automation support, whilst simultaneously meeting the safety and environmental goals of SESAR. Human operators will remain at the core of the system (overall system managers) using automated systems with the required degree of integrity and redundancy.

In addition, this strategic business need covers the evolution of Ground and Airborne Safety Nets (and their mutual compatibility) through the use of new surveillance means and system-wide information sharing. They will be fully adapted to SESAR future trajectory management systems and new separation modes, thus ensuring their continuing effectiveness as a last safety layer against the risk of collision (and other hazards).



6. System Wide Information Management

The concept of 'System Wide Information Management' - SWIM - covers a complete change in paradigm of how information is managed along its full lifecycle, involving stakeholders from across the whole European ATM network.

SWIM is an advanced concept designed to facilitate greater sharing of ATM system information, such as aeronautical, flight trajectory, aerodrome operational, meteorological, air traffic flow, surveillance and capacity and demand. It consists of standards, infrastructure and governance enabling the management of ATM information and its exchange between qualified parties via interoperable services.



Figure 2: Mapping of Essential Operational Changes to SESAR Key Features

6 Key Features

Essential Operational Changes per Step and Feature

Key Feature	Deployment Baseline	Step 1 Time based	Step 2 Trajectory based	Step 3 Performance based
Moving from Airspace to 4D Trajectory Management	<ul style="list-style-type: none"> Civil/Military Airspace and Aeronautical Data Coordination A/G datalink CPDLC 	<ul style="list-style-type: none"> Traj Mgt & BMT System Interop with A/G data sharing Free Routing 	<ul style="list-style-type: none"> Full 4D New A/G datalink Free Routing TMA ext to TMA entry 	
Traffic Synchronisation	<ul style="list-style-type: none"> Basic AMAN 	<ul style="list-style-type: none"> i4D + CTA Integrated AMAN DMAN & extended AMAN horizon 	<ul style="list-style-type: none"> Multiple CTOs/CTAs Mixed mode runway operations 	
Network Collaborative Management & Dynamic/Capacity Balancing	<ul style="list-style-type: none"> Basic Network Operations Planning 	<ul style="list-style-type: none"> Network Operations Planning 	<ul style="list-style-type: none"> Network Operations Planning using SBTs/RBTs 4D traj used in ATFCM UDPP 	
System Wide Information Management	<ul style="list-style-type: none"> Xchange models IP based network 	<ul style="list-style-type: none"> Initial SWIM services 	<ul style="list-style-type: none"> Full SWIM Services 	
Airport Integration & Throughput	<ul style="list-style-type: none"> Airport CDM A-SMGCS L1&L2 	<ul style="list-style-type: none"> Surface Management Integrated with arrival & departure Airport Safety Nets 	<ul style="list-style-type: none"> Further integration of surface & departure management A-SMGCS L3&L4 	
Conflict Management & Automation	<ul style="list-style-type: none"> Initial Controller Assistance Tools 	<ul style="list-style-type: none"> Enhanced DST & PBN Conflict Detection & Resolution 	<ul style="list-style-type: none"> Advanced Controller Tools to support SBT/RBT Enhanced trajectory prediction 	

Operational changes will come through the evolution of technical systems, procedures, human factors and institutional changes, including standardisation and regulation.

SESAR RELEASES: developing operational improvements

Release 1 included 25 operational validations throughout Europe. The exercises centred on the development of efficient and green terminal airspace operations, the initial 4D trajectory, end-to-end traffic synchronisation and integrated and collaborative network management.

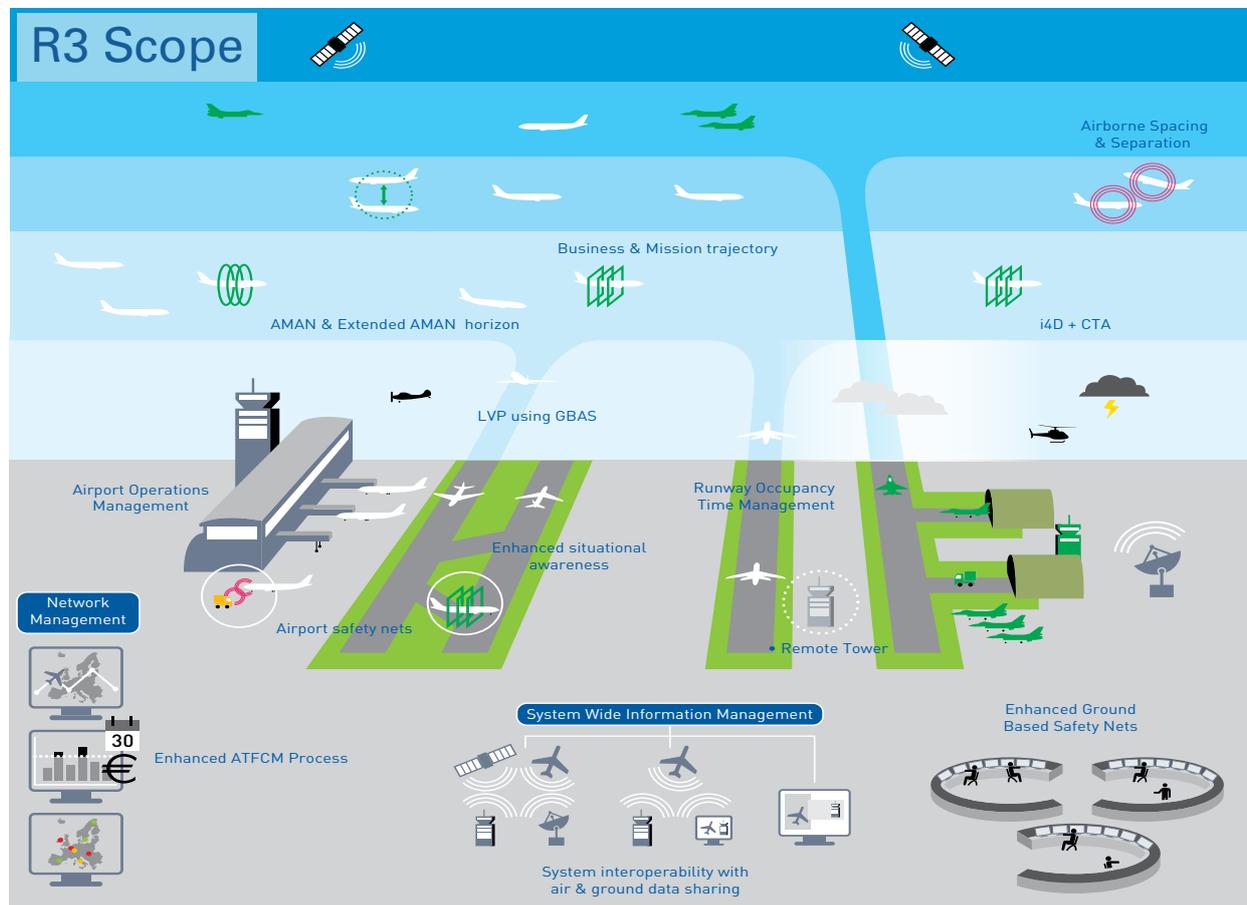
Release 2 built on the experience gained during Release 1, widening the scope of the work and comprised of 30 exercises, covering 4 ATM Master Plan Key Features clustered into 16 themes.

Release 3 includes 19 exercises covering all 6 Key Features.

OPERATIONAL IMPROVEMENTS PLANNED FOR RELEASE 3

The scope of Release 3 activities covers the full range of Key Features and is illustrated in Figure 2 below:

Figure 3: Activities addressed in Release 3



The main contributions to essential operational changes, grouped by Key Feature, that Release 3 will deliver are summarised below:



Traffic Synchronisation

- Streaming techniques including Point Merge procedures in the frame of an extended horizon of the arrival manager in a multi-airport Terminal Manoeuvring Area (TMA).



Airport Integration & Throughput

- Detection of runway incursions and infringements of restricted areas by aircraft and vehicles, and provision of alerts to ATC controllers and vehicle drivers;
- Linking the Airport Operations Plan (AOP) with the Network Operations Plan (NOP) for a better management of the arrivals based on the Target Time of Arrival (TTA).



Moving from Airspace to 4D Trajectory Management

- Optimisation of flight trajectories supported by the i4D trajectory management (time based operations).



Network Collaborative Management and Dynamic Capacity Balancing

- Further development of the Short Term Air Traffic Flow and Capacity Management (ATFCM) Measures (STAM) coordination procedures;
- Enhanced flight-plan processing based on 4D profiles and aircraft performance provided by Airline Operations Centre.



Conflict Management and Automation

- Enhanced Short Term Conflict Alert (STCA) system using down-linked aircraft parameters.



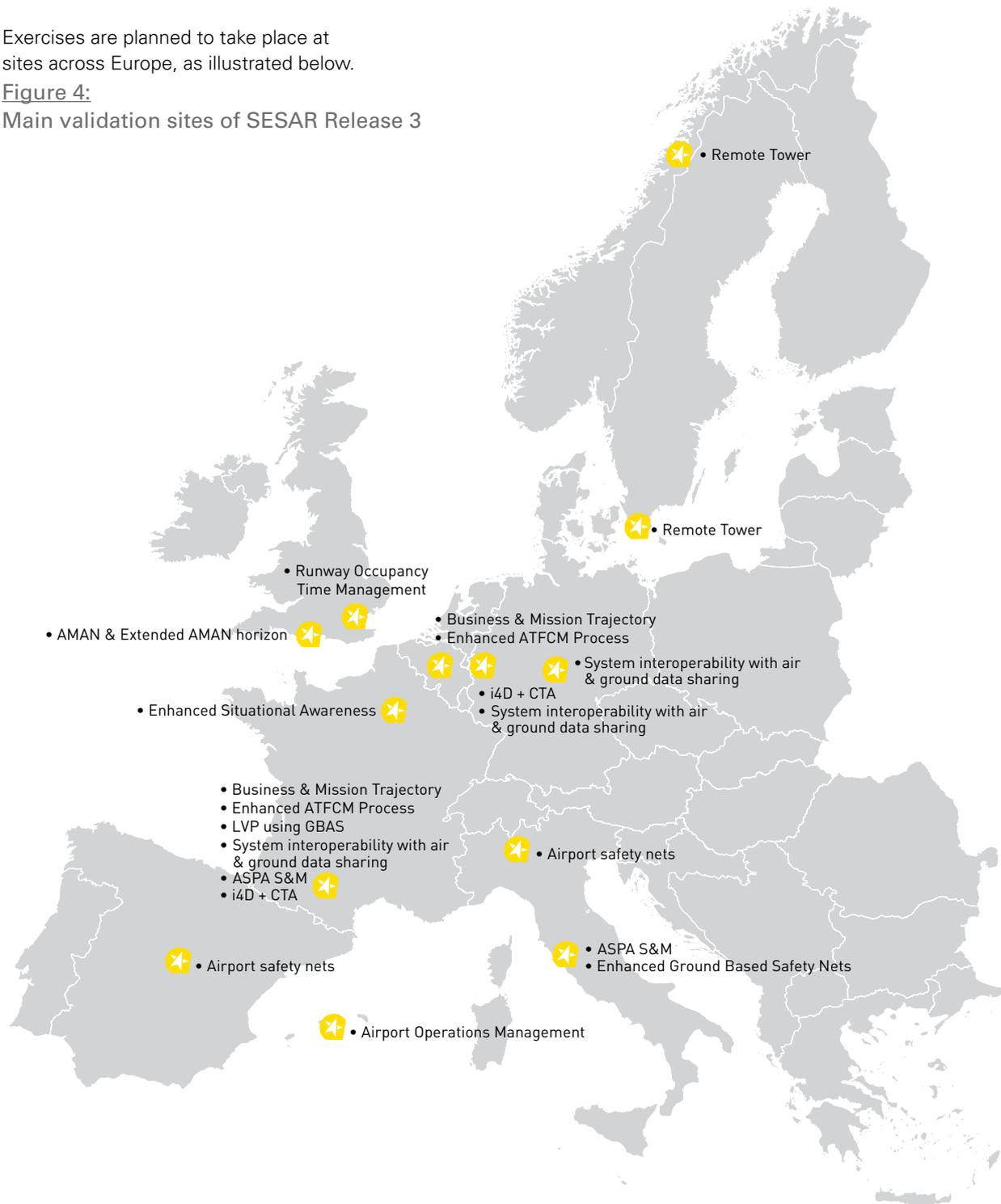
System Wide Information Management (SWIM)

- Coordination between Air Traffic Service (ATS) Units through the utilization of Flight Object exchange mechanisms.

Exercises are planned to take place at sites across Europe, as illustrated below.

Figure 4:

Main validation sites of SESAR Release 3



The main contributions to essential operational changes, grouped by Key Feature, that Release 3 will deliver are further detailed below:

TRAFFIC SYNCHRONISATION

Airborne Spacing (ASPA) Sequencing & Merging (S&M)

The exercise will validate two Airborne Spacing manoeuvres to increase synchronisation of traffic in the TMA:

- Vector then merge;
- Follow route then merge.

It will also assess correlated benefits to controllers and pilots.

Benefits:

- Increase controllers' efficiency via more automation;
- Increase safety and performance in the TMA;
- Ensure fuel efficiency thanks to a more regular flow of traffic.

Arrival Manager (AMAN) and Extended AMAN Horizon

This exercise, at Southampton in the UK, will trial extended-horizon AMAN streaming techniques to more than one airport and will couple them with Point Merge procedures.

Benefits:

- Increase controller efficiency through smoother arrival flows, creation of optimum 2D routes in the TMA and better situational awareness, using new tools to monitor separation between aircraft.

AIRPORT INTEGRATION AND THROUGHPUT

Low Visibility Procedure using GBAS

This exercise aims to validate instrument procedures on approach, which are used in low-visibility conditions through

satellite-navigation landing systems; they also allow for curved path flying.

Benefits:

- Increase in safety;
- Optimisation of trajectories;
- Maintain airport throughput during low visibility conditions;
- Reduction of fuel and noise footprint.

Airport Safety Nets

This exercise aims to improve airport surface management, thanks to early detection and alerting to ATC controllers, pilots and vehicle drivers about any incursion on the runway or into restricted areas by aircraft and/or vehicles.

Benefits:

- Alerting of risk-bearing incursions by aircraft or vehicles into airport operations areas.

Remote Tower

Malmö air traffic control centre will remotely operate the airport tower of Vaerøy (Norway) airport, providing Aerodrome Flight Information Service.

Benefits:

- Reduce costs by providing Aerodrome Flight Information Services from a remote location.

Enhanced Situation Awareness

This exercise will evaluate the use of RunWay Status Lights (RWSL) in Charles de Gaulle airport. RWSL is a fully automatic system based on 'Advanced Surface Movement Guidance & Control System' surveillance that detects the exact status of the runway. The information on runway usage is directly made available to the vehicle drivers and flight crews through new airfield lights.

Benefits:

- An increase in runway usage awareness;
- Reduction of the number of non-authorized runway incursions impacting operations.

Runway Occupancy Time Management

This exercise involves an Airbus A380 at London Heathrow. It will test a voice procedure and quantify elements of Brake to Vacate (BTV) performance.

The procedure involves the Flight Crew activating BTV and informing Air Traffic Control, via voice radio, of the Arrival Runway Occupancy Time (AROT) and intended exit. The live trials will also assess consistency of performance in vacating runways at previously agreed runway exits.

Benefits:

Improve the management of runway occupancy by:

- Quantifying the consistency of actual and predicted runway exiting;
- Quantifying the consistency of predicted and actual Runway Occupancy Time;
- Establishing and testing the voice-based operating procedure.

Airport Operations Management

This exercise aims to initiate integration of Airports into the ATM Network, through a link between the AOP (Airport Operations Plan) and the NOP (Network Operations Plan).

This entails moving from the current departure-based management of flights (focused on Calculated Take-Off Time) to an arrival-time based management (focused on Target Time of Arrival exchange).

This exercise addresses both a feasibility assessment for the integration and the assessment of the quality of the prediction made for TTAs.

Benefits:

- Improve arrival predictability and assess its propagation to departure predictability;
- Reduce the arrival traffic bunching effect and assess the operational benefits and safety contribution.



MOVING FROM AIRSPACE TO 4D TRAJECTORY MANAGEMENT

Initial 4D (i4D) Trajectory Management and Controlled Time of Arrival

Sequenced exercises will concentrate on the development of tools, such as 'Human Machine Interface' refinement or enhanced 'What-if?' function, to assist controllers in the application of the i4D trajectory-management concepts in en-route airspace (traffic sequencing).

Their aim is to validate the concept of a shared trajectory to ensure consistency of information between ground and airborne systems.

Benefits:

Demonstrate the optimisation of flight trajectories supported by the i4D trajectory management (time based operations), in order to improve:

- ATM ground system performance;
- Flow/queue management;
- Early conflict detection and resolution.



NETWORK COLLABORATIVE MANAGEMENT AND DYNAMIC CAPACITY BALANCING

Business and Mission Trajectory

This exercise aims to validate enhanced flight planning processes through extended interoperability between civil and military Aircraft Operators and the network Manager. In particular it will focus on:

- Submission of calculated 4D profiles and aircraft performance information by the originator of the Flight Plan (Aircraft operator);
- Modification of the Integrated Initial Flight Plan Processing System (IFPS) to integrate 4D profiles and performance information for the flight plan validation process.

Benefits:

- Improve flight plan predictability through the exchange of additional flight specific information.

Enhanced Air Traffic Flow and Capacity Management (ATFCM) Processes

These three exercises will focus on validating:

- A prototype enabling the reduction of the sector complexity and increase of air traffic controller efficiency;
- Processes for operational improvements to Short Term ATFM Measures;
- Early integration of AOP and NOP by sharing TTA information at the planning stage.

Benefits:

- Improve air traffic flow through enhanced processes and better integration of airport and network operations plans.

**CONFLICT MANAGEMENT AND AUTOMATION****Enhanced Ground Based Safety Nets**

This exercise entails the operational validation of an enhanced STCA prototype using existing Aircraft derived Data (e.g. roll angle) that are subject to quick variations and/or frequent updates.

Benefits:

- Increase safety by reducing nuisance alerts and/or providing genuine alerts with increased warning time.

**SYSTEM WIDE INFORMATION MANAGEMENT (SWIM)****System Interoperability with Air and Ground Data Sharing**

This exercise will test new coordination procedures for ATS units on three validation platforms in Germany, France and the Netherlands. The trials will include the coordination and transfer of flights, the distribution of time constraints supporting the sequencing of arrival flows, as well as downstream and upstream negotiation elements.

Benefits:

- Improved controller efficiency through the seamless, silent coordination between different ATS units.

Conclusions and outlook

The main benefits deriving from the Release approach is that it allows SESAR's partners and stakeholders to validate new procedures and technologies in a hands-on, timely and flexible way. This means that solutions can be adapted according to genuine business requirements.

Through the Release process, SESAR has been able to achieve concrete results which provide the basis for cost and benefit assessments for a wide range of ATM stakeholders.

Going one step further, the Release process enables demonstration activities to take place on a larger geographical scale and allows involvement of stakeholders from across the air transport industry in a collaborative way.

To date, 7 SESAR solutions have been demonstrated to be ready for industrial development and deployment.

With the third Release, the SESAR programme clearly builds on the experience gained during Release 1 and 2, with Release 3 having a much longer term vision and closely linked to the updated ATM Master Plan (Figure 5 and 6).

Through the Release process, SESAR's members have proven that, by working together, real changes in the ATM domain are achievable. Together, SESAR and its partners have demonstrated their ability to deliver concrete benefits and deployable solutions to the community.





Figure 5: How the SESAR Release process contributes to the Master Plan key features

Key Feature	Release 1 (25 Exercises)
<p>Moving from Airspace to 4D Trajectory Management</p>	<ul style="list-style-type: none"> • Approach procedures with vertical guidance (APV) • Integrated controller working position
<p>Traffic Synchronisation</p>	<ul style="list-style-type: none"> • P-RNAV in a complex TMA (full implementation) • Point Merge in a complex TMA • Enhanced Airborne Collision Avoidance System (ACAS) • AMAN & Extended Horizon • AMAN-DMAN Integration • Controller working position enhancements • Initial 4D (i4D) & Controlled Time of Arrival – initial operations
<p>Network Collaborative Management & Dynamic/Capacity Balancing</p>	<ul style="list-style-type: none"> • Short-term Air Traffic Flow and Capacity Management (ATFCM) measures improvements
<p>System Wide Information Management</p>	
<p>Airport Integration & Throughput</p>	<ul style="list-style-type: none"> • Controller working position - Data entry to CFMU • Remote Tower
<p>Conflict Management & Automation</p>	<ul style="list-style-type: none"> • Sector Team Organisation & task sharing • Enhanced Short Term Conflict Alert (STCA) • Complexity Assessment & Resolution • Controller working position enhancements

(1) Please note that the objectives mentioned under each Release may include more than one exercise

Release 2 (30 Exercises)

- Free Routing • Business and Mission Trajectory Flight Planning

- Airborne Spacing, Sequencing and Merging
- Initial 4D Trajectory (i4D) & Controlled Time of Arrival – Time management
- Arrival Manager (AMAN) and Extended AMAN Horizon with precision Navigation in complex TMA
- AMAN and Point Merge in extended TMA
- Point Merge in a complex TMA using P-RNAV for Continuous Descent Approaches (CDA)

- Airspace Management and Advanced Flexible use of Airspace – sharing of real time airspace usage

- Situation awareness improvements at controller working position
- Airport Safety Net tool supporting clearances for the runway controller
- Use of Time-Based Separation Minima
- Surface Planning and Routing
- Remote Tower, single airport ATS

- Enhanced Conflict Detection & Resolution tools for high density operations
- Tooling for complexity and density assessment related to capacity
- Sector Team Operations – multi-sector planner

Release 3 (19 Exercises)

- ATS coordination procedures for ATS Units including coordination & transfer of flights

- Airborne spacing (ASPA) Sequencing and Merging (S&M) for TMA
- Traffic sequencing assistance for Initial 4D Trajectory Management and Controlled Time of Arrival
- Arrival Manager (AMAN) and Extended AMAN Horizon for multiple airports

- Enhanced flight planning considering 4D profiles or 4D data
- Enhanced Air Traffic Flow and Capacity Management (ATFCM) processes

- Air and Ground Data Sharing in support of ATS coordination procedures for coordination & transfer of flights

- Low Visibility Procedure using GBAS
- Airport Safety Nets for incursion detection
- Remote Tower, single airport, ATS & FIS
- Enhanced Situation Awareness using runway status lights
- Runway Occupancy Time Management through Brake to Vacate performance
- Integrated Airport Operations Management by use of Airport Operations Plan (AOP) link to Network Operations Plan (NOP)

- Enhanced Ground Based Safety Nets using aircraft derived data in Short Term Conflict Alert (STCA)

Glossary of terms and abbreviations

2D	2 Dimensional Flight Trajectory
4D	4 Dimensional Flight Trajectory
ACAS	Airborne Collision Avoidance System
ADDEP	Airport Departure Data Entry Panel
AMAN	Arrival Manager
ANSP	Air Navigation Service Provider
AOP	Airport Operations Plan
AROT	Arrival Runway Occupancy Time
ASPA	Airborne Spacing
ATC	Air Traffic Control
ATFCM	Air Traffic Flow and Capacity Management
ATM	Air Traffic Management
ATM Master Plan	Roadmap to achieve SESAR's objectives
ATS	Air Traffic Services
BTV	Brake to Vacate
CDA	Continuous Descent Approach
CORA	Conflict Resolution Assistant
DMAN	Departure Manager
FPL	Flight Plan
i4D	Initial 4-Dimensional Trajectories
IFPS	Integrated Initial Flight Plan Processing System
ILS	Instrument Landing System
NOP	Network Operations Plan
LPV	Localizer Performance with Vertical Guidance
MTCD	Medium Term Conflict Detection
OFA	Operational Focus Area
P-RNAV	Precision Area Navigation
R&D	Research and Development
RA	(ACAS) Resolution Advisory
R/T	Radio Telecommunication
RWSL	RunWay Status Lights
S&M	Sequencing and Merging
SESAR	Single European Sky Air Traffic Management Research
STAM	Short Term Air traffic Flow and Capacity Management Measures
STCA	Short-Term Conflict Alert
SWIM	System Wide Information Management
TCAS	Traffic Alert and Collision Avoidance System
TMA	Terminal Manoeuvring Area
TTA	Target Time of Arrival



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MG-AC-13-001-EN-C

ISBN 978-92-9216-010-4



9 789292 160104

IMPRINT ISBN 978-92-9216-010-4 - DOI 10.2829/1891 - © SESAR Joint Undertaking, 2013

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