

2012



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SESAR Release



2012

The second SESAR Release explained

1 /

Table of Contents

01 SESAR Releases: advancing ATM modernisation	p.02
02 SESAR explained	p.03
03 ATM today: in need of change	p.04
04 SESAR: delivering results	p.05
05 Tomorrow's air traffic management	p.06
06 Release 1: first components realised	p.07
07 Release 2: the next step	p.10



SESAR Releases: advancing ATM modernisation

As part of the SESAR Programme, the Release approach is an ambitious effort to validate mature key SESAR solutions in an operational environment and to prepare their deployment. This not only creates potential for early improvements of the current ATM system, but provides an excellent platform for a more result-oriented approach to research and development (R&D).

This brochure introduces the 18 Release 2 exercises planned for 2012, and lists the high-level achievements of Release 1. Further Releases will emphasise greater integration with the SESAR programme, strengthening the flow of activity from long-term innovative research through to operational deployment.

Through the incremental introduction of Release solutions the aviation community will benefit from improvements in ATM efficiency from an early stage on:

- **Airlines** will see savings in improved routings and continuity of air navigation services as well as in operational costs through increased punctuality and shorter flights. Moreover improved operational procedures will increase predictability, capacity and lower the environmental impact.
- Validation of the initial 4D trajectory will pave the way for **pilots** to execute the ideal flight route in all dimensions, while **airports** will be better integrated into European network operations.
- Release 1 already saw much activity directed towards improving the work conditions of **air traffic controllers**. Enhanced tools with improved human/machine interfaces for controller working positions will ensure that relevant information will be provided to the controller at the right time, in an easy and intuitive way. Advanced procedures for ATC sector team organisation enables controllers to cope safer and more easily with complex air traffic situations.
- **Passengers** will profit from improved punctuality and shorter flight duration, as the gradual removal of air traffic bottlenecks in busy areas and at airports continues.
- Overall, the SESAR programme aims to reduce the **environmental** impact of flights by at least 10%. Improved, more efficient routes means aircraft will burn less fuel and the noise impact will be better managed.

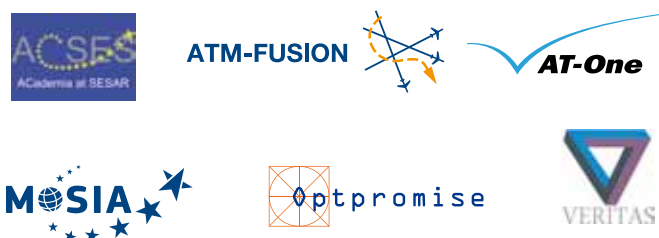
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02 SESAR explained



Use of PBN for en-route separation purposes Release 1 validation exercise © ENAV

3/

The SESAR programme is the operational and technological answer to Europe's air traffic management challenges. Embedded in the EU's ambitious Single European Sky initiative, the aim of SESAR is to ensure the modernisation of the European air traffic management system by coordinating and concentrating all relevant research and development efforts in the European Union.

Settled to manage the development phase of this modernisation programme, the SESAR Joint Undertaking is a €2.1 billion public/private partnership bringing together 2,500 people working on more than 300 projects in Europe and beyond. Aligned with the ATM Master Plan, the work programme covers projects presently extending from 2009 to 2016. Results delivered through the Release process will see the European ATM system gradually evolve towards full performance-based operations by the end of this decade.



An Airbus A320 test aircraft performed the world's first I-4D flight on 10 February 2012. © Airbus, 2012



Joint Undertaking

innovate

MAGNITUDE
CONSORTIUM

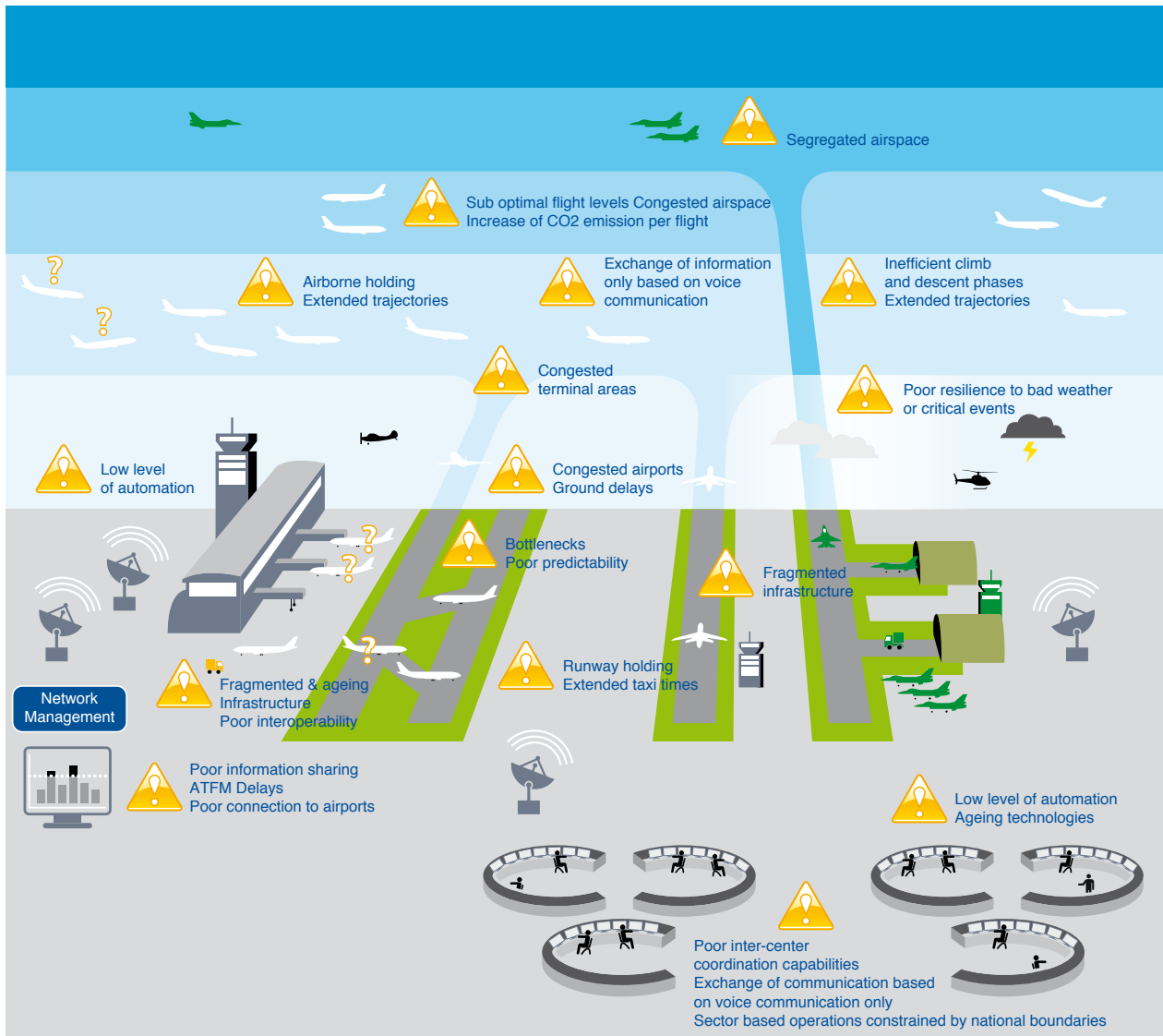
ATM today: in need of change

The increasing complexity of European airspace, coupled with significant traffic growth over the years, has imposed constraints on an ATM system which is still primarily organised around rigid components. The result is that passengers, airlines and the environment have to cope with burdensome inefficiencies: delays, sub-optimal flight levels, poor planning, extra routings, airborne

holding, etc. All this adds to costs and prevents optimum environmental performance.

SESAR as the technological element of the Single European Sky addresses these constraints, bringing the promise of a new air traffic management infrastructure.

Air traffic management today



04 SESAR: delivering results

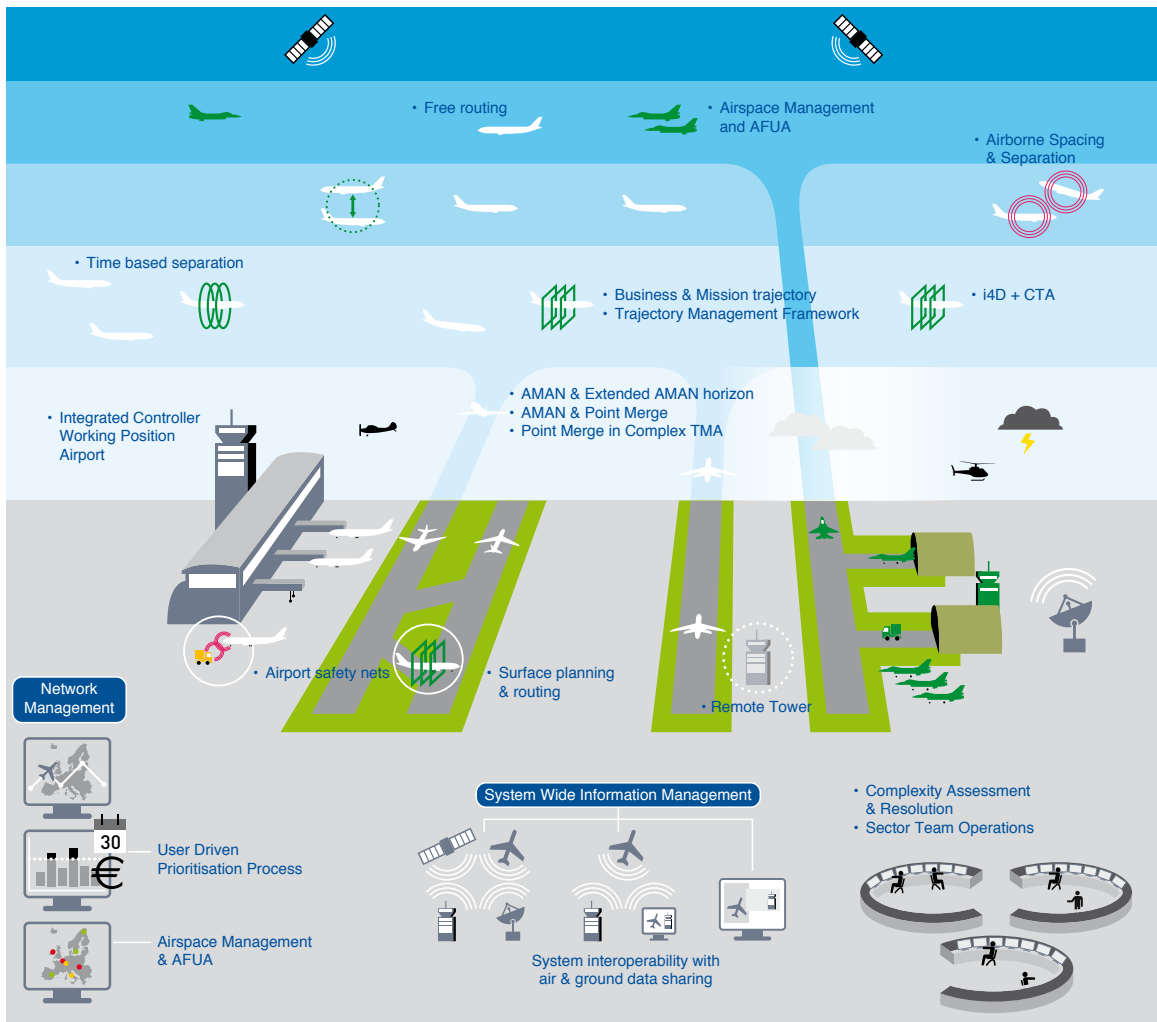
SESAR's Release approach is the first time that European ATM research and development has been organised in such a way: through the ongoing validation of new SESAR solutions in an operational environment, the SESAR Joint Undertaking and its members pave the way for the incremental introduction of new technologies and procedures.

terminal airspace operations, the initial 4D trajectory, end-to-end traffic synchronisation and integrated and collaborative network management.

Release 1 included 25 operational validations throughout Europe. The exercises centred on the development of efficient and green

Release 2 and further Releases will build on the experience gained during Release 1, widening the scope of the work and aiming for a more coherent strategy, ensuring that the ATM Master Plan is properly addressed, in line with end-user expectations.

Activities addressed in Release 1 and 2



Tomorrow's air traffic management

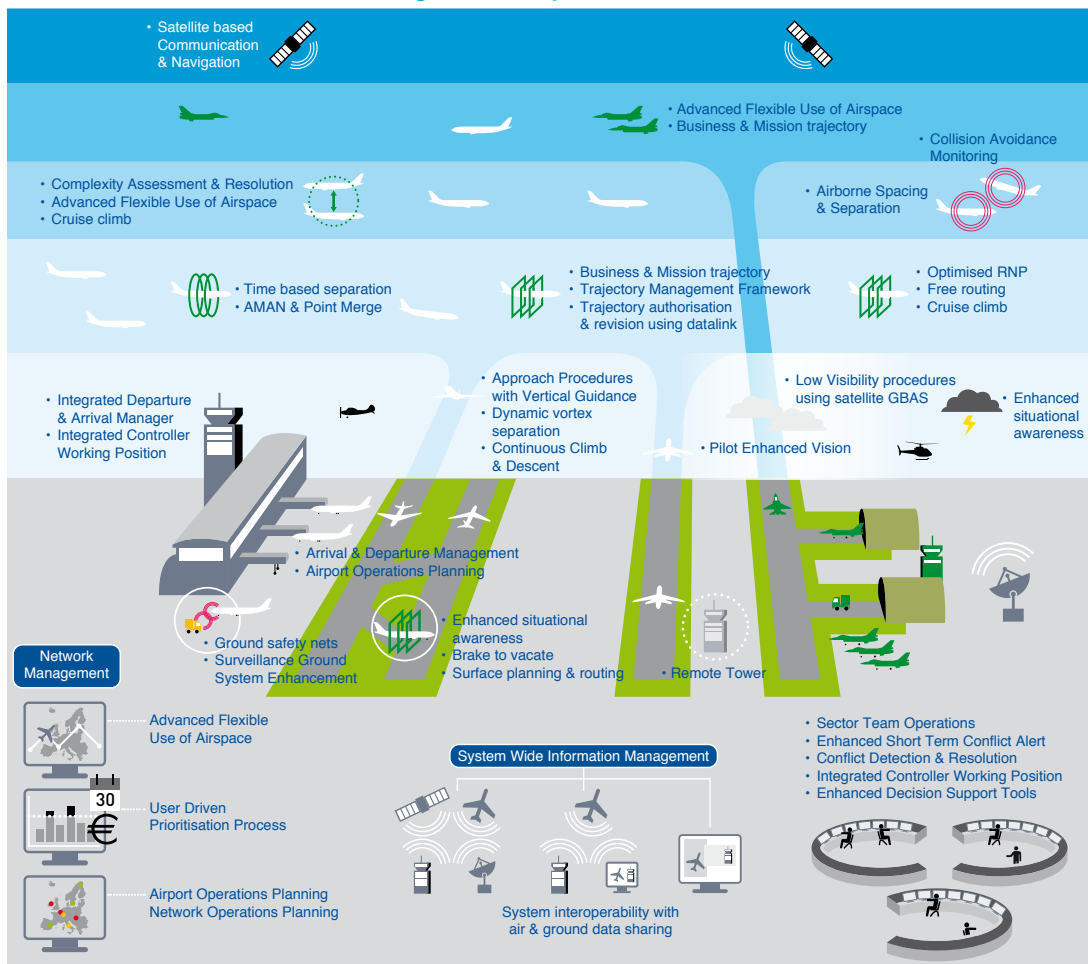
In the future ATM system brought by SESAR, airspace users (both civil and military) will be able to choose and fly their preferred routes instead of adhering to the fixed routes of today. Airlines, controllers, airports, and all other stakeholders of one of the world's most complex ATM environments will exchange and share the same data, ending the fragmentation which is one of the main limitations of today's ATM system. Flexibility will improve because planning decisions can be made much later, taking into account the most recent operational developments.

the ICAO Global ATM Operational Concept will increase airspace capacity by reducing controller workload and minimising tactical interventions. Datalink air-ground communications will improve pilot situational awareness and allow integration of traffic between the aircraft and the ground. While ensuring the human always remains at the heart of decision-making, SESAR brings powerful automation tools which will both ease and speed decision making.

The new operational concept from the SESAR programme which builds on

Airports will become efficient nodes of the ATM system. Integrated airport operations planning, advanced surveillance techniques, ground-based safety nets and new runway management tools are amongst the improvements that will mean aircraft can be served more efficiently from gate to gate.

The SESAR air traffic management system



Release 1: first components realised

During 2011, 25 exercises were completed under the Release 1 programme. They mainly 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. The SESAR Releases will not only lead to early improvements to the European ATM system, but will also serve to increase confidence in the SESAR concept.

Final assessment of the results of Release 1 will be conducted in April 2012, leading to a formal conclusion as to the suitability of the achievements for industrialisation. The results are also being fed into the next update of the ATM Master Plan.

The following chapter presents a short overview of the validation exercises (clustered into 16 Operational Focus Areas) performed in 2011.

Full implementation of P-RNAV in complex TMA

This exercise looked at improving operational procedures and guidelines for Precision Area Navigation (P-RNAV) in complex TMAs.

Results

The trials firstly confirmed the **feasibility** of continuous descent approaches (CDAs) and continuous climb departures (CCD) through P-RNAV. The exercise also showed an **increase in capacity** by integrating P-RNAV and conventional routes in high traffic density TMAs. At the same time, the **workload** of pilots and controllers could be reduced.

Point merge in complex TMA

During operational validations improved point merge procedures in a complex TMA were validated. The procedures relied on better exploitation of the Flight Management System (FMS) allowing less radar vectoring and fewer constraints by controller instructions on speed and level. The improved procedures built on P-RNAV and continuous descent approaches.

Results

The exercises demonstrated that point merge procedures work more effectively, and provide a potential

capacity increase, when used with an effective arrival manager. Like this, the **runway throughput** can be improved and **fewer holdings** are necessary. Consequently, a reduction of fuel burn for departure and some arrival traffic was observed.

Approach procedures with vertical guidance

The exercise aimed at validating approach procedures with vertical guidance using satellite based augmentations system. This will pave the way to fly instrument landing system type approaches to airports independently of ground based infrastructure.

Results

While keeping the controller workload within acceptable limits, the trials showed mostly **improved airport landing rates** with reduced airline diversions. Additionally, by using improved vertical guidance, **environmental benefits** resulting from reduced fuel burn or noise footprint are expected.

CDM and sector team operations

Through shadow mode procedures to improve sector team organisation and coordination (roles & responsibilities) were validated. Requirements for improved tools regarding information and task sharing were delivered.

Results

Controllers appreciated the **user-friendliness** of the pre-operational system in terms of ergonomics and functionalities. They were able to effectively perform their tasks using the new procedures.

Enhanced short term conflict alert (STCA)

This validation exercise looked at supporting controllers in identifying possible conflicts for steady and manoeuvring aircraft in the TMA. The aim was to generate useful alerts with an adequate warning time.

Results

The enhanced STCA allowed a **reduction of false alarms** while the genuine alert rate and warning times are maintained or even slightly increased. This will lead to the safety of flight especially during complex operations.

Link autopilot with ACAS

The trials consisted in validating the operational and safety benefits of automatic response to an ACAS resolution advisory (RA), instructing the autopilot of a necessary change in flight levels due to potential collision.

Results

The automated resolution advisory significantly reduced the **response delay** to no more than four seconds bringing **safety benefits**.

Integrated Arrival Manager (AMAN) and Departure Manager (DMAN)

Live trials at Paris Charles de Gaulle airport assessed the basic DMAN operating method in a highly complex operating environment and validated the usability and reliability of the departure manager.

Results

The exercise showed an improved synchronisation of airport traffic, enhancing **efficiency** through timeliness and **predictability** of traffic.

Arrival Manager (AMAN) and Extended AMAN horizon

Through operational validation at Rome TMA and airport an evaluation of extended arrival manager was performed. Further trials took place in the Swedish airspace as well as the Dutch airspace and adjacent FIRs.

Results

Workload for en-route and terminal controllers was reduced and **capacity** in the terminal area increased.

Enhanced airborne collision avoidance system (ACAS)

This exercise aimed at avoiding false alarms in the event of high vertical climb and descent rate encounters based on a new altitude capture law.

Results

The new, automatic altitude capture laws lead to a **significant reduction** of the false alarm rates reducing workload for controllers and increasing safety.

Spotlight on: I-4D and controlled time of arrival

The first four-dimensional trajectory management (I-4D) validation exercise took place on 10 February 2012, when an A320 test aircraft flew from Toulouse to Copenhagen and Stockholm and back. It was the culmination of months of preparation between SESAR partners, including aircraft, avionics and equipment manufacturers and air navigation service providers.

I-4D represents a key element in the transition from constrained flights in the current ATM system to optimised flights in the future Single European sky. I-4D operations establish far in advance a sequence for aircraft converging on a merging point in a congested area. After coordination between the ground systems and the aircraft, each aircraft is allocated a time slot for its arrival at a merging point, and in compensation is allowed to fly to that point, without any vectoring instruction from the controllers.

The trial aircraft flew through the Maastricht Upper Air Control Centre area, where the aircraft and the ground systems agreed on a time constraint at a merging point close to Copenhagen airport. The flight then continued into Danish airspace and demonstrated an optimised descent to Copenhagen.

Complexity assessment and resolution

In shadow mode trials, Eurocontrol Maastricht tested a complexity prediction tool which is based on controller capabilities to solve different complex situations in the airspace, but also possible controller resolutions in the traffic prediction through continuous simulations.

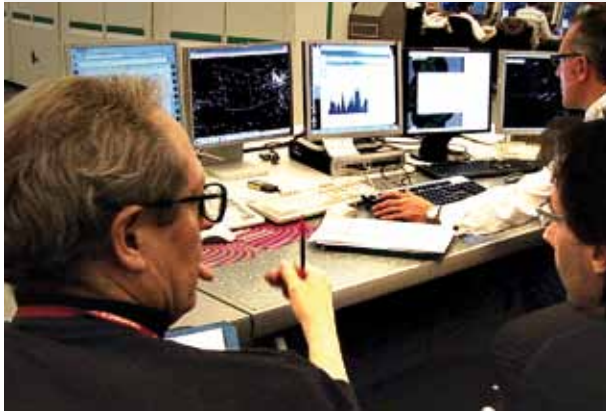
Results

The used complexity metrics proved to be a reliable measure of the controllers' workload. Combined with the use of traffic complexity predictions, this **workload** could be reduced considerable.

Spotlight on: Short Term ATFCM Measures (STAM) validation exercise

Positive achievements were reported for the first trial, on 8-10 November 2011, of the Short Term ATFCM Measures (STAM) validation exercise.

STAM measures applied to minor ATM events such as ground delays, flight level capping and re-routings can reduce the complexity of traffic peaks, easing the overall flow of traffic.



Team during the STAM Release 1 validation exercise © Eurocontrol

The trial was part of the overall dynamic Demand Capacity Balancing (dDCB) initiative, which used collaborative decision making on the day of operations to maintain the balance between user demand and available capacity.

The iterative dDCB process takes place between a few hours and a few minutes before sector entry time, and comprises the initial detection of demand and capacity imbalance, network view and complexity assessment and preparation of the STAM, with the emphasis on minimising the impact on aircraft operators. The selected STAM measures are then coordinated with the actors concerned, and finally implemented.

The validation exercise included Flow Management Positions at London, Reims and Maastricht along with 11 airlines and the Network Manager.

53 STAM Measures were initiated during the trial. On 9 November, a hotspot was identified at Reims ACC, requiring a regulation to be applied on the UHL4 sector due to high demand and flow complexity. Initial regulation triggered a total delay of 810 minutes. Application of nine STAM measures (flight level capping) reduced the initial regulation delay to 99 minutes. The results are being carefully analysed, with operational implementation being considered for 2012-2013.

Integrated controller working position - airports

The aim of this validation exercise was to develop a low-cost departure data entry panel at airports to share departure data between the tower and the approach controllers as well as between the tower and the Central Flow Management Unit (CFMU). Shadow mode operations were conducted at Southampton airport tower.

Results

During the trials, an increased accuracy of estimated take-off time could be observed. Due to the fact that the approach controller received information early, more precise **departure** of aircraft was possible.

Integrated controller working position – TMA

This trial included the validation of specifications for a new human machine interface for TMA controller working position with improved design, addressing human factors related issues.

Results

The feedback from controllers participating in this trial were mostly **positive**. They highlighted that the tools were useful and the automation features were trustworthy. They also appreciated the support in building and retaining a short – medium – and long term traffic picture.

Integrated controller working position – en-route

Similar to the previous trial, this exercise validated a new human machine interface for en-route controllers. The design of this upgraded working position addresses human factors related issues.

Results

Feedback from this trial will be part of the human machine interface on which new SESAR concepts will be built.

Remote Tower

During shadow-mode operations at Malmö Sturup airport with Ängelholm airport as control facility, the cost-effective provision of air traffic services at a remote airport was demonstrated.

Results

Remote tower technology will allow air traffic at small or medium-sized airports to be **remotely** managed from a single ATS centre.

Release 2: the next step

Release 2 will build on the results from Release 1 but will be wider in scope and will emphasise on coherence with the overall SESAR programme. The main operational improvements aimed for in Release 2 are in the areas of **airport platform safety, airborne operations, ATC operations and network management**. Priority has been given to exercises demonstrating that future deployment is feasible in the short-medium term, assuming validation results confirm their suitability for delivery.

In its effort to answer to the needs of all **airspace users** and to validate the proposed technical and operational improvements in a real life environment, airspace users are involved in the Release 2 trials: Air France, Flybe, Lufthansa, Novair, SAS, TAP, Wideroe, IATA, the European Low Fares Airline Association, the European Business Aviation Association and the International Council of Aircraft Owners and Pilots Association (General Aviation).

The programme contains 35 exercises, clustered into 18 themes (Operational Focus Areas, see description here below). Four exercises have been carried over from Release 1.

Main validation sites of the SESAR Release 2012



Airport safety nets

The aim of this exercise is to develop and assess a tool for the detection of conflicting ATC clearances for the runway controller. Particularly issues addressing the acceptance and safety (situation awareness and workload) of the final operational scenario and procedures will be assessed.

Benefits

The upgraded systems will **improve safety** at airports through better situational awareness and conflict alert systems, while at the same time increasing capacity.



Remote Tower Release 1 validation exercise in Sweden © SAAB

Time-based separation

This exercise validates the use of time-based separation minima by tower and approach controllers. In particular, new controller procedures and support tools will enable the use of refined time based separation minima in typical operational circumstances as well as challenging wind conditions and other critical situations.

Benefits

Through the enhancement of current distance-based approach separations with time-based separations, **runway capacity** is expected to be increased in critical conditions.

Point merge in complex TMA

On platforms operated by ENAV, point merge procedures will be validated. They will rely on better exploitation of the Flight Management System (FMS) leading to less radar vectoring, as well as controller's instructions on speed and level, completing the achievements of Release 1. The exercise aims at facilitating continuous descent arrivals and at providing a baseline for trajectory based operations in the TMA.

Benefits

New procedures and better exploited Flight Management Systems will improve and harmonise **arrival operations** while minimising the **environmental impact** of flight.

Trajectory Management Framework

The aim of two exercises conducted by DSNA in Toulouse and NATS in London is to validate that the performance of the air traffic control conflict detection and resolution tool in a high density controlled airspace improves when the underlying trajectory prediction is supported by AOC data. Several airlines are participating in this trial.

Benefits

Trajectory management is a fundamental element of SESAR, aiming to improve ATC efficiency by establishing the optimum flight plan of aircraft in the system before departure, improving the predictability of traffic and reducing delays.

Free Routing

Through exercises and live trials involving several airlines, recommendations for user preferred routing operations inside Europe will be elaborated.

Benefits

Free routing will allow airspace users to **freely plan their routes** between specified exit and entry points without reference to the air traffic services route network. This will lead to improvements in efficiency, bringing **financial and operational advantages** to all players in the system in particular during the **en-route phase**.

Business and mission trajectory

This shadow mode trial will look into the validation of enhanced current **flight planning** processes mainly through increasing interoperability between airline and CFMU. In particular, it will study the provision by the airline operational control centre of flight performance data in addition to ICAO flight plan information.

Benefits

Through the exchange of additional, up-to-date information, flight planning will be substantially improved increasing the predictability of flights.

System interoperability with air and ground data sharing

On three validation platforms in Germany, France and the Netherlands, new coordination procedures for air traffic service units will be tested. The trials will include the coordination and transfer of flight, the distribution of time constraints supporting the sequencing of arrival flows, as well as downstream and upstream negotiation elements.

Benefits

Through the seamless, silent coordination between different air traffic service units, **controller workload** will be decreased.

Airborne spacing sequencing and merging

This exercise looks at two self-separation manoeuvres of aircraft (remaining behind and merging, then



ENAV aircraft simulator used during Release 1 validation exercises © ENAV

remain behind) on aircraft simulators in Toulouse and Rome.

Benefits

Increased automation will lead to more efficiency and decreased workload per flight for controllers.

Sector team operations

NATS will carry out an operational validation of a concept of a multi-sector planner operating environment, with emphasis on identifying roles and responsibilities. Tool support and information sharing functions will be delivered.

Benefits

The procedures and software will allow more efficient management, sharing of tasks and coordination amongst controllers.

Arrival manager (AMAN) and extended AMAN horizon

This exercise will assess the integration and consolidate the benefits of the arrival manager (AMAN) with P-RNAV procedures in a complex terminal manoeuvring area (TMA) with more than one airport. The trial will be carried out by AENA at Madrid airport. A further exercise, at Southampton in the UK, will trial extended horizontal arrival manager streaming techniques to more than one airport.

Benefits

The goal is to achieve a reduction of controller workload through smoother arrival flows, creation of optimum 2D routes in the TMA and better situational awareness using new tools to monitor separation between aircraft.

Arrival manager (AMAN) and point merge

DSNA will test in live trials procedures, requirements and cases for using point merge in TMA-extended with the aim of achieving continuous descent approaches from high altitudes in high traffic environments.

Benefits

The new procedures will lead to smoother aircraft trajectory on approach, reducing fuel costs and

environmental impact. They also support the 4D trajectory concept.

I-4D and controlled time of arrival

Through simulator and flight trials, SESAR members and participating airlines validate operational procedures for flying to a time (controlled time of arrival - CTA) in the en-route as well as the TMA airspace.

Benefits

The trials aim at further advancing initial 4D trajectory operations for the optimisation of flights.

Surface planning and routing

Live trials will be the basis for the validation of procedures and technical specifications for planning, assigning and modifying of a route to individual aircraft and vehicles using datalink.

Benefits

Provides safe, efficient movement of aircraft and vehicles around the airport.

Complexity assessment and resolution

Release exercises in Barcelona and Maastricht will evaluate the possibility to improve the match between traffic densities and spare capacity in the network. Supporting tools to balance demand and capacity are being developed. A further exercise will demonstrate that the interoperability and i4D information will increase the accuracy of the traffic complexity management tool, allowing better prediction of available airspace capacity.

Benefits

The validated procedures and tools will support decision making to solve complexity issues by continuously adapting the traffic load.

Airspace management and advanced flexible use of airspace

Indra and Eurocontrol work together on this trial to improve air traffic flow and capacity management. They will validate new procedures to automatically share the static airspace and its use plan or updated use plan data with network managers and flow management positions.

Conclusions and outlook

Benefits

The validated procedures are the first step towards **collaborative decision making** which will lead to enhanced airspace management efficiency.

User driven prioritisation process

New procedures are being studied which will enable airspace users to swap take-off time on a collaborative decision making airport on the day of flight. Such a swap might be useful in case of 'significant' demand/capacity unbalance mismatch. A wide scale of live trials will be carried out at Heathrow airport.

Benefits

The user driven prioritisation process will improve **flexibility for airlines**.

Integrated controller working position - airport

Operational validations in France, Spain, Italy and Germany are designed to validate human/machine interface improvements including safety aspects as well as operating procedures at airports. The aim is to provide the controllers with a clear picture of the actual traffic situation and with all the necessary traffic data to assist them in their control tasks. The data sets are presented either as text or graphics.

Benefits

Improved air traffic controller working environment will lead to **more efficiency** and a lower workload.

Remote Tower

A remote airport tower at Ängelholm (Sweden) airport will be operated from Malmö air traffic control centre. A further exercise will conduct a similar trial at Vaerøy (Norway) airport.

Benefits

A single tower will be able to **operate several unmanned towers** at smaller airports, reducing costs.

ATM modernisation is a complex and ambitious objective and this complexity needs to be managed. The SESAR programme looks at ATM modernisation from innovative research to industrialisation and standardisation; its mandate for long-term research ensures the continuity of the SESAR approach.

The main benefits from the SESAR release process are twofold: firstly, it provides a direct relationship between SESAR and the future ATM system, allowing all SESAR partners to validate new procedures and technologies from a very early stage on. Secondly, it considerably changes how research and development in the ATM domain are brought about. The developed concepts are directly validated and if they are not fit for purpose, they will be adapted or not further pursued. Especially by including the airlines as well as military airspace users in this process, SESAR also makes sure that all new technologies and procedures are in line with users' expectations.

With the second SESAR Release, the SESAR programme clearly builds on the experience gained during Release 1 with Release 2 being wider in its scope and more coherent in its approach. With the longer term Releases 3 and 4 the SESAR JU plans to further build on the top-down approach, working from the new ATM Master Plan.

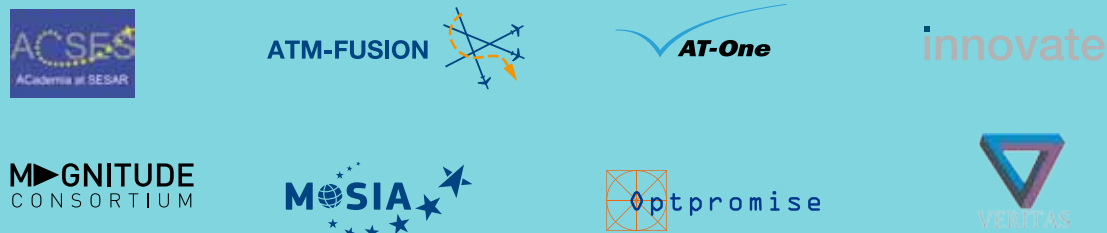
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