RESULTS

SESAR Release 2

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RESULTS

SESAR
Release 2 Results

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Towards a business need driven release approach

SESAR is a performance and delivery-oriented research and 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 while promoting a more results-oriented approach to R&D.

A Release comprises a selection of solutions that have been through a systematic validation process. By going through this process, each solution has proven to be ready for industrialisation leading to operational deployment. The SESAR Release programme includes one Release per year, starting with Release 1 in 2011.

In early 2012, the SESAR Joint Undertaking (SJU) strengthened the effectiveness of the Release approach by identifying five strategic priority business needs to meet the most pressing operational demands of ATM stakeholders. These strategic priority business needs reflected the key features contained in the European ATM Master Plan.

Against this background, in 2012, the SJU launched Release 2, which contained 30 exercises, taking place across 18 European locations and focused on the strategic priority business needs. Out of the 30 exercises contained in Release 2, significant results were obtained from 28 exercises and the remaining 2 exercises will be assessed in 2014 as part of Release 3. Release 2 built on the results of Release 1, widened its scope and emphasised the importance of coherence with the overall SESAR Programme by linking Release 2 with the ATM Master Plan.

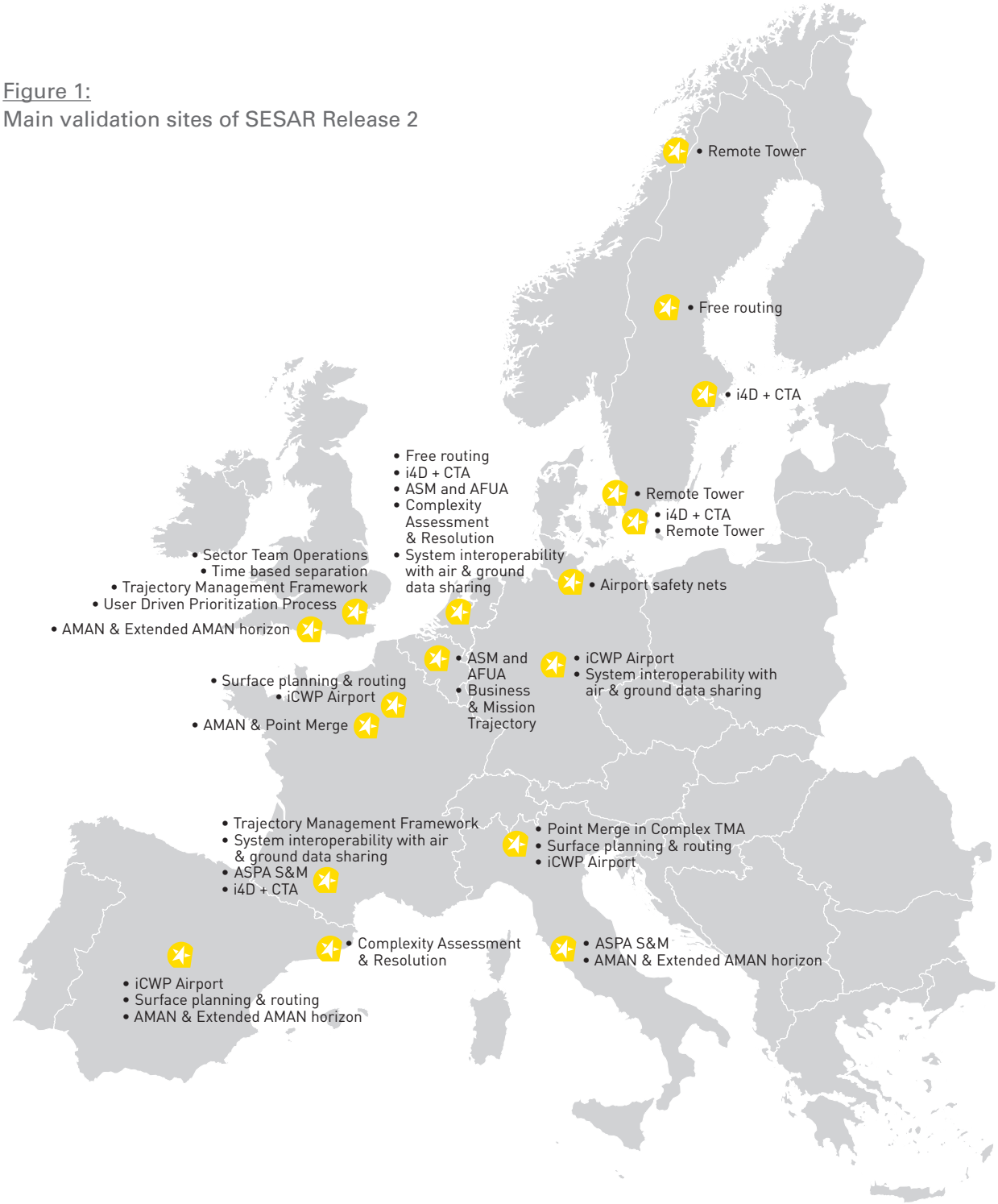
Priority was given to exercises demonstrating that future deployment is feasible in the short to medium term, assuming validation results confirm their suitability for delivery.

In an effort to answer the needs of all airspace users, the following stakeholders were involved in the Release 2 trials: Air France, Flybe, Lufthansa, Novair, SAS, TAP, Wideroe, IATA, European Low Fares Airline Association, European Business Aviation Association and International Council of Aircraft Owner and Pilot Associations (General Aviation).

SESAR strategic priority business needs

- **MOVING FROM AIRSPACE TO 4D TRAJECTORY MANAGEMENT**
- **TRAFFIC SYNCHRONISATION**
- **NETWORK COLLABORATIVE MANAGEMENT AND DYNAMIC CAPACITY BALANCING**
- **AIRPORT INTEGRATION AND THROUGHPUT**
- **CONFLICT MANAGEMENT AND AUTOMATION**

Figure 1:
Main validation sites of SESAR Release 2



Release 2 results: some highlights

The aim of SESAR's Release approach is to feed the aviation community with an incremental flow of new or improved ATM technological solutions at a pre-industrialisation stage. Results delivered through the Release process will gradually allow the European ATM network to evolve in accordance with the new SESAR paradigm, and thereby help the aviation community to overcome the constraints which currently limit the optimal performance of the ATM environment.

Release 2 featured 30 validation exercises, which took place throughout Europe in 2012. The main results of these exercises focused on: refining the time-based separation minima between arrival aircraft; optimising the Air Traffic Control (ATC) sectorisation to better cope with the traffic demand; providing new direct routing for airlines; and increasing ATC efficiency.

Time-Based Separation (TBS): Maintain arrival capacity

The Time-Based Separation (TBS) for Arrivals concept was developed as a solution **to permanently provide arrival capacity resilience to headwind conditions on final approach.** With Distance-Based Separation (DBS) procedures based on wake-turbulence categories and radar spacing, the achieved arrival capacity is impacted as stronger headwind conditions on final approach increase the time taken to fly the distance-based separations. This leads to landing rate losses.

A set of real-time simulations took place in London Heathrow.

New controller procedures and supporting tools enable the use of refined TBS minima between aircraft in typical operational circumstances, as well as in challenging wind conditions.

The validation results indicate that TBS in Heathrow could deliver significant operational benefits, including:

- Higher aircraft landing rates in stronger wind conditions;
- Reduced holding and approach times; and
- Reduced stack-entry to touchdown times.

For the traffic samples and wind conditions simulated, up to 5 additional aircraft per hour were landed, with an average of 2 additional aircraft per hour. The mean reduction in holding times was of 0.9 minutes, while stack-entry to touchdown times were reduced by 1.4 minutes.

The percentage of separation errors was almost half with TBS when compared to DBS showing that, with the TBS indicators, controllers were able to provide improved separation overall. Controller workload was not impacted.

Automated Support for Dynamic Sectorisation: Optimised capacity

Dynamic Capacity Management allows **adapting the capacity to traffic load by grouping and de-grouping sectors and managing the staff resources accordingly**. Unused latent capacity can occur at all Flow Management Positions (FMP) during peak traffic times. Current tools facilitate the detection of overload but do not offer better options to deal with it.

A SESAR Release 2 shadow mode validation exercise, carried out in Barcelona Area Control Centre (ACC) in October 2012, focused on the analysis of the use of a supporting tool for operations supervisors to evaluate the most suitable ACC En-Route sector configuration during the day of operations, in terms of capacity to match forecast demand.

This tool enables the evaluation of the most suitable ACC sector configuration in a high-density area to meet the capacity needs of the traffic load. The tool is mainly used during the day of operations, between 8 to 2 hours before the beginning of an Air Traffic Controllers (ATCO) shift, taking into account:

(1) Continuous refinement of planning using demand data through the planning phases (weeks, days, hours before execution) and determining how demand evolution has a direct impact on capacity management;

(2) Local constraints such as the number of available ATCOs; and

(3) "What If" scenarios designed at local level (such as impact in capacity due to bad weather conditions, change of operational circumstances in associated airports…).

The validation exercise demonstrates a number of performance benefits, comprising:

- A reduction of saturation periods;
- An increase in flights able to enter an airspace volume;
- A reduction of the number of delayed flights; and
- Improved situational awareness - thereby avoiding demand and capacity imbalances that could lead to safety issues and allowing ATCOs to handle more flights per sector even in non-nominal conditions.

User-Preferred Routing: fly as direct as possible

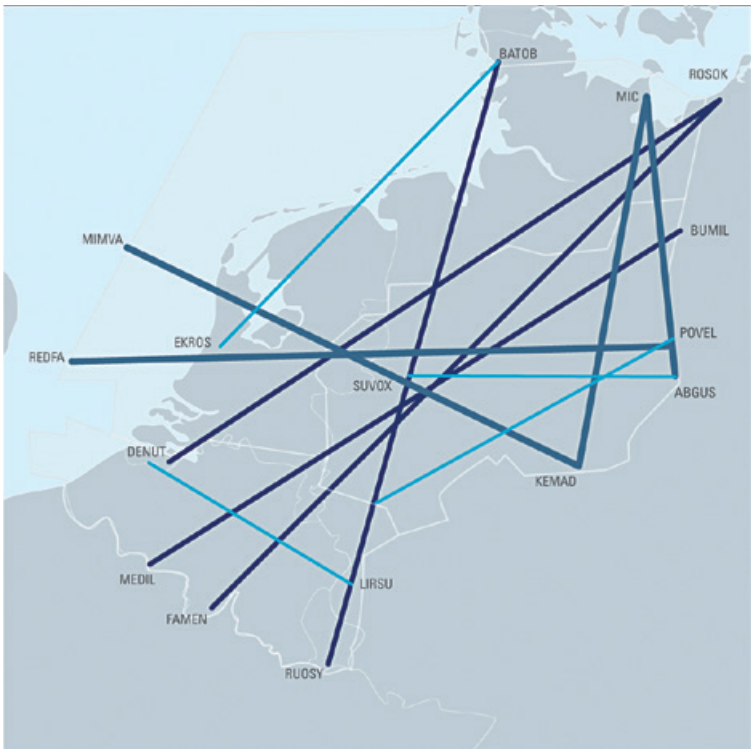
The European Free Route Airspace Concept is designed to support Free Route Operations, which **enable Airspace Users to freely plan a route between published entry and exit points** without reference to the Air Traffic Services (ATS) route network, subject to airspace availability. This ability for Airspace Users to choose their own routes is called User-preferred Routing (UPR).

UPR validation activities in SESAR Release 2 were performed during Spring 2012 and aimed to extend the current use of free routes in the Maastricht Upper Airspace Control Centre (MUAC) Area of Responsibility (AoR) and implement a first step towards Free-Route Operations within MUAC airspace.

The concept, as trialled in SESAR Release 2, increases the number of available Direct Routes in MUAC AoR (allowing for more than 250 new Direct Routes ready to be implemented) and extends the implementation of direct routes to week days, extending the current weekend-only operations. From a performance perspective, the implementation of the UPR operation brings the following benefits:

- Reduced flight distance (average reduction of 7%);
- Improved flight-time efficiency; and
- Environmental benefits, i.e. improved fuel efficiency, reduction in fuel burnt and reduction of emissions (in the range 6 - 12%).

Figure 2: Some of the UPR routes within MUAC airspace



Multi-Sector Planning (MSP)

The Multi Sector Planning (MSP) concept was tested through a series of three validation activities, which were performed in March 2012, at the London ACC.

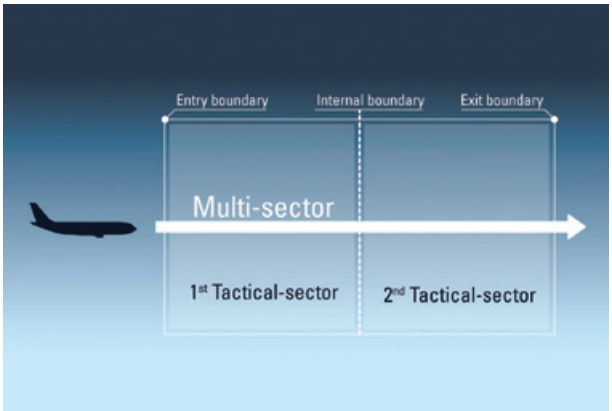
These exercises aimed at validating the MSP concept that reconsiders the usual ATC team composed of 1 Planner and 1 Tactical controller. The MSP concept **proposes a structure whereby a single Planner Controller is planning and organising the traffic for two Tactical Controllers, each of whom is controlling a different sector (1P-2T configuration)**. The validation included an assessment of roles and responsibilities in a complex operating environment, taking advantage of advanced Planner support tools developed on the NATS iFACTS system. The SESAR Release 2 exercises demonstrated that the 1P-2T configuration:

- Provided an environment where all controllers reported a comfortable level of workload for the operations; and
- Proved to be viable in a range of sector types (high-level, en-route, Terminal Manoeuvring Area (TMA) interface, vertically split sectors, etc.) over a wide variation in traffic levels and complexities at the London ACC.

The SESAR Release 2 validation activities of the 1P-2T concept also introduced a new support tool, which showed:

- An improved situational awareness and task sharing;
- Less need for tactical intervention resulting in a reduced workload per flight and increased controller productivity through automatic calculation of optimal arrival sequences and coordination support;
- Reduced ATCO workload resulting in better usage of ANSP workforce, thanks to a more balanced distribution of workload among ATCO teams; and
- Flexibility in sourcing and deploying ATCOs resulting in improvements in cost-effectiveness, as well as improvement in the ability to resource demand, providing significant reduction in costs associated with staff overheads.

Figure 3: Multi-sector planning



A further phase of concept development will extend the concept from 1P-2T to 1P-nT (i.e. several Tactical Controllers under the responsibility of a single Planner Controller) and will develop the manner in which boundary transfer is dealt with from the traditional co-ordination model to a more flexible "collaboration" model, where there is no longer the requirement for prior co-ordination for every flight between sectors.

Exercise Factsheets

Release 2 contained 30 exercises, which took place across 18 European locations and focused on the 5 strategic priority business needs. Out of the 30 exercises contained in Release 2, significant results were produced by 28. The remaining 2 exercises will be assessed in 2014 as part of Release 3.

The following factsheets present the research results from each of the exercises conducted as part of Release 2. The criteria applied for assessing the maturity of the concepts under review, and hence the success of the exercise, are as follows:

- The operational and system requirements were developed and tested in a realistic environment and are properly documented;
- Validation evidence shows that the expected performance is adequate to justify further investment for industrialisation;
- Evidence shows that, when implemented, the concept option will be safe under normal and abnormal operational conditions; and
- The validation process has been conducted with a level of rigour and quality sufficient to justify confidence in the results.

"Release 2 contained 30 exercises, which took place across 18 European locations and focused on the 5 strategic priority business needs."

Each exercise factsheet integrates the following colour codes:

Conclusions

- The exercises successfully demonstrated the maturity of the concept.
- The exercises partially demonstrated the maturity of the concept.
- The exercises did not demonstrate the maturity of the concept.

Preparation for industrialisation

- The exercise results are conclusive and sufficient to support a decision for industrialisation.
- Further work on the concept is planned prior to industrialisation.
- No benefits are demonstrated for this concept element.

01

Exercise

MOVING FROM AIRSPACE TO 4D TRAJECTORY MANAGEMENT

Trajectory Management Framework

(SESAR Reference: EXE-O5.05.02-VP-301)

Main objectives

This validation exercise was conducted by NATS and aimed at ensuring that ATC conflict-detection and resolution tool performance, in high-density area controlled airspace, improves when the underlying Trajectory Prediction (TP) is supported by data from an airline's Flight Operations Centre (FOC) .

Results

A benefits assessment made at European level estimated the following benefits:

- 300 nuisance alerts avoided per day, which means a total of more than 100,000 conflict-resolution actions could be avoided per year;
- Reduction of controller workload;
- Level-off avoidance translates into a monetary saving of €1,270,000 per year; and
- Significant environmental/fuel efficiency benefits were achieved: approximately 2 million kg fuel economy a year and estimated reduction of 6,100 tonnes of CO_2 a year.

Conclusion

The exercise demonstrated the maturity of the operational improvement in the context of specific NATS scenario objectives.

Preparation for industrialisation

The exercise successfully demonstrated the possible implementation of some AOC data to enhance trajectory prediction to improve the NATS Medium Term Conflict Detection (MTCD) tool.

Exercise

TRAFFIC SYNCHRONISATION

Airborne Spacing, Sequencing and Merging

(SESAR Reference: EXE-05.06.06-VP-198 and EXE-05.06.06- VP-392)

Main objectives

This exercise explained airborne spacing manoeuvres to fine-tune the sequencing of the arrival traffic towards the airport. The exercise ran on aircraft simulators in Toulouse and Rome.

Results

The exercise results are summarised below:

- Results from the Real Time Simulation using SELEX-SI and AIRBUS Industry Based Prototype (IBP), suggested that the introduction of Airborne Spacing (ASPA) manoeuvres in Rome TMA do not negatively affect the predictability of aircraft trajectory.
- Data indicated that workload of ATCOs does not significantly increase, suggesting that the implementation of ASPA manoeuvres during critical events do not negatively affect current safety levels.
- Feedback from pilots indicates that ASPA operations are well integrated in current flight crew tasks. The ASPA function allowed the flight crew tasks to be performed with an acceptable level of workload and without degrading performance of other tasks. Roles and responsibilities within the flight crew were clearly identified and considered as appropriate in nominal situations.
- The evaluation of impact of the Airborne Spacing on flight efficiency, in terms of aircraft speed behaviour will be subject to further validation.
- Significant progress was made on the definition of ASPA-specific radio phraseology messages, and on how these can be combined with Controller Pilot DataLink Communications (CPDLC) messages for ASPA operations, although more work is needed in both areas in future validation activities.

Conclusion

These exercises partially demonstrated the maturity of the concept.

Preparation for industrialisation

Further activities will be conducted as part of Release 3.

03

Exercise

TRAFFIC SYNCHRONISATION

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

(SESAR Reference: EXE-04.03-VP-029, EXE-04.03-VP-330 and EXE-05.06.01-VP-204)

Main objectives

Through simulations and flight trials, SESAR members and participating airlines performed an exercise to investigate operational procedures for flying to a time in en-route, as well as in TMA airspace.

These trials aimed to investigate procedures that make use of i4D capabilities to enhance queue management and minimise delays. In order to do this, i4D simulations were carried out by integrating mainline aircraft with a simulator at Toulouse airport and connected with MUAC. In addition, i4D simulations involved an Airbus 4D predictor and covered gradual validation of trajectory exchange in en-route between air and ground. The exercise also validated the concept of a shared trajectory to ensure consistency of information between ground and airborne systems.

At Malmö ATC Centre, another exercise was carried out in order to address the i4D+CTA concept in the TMA, using an extended Arrival Manager (AMAN) horizon to allocate a CTA on each arrival route. The arrival sequence of traffic is therefore already set up by the En-Route controllers and then taken over by the TMA controllers. It enables smoothing the flow of arrivals in anticipation of the synchronisation of traffic nearer the airport.

Results

The exercises results highlighted the following:

- The simulation facilitated discussion on the concept between key stakeholders (ANSP, ATCO, Ground and Airborne Industry) and helped identify issues for the next phase of concept development; and
- The controllers who participated generally reported acceptance of the concept, with some caution expressed regarding the need for further refinement and assessment.

Conclusion

The exercises partially demonstrated the maturity of the concept.

Preparation for industrialisation

Further validation activities will be conducted as part of Releases 3 and 4.

Exercise

TRAFFIC SYNCHRONISATION

Arrival Manager (AMAN) and Extended AMAN (E-AMAN) Horizon

(SESAR Reference: EXE-05.03-VP-034)

Main objectives

This exercise assessed a first integration of the AMAN with precision navigation procedures in a complex TMA involving more than one airport. The trial was carried out by AENA at Madrid airport.

The main objective of this exercise was 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.

A human actor (Queue Manager) checked the proposed sequence and manually edited any change in the sequence of flights according to traffic, weather and airspace situation.

Results

The exercise demonstrated the following:

- The integration and use of precision navigation procedures in coordination with AMAN extended to upstream sectors as a facilitator to manage traffic within the TMA, significantly reduces the perceived workload of the TMA controllers;
- The role of the Queue Manager, as an independent actor with an overall view of the traffic situation, was essential in order to monitor and validate the arrival sequence provided by the Extended AMAN (E-AMAN);
- Sharing the same information by all En-Route and TMA controllers in the operations room increased the situational awareness at all Controller Working Positions (CWP) and allowed for the silent coordination between adjacent sectors. This not only assured safety but also increased efficiency and the quality of service; and
- The E-AMAN method of operation, in combination with the application of conventional vectoring techniques, significantly improved the operations efficiency Key Performance Area (KPA) in reducing the need for stacking traffic in holding patterns.

Conclusion

This exercises partially demonstrated the maturity of the SESAR Solution.

Preparation for industrialisation

Further validation activities will be executed as part of Release 3.

Point Merge in Complex TMA

(SESAR Reference: EXE-05.07.04-VP-228)

Main objectives

The aim of this exercise was to validate improved Point Merge procedures in a complex TMA, in Milan, building on Precision Area Navigation (P-RNAV) and Continuous Descent Approaches (CDA).

This exercise complemented a Release 1 exercise carried out in London's multi-airport TMA, which includes Heathrow, Gatwick, Stansted, Luton and London City Airport.

Results

The results of this exercise revealed that:

- Air Traffic Controller efficiency is improved, with an estimated 50% reduction in radio telecommunication (R/T) and 75% reduction in the need for vectoring, while airspace capacity increased by at least an average of 20%;
- Situational awareness is significantly better and handling of unusual situations is improved;
- Safety levels are maintained or even slightly improved;
- Runway throughput is improved by 4% on average; and
- Potential fuel burn is reduced by 2% (resulting from reduction in radar vectoring and better vertical profile achieved by aircraft).

Conclusion

As part of the Deployment Baseline, this exercise is considered as completed.

Preparation for industrialisation

The exercises have successfully demonstrated the possible implementation of Point Merge procedures in both London and Milan's multi-airport TMAs.

TRAFFIC SYNCHRONISATION

Exercise

AMAN and Point Merge

(SESAR Reference: EXE-05.06.07-VP-427)

Main objectives

DSNA implemented live trial procedures at its Paris ACC, in order to test the requirements and cases for using point merge in an extended TMA with the aim of achieving CDA from high altitudes in high traffic environments.

Results

The results of this exercise demonstrated:

- An increase in safety resulting from a more structured airspace, which influences positively controller and pilot situational awareness;
- A reduction in the controller workload, due to the reduction in frequency usage, that could allow an increase in capacity;
- An improvement in trajectory prediction and a reduction in the number of open loops which will have a positive impact on predictability;
- The simulation exercises showed no increase in fuel burn for arrivals.

Conclusion

This exercise demonstrated the maturity of the concept.

Preparation for industrialisation

The exercise has successfully demonstrated the possible implementation of Point Merge procedures in an extended horizon of the TMA operations at Paris ACC.

AIRPORT INTEGRATION AND THROUGHPUT

Airport Safety Nets

(SESAR Reference: EXE-06.07.01-VP-438)

Main objectives

This exercise involved the validation of procedures and tools for the detection and presentation of conflicting ATC clearances to the Tower Runway Controllers, at Hamburg Airport, through Shadow Mode Trials.

The trials aimed at demonstrating the operational feasibility of the Conflicting ATC Clearance concept in a complex environment, with crossing runways. In particular, issues addressing the acceptance and safety (situational awareness and workload) of the final operational scenario and procedures were assessed.

Results

The overall results of this exercise indicated that:

- The concept would deliver a useable system, with a reduction in the number of conflicting ATC clearances;
- Operational feasibility, in terms of acceptance and fulfilment of operational requirements, and technical feasibility of the new service were demonstrated in an airport environment;
- ATCOs were positive about the predictive conflict indication. Virtually no nuisance alerts were generated by the new safety net;
- Performance improvements were demonstrated, primarily in terms of safety.

Conclusion

This exercise partially demonstrated the maturity of the SESAR Solution.

Preparation for industrialisation

In order to be fully prepared for industrialisation, further exercises will be conducted in the Release 3 and Release 4 process.

Exercise

AIRPORT INTEGRATION AND THROUGHPUT

Remote Tower

(SESAR Reference: EXE-06.09.03-VP-057)

Main objectives

The overall aim of this trial was to assess the technical and operational capability of an initial prototype for the provision of ATS to a single aerodrome, from a remote control site, located at a distance of approximately 100 kilometres away, in an operational environment.

This trial built upon the technical and operational findings of Release 1 Remote Tower exercises by addressing objectives and scenarios that were not concluded in Release 1. In addition, the trial investigated various technical configurations to gain an understanding of the different operational service levels that were possible using different technical enablers.

During this trial, ATS at Ängelholm airport were provided from a remote tower located in Malmö ATC centre through shadow mode operations.

Results

The exercise results show that:

- All exercise participants expressed their positive assessment of the concept in terms of feasibility;
- The concept is considered to provide a level of service equal to when the ATS are provided from a local tower;
- Human performance and safety were not negatively impacted;
- The exercise provided insight into the potential levels of service (and corresponding safety and human performance levels) when using different configurations based on technical enablers seen as essential, and those which are seen as beneficial but optional.

Conclusion

This exercises partially demonstrated the maturity of the SESAR concept.

Preparation for industrialisation

Further Remote Tower validation activities have been included in Release 3 in order to complete the validation of the Single Aerodrome Remote Tower concept.

Time Based Separation (TBS)

(SESAR Reference: EXE-06.08.01-VP-302 and EXE-06.08.01-VP-303)

Main objectives

This exercise sought to validate the use of TBS minima by tower and approach controllers. In this regard, the exercise focused on new controller procedures and support tools, in order to enable the use of refined TBS minima in typical operational circumstances, as well as challenging wind and other critical situations. Validation exercises were run through real-time simulations by NATS at Heathrow and in the Whiteley facilities.

The application of time-based, wake-turbulence radar separation rules on final approach provides consistent time spacing between arriving aircraft in order to maintain runway approach capacity independently of any headwind component.

The final approach controller and the tower runway controller are provided with the necessary TBS tool support to enable consistent and accurate delivery to the TBS rules on final approach. The minimum radar separation and runway-related spacing constraints are required to be respected when applying the TBS rules.

Results

Overall, the exercise demonstrated significant improvements and benefits for airport operations involving TBS:

- An increase in aircraft landing rates, even in stronger wind conditions, with up to 5 additional aircraft landing with TBS per hour compared to those landing with the traditional DBS procedure. Overall flights landing with TBS led to an average of 2 additional aircraft landing per hour; and
- A reduction of holding times (an average reduction of 0.9 min with a maximum reduction of 9.4 min) and stack-entry to touchdown times (an average reduction of 1.4 min, with a maximum reduction of 9.3 min).

Conclusion

The TBS Method of Operations is now considered as ready for deployment.

Preparation for industrialisation

The exercise results are conclusive and sufficient to support a decision for industrialisation.

Exercise

AIRPORT INTEGRATION AND THROUGHPUT

Surface Planning and Routing

(SESAR Reference: EXE-06.03.02-VP-064, EXE-06.03.02-VP-065 and EXE-06.03.02-VP-401)

Main objectives

These exercises aimed to validate the use of automated assistance to controllers for surface movement planning and routing using data link.

The operational improvement consists of Advanced Surface-Management Guidance and Control System (A-SMGCS) functions based on improved procedures and technical specifications for planning, assigning and modifying routes for mobiles (i.e. aircraft and service vehicles) operating at the airport. This approach enables routes to be communicated to mobiles via data link as part of the guidance function and also alerts ATCOs should a runway incursion be detected.

Real-time simulations were undertaken at Charles de Gaulle, Milan and Madrid airports.

Results

Overall results can be summarised as follows:

- Surface Planning and Routing functions were found to be beneficial.
- Data link was considered as useful in the context of non-time-critical communications.
- Increased use of data link resulted in reduced voice frequency channel occupancy.
- Routing and data link functions led to a decrease in situational awareness (time spent head-down to update the system and/or to detect and read messages). Additionally, the function slightly increased the controllers and apron managers' workload. A set of data-link messages should be enhanced to manage the traffic more effectively.
- Human Machine Interface (HMI) was found to be too time-consuming in the manual mode and a reduced number of steps are needed to improve the Human aspect of the routing and planning function. A combined usage of voice for short-notice clearances and data link for the others will be investigated in future trials.

Conclusion

The exercises partially demonstrated the maturity of the concept.

Preparation for industrialisation

Further validation activities concerning surface planning and routing are planned as part of Release 3 and Release 4.

Controller Working Position (CWP) - Airports

(SESAR Reference: EXE-06.09.02-VP-317, EXE-06.09.02-VP-567, EXE-06.09.02-VP-568 and EXE-06.09.02-VP-569)

Main objectives

Operational simulations in France, Spain, Italy and Germany were designed to validate human-machine interface improvements including safety aspects and 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.

Results

Overall results can be summarised as follows:

- Globally, the results indicate that the controllers were able to efficiently manage the traffic by using the advanced CWP even when the traffic load was high; they also rated their situational awareness as good;
- The readability and meaningfulness of textual information and graphical objects were overall positively assessed;
- The controllers found that it was easy to transfer the electronic flight strips to another position and to assume an aircraft (i.e. taking control and responsibility for it); and
- The combination of information coming from different sources was considered as acceptable, and the combination of sources didn't produce any unwanted information noise.

Conclusion

This validation exercise partially demonstrated the maturity of the concept.

Preparation for industrialisation

Further validation activities concerning surface planning and routing are planned as part of Release 3 and Release 4.

Exercise

NETWORK COLLABORATIVE MANAGEMENT AND DYNAMIC CAPACITY BALANCING

Airspace Management and Advanced Flexible use of Airspace

(SESAR Reference: EXE-07.05.02-VP-016 and EXE-07.05.02-VP-017)

Main objectives

These exercises aimed to validate exchange of data between airspace management support systems and the NM system. It also aimed at interfacing airspace management tools with ATC systems and presenting the real status of airspace on the CWP.

Results

These exercises reported the following benefits:

- Safety - enhanced shared situational awareness provided through real-time airspace status information led to a reduction of uncertainty and misinterpretation of current airspace status information.
- Increased airspace capacity for both En Route and TMA - the automatic update and availability of real-time airspace status information improves the tactical mission and flight-planning process between the systems involved; and
- Environment - improved trajectories closer to the UPR are better planned and flown thanks to the availability of more precise information. This reduces the likelihood of an aircraft flying a greater distance than necessary, and consequently brings benefits in terms of reduced fuel burn and emissions.

Conclusion

The exercises partially demonstrated the maturity of the operational improvement.

Preparation for industrialisation

Further validation activities should be conducted as part of Release 4.

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Exercise

NETWORK COLLABORATIVE MANAGEMENT AND DYNAMIC CAPACITY BALANCING

Business and Mission Trajectory

(SESAR Reference: EXE-07.06.02-VP-311)

Main objectives

This exercise involved an enhanced validation of current flight-planning processes, mainly through increasing interoperability between FOC and the NM operations centre. In particular, it studied the integration of aircraft performance data and 4D profiles in the Integrated Initial Flight Plan Processing System (IFPS).

Results

The validation exercise allowed:

- Partial evaluation of the operational feasibility of the extended flight-plan validation process (including impact on the rate of flight-plan acceptance/rejection and on the conformance with airspace/route usage rules);
- Quantitative evaluation of the potential benefits of new flight-planning procedures and acceptance rate of flight plans, and demonstrating positive impacts on efficiency, safety and cost-effectiveness; and
- Identification of issues that need to be addressed prior to implementation. Most of the issues highlighted the need to better share airspace data and constraints and clarify some current rules in order to have a consistent interpretation by all actors.

Conclusion

The exercise partially demonstrated the maturity of the operational improvement.

Preparation for industrialisation

Further validation activities are planned as part of Release 3.

Exercise

NETWORK COLLABORATIVE MANAGEMENT AND DYNAMIC CAPACITY BALANCING

Free Routing

(SESAR Reference: EXE-07.05.03-VP-571)

Main objectives

Through simulations and live trials involving several airlines, this exercise aimed to elaborate recommendations for UPR operations inside Europe. Real-time simulations were carried out at the MUAC and concerned H24/7 operations.

Results

79%[1] of the tested direct routes for night, near-night and week-end operation have been approved for implementation. Among the validated routes, 98 direct routes have been identified for 24-hour activation.

The implementation of UPR operations in the MUAC area brings benefits in terms of:

- Improved flight efficiency - a reduction of the average flown distance of 7% and a reduction in flight-time of 5% (~ 2 minutes per flight);
- Improved environmental sustainability – a reduction in fuel burnt and emissions ranging from 6 to 12%; and
- No impact on safety - despite increased complexity.

The validation activity showed that allowing a UPR flight plan to cross an active segregated area is not manageable in the execution phase due to unacceptable increases in ATCO workload. Hence interactions of UPR with Advanced Flexible use of Airspace (AFUA) have to be investigated.

Conclusion

The exercise demonstrated the maturity of the operational improvement in the context of specific NATS scenario objectives.

Preparation for industrialisation

The exercise results successfully identified a new list of Direct Routes that could be implemented in MUAC airspace outside the activation periods of military areas.

(1) 255 new direct routes out of 322, representing 79% of the tested routes

CONFLICT MANAGEMENT AND AUTOMATION

Automated Support for Dynamic Sectorisation

(SESAR Reference: EXE-04.07.07-VP-006)

Main objectives

Dynamic Capacity Management allows adaptation of the capacity to satisfy traffic load by grouping and de-grouping sectors and managing staff resources. Unused latent capacity can occur at all FMPs during peak traffic times. Current tools facilitate the detection of overload but do not offer better options to deal with it. This exercise, therefore, aimed to validate a supporting tool which enables the ATC supervisor to select the most suitable ACC En-Route sector configuration by matching capacity to forecast demand. Shadow mode trials were carried out at Barcelona ACC.

Results

Qualitative assessment demonstrated that tool functionalities are useable and useful, the supporting tool proving to be a significant aid for sector configuration.

Additional benefits include:

- Safety improvements due to increased situational awareness and early management of constraints;
- Increased capacity due to better use of available resources, both human and airspace:
  - Saturation Periods are reduced;
  - The number of flights able to enter airspace volume are increased by 10%;
  - The number of delayed flights is reduced by 5%.
- Improved efficiency due to the reduction in delays and adjusting ATC sectors to traffic flows; and
- Improved cost-effectiveness due to better usage of available resources adapting them to demand forecast in advance.

Conclusion

This exercise demonstrated the maturity of the SESAR solution.

Preparation for industrialisation

The exercise results are conclusive and sufficient to support a decision for industrialisation.

CONFLICT MANAGEMENT AND AUTOMATION

Exercise

Complexity Assessment and Resolution

(SESAR Reference: EXE-04.03-VP-031 and EXE-04.05-VP-043)

Main objectives

The exercises focused on the validation of supporting tools that predict and monitor airspace complexity issues and manage related traffic load. In this context, prototype tools and algorithms were developed and assessed through real-time simulation for MUAC and France (DSNA).

Results

The validation exercises demonstrated that:

- Tools improved the quality of workload prediction, leading to a reduction in the number of flights affected by level or route changes, time revisions, regulations, etc; and
- Automated detection of potential overload situations allows application of mitigation strategies as early as possible, ranging from modification of individual trajectories to modification by the Local Traffic Manager (LTM) of the route of several aircraft in a flow to balance incoming traffic.

Benefits were identified in terms of increased capacity, flight efficiency and avoidance of overload situations. The impact of the new procedures on LTM and Controller workload has to be assessed further.

Conclusion

The exercise partially demonstrated the maturity of the SESAR solution.

Preparation for industrialisation

Further validation activities will be conducted as part of Release 3 and Release 4 for this SESAR Solution.

Sector Team Operations

(SESAR Reference: EXE-04.07.08-VP-304)

Main objectives

This exercise aimed at validating new procedures for the NATS London ACC, a multi-sector planner operating environment (1 Planner and 2 tactical Controllers (1P-2T)), with an emphasis on identifying roles and responsibilities. This exercise aimed to deliver a support tool and information-sharing functions.

Results

The results may be summarised as follows:

- Improved situational awareness and task sharing as a result of new support tools;
- Reduced workload per flight because of less need for tactical intervention and increased controller productivity through automatic calculation of optimal arrival sequences and coordination support;
- Improved capacity due to reduced ATCO workload, better usage of ANSP work force, distribution of workload among ATCO teams;
- Flexibility in resourcing and deployment of ATCOs resulting in improvements in cost-effectiveness; and
- Improvement in ability to resource to demand, providing significant reduction in costs associated with staff overheads.

This concept was demonstrated to be viable for a range of sector types (high-level en-route, TMA interface, vertically split sectors etc.) and for a wide variety of traffic levels and complexities, at London ACC.

It is not expected that the operations validated in this exercise are applicable to all sectors at all traffic levels, but that generally there should be a number of sector groups that could safely be combined in this way and operate efficiently at reasonably high traffic levels (which, today, would demand separate Planners).

Conclusion

The exercise partially demonstrated the maturity of the operational improvement. Further validation activities are planned to address the more general SESAR Solution for sector team operations.

Preparation for industrialisation

The exercise results are conclusive in defining 1P-2T controller operations that could be implemented in a range of sector types in London ACC.

Conclusion

The second SESAR Release has clearly built on the experiences gained during Release 1, with Release 2 being more closely linked and focused on the key features identified in the updated European ATM Master Plan.

Priority was given to exercises demonstrating that future deployment is feasible in the short-to-medium term, assuming validation results confirm their suitability for delivery. Although there is still more work to be done, SESAR's members have proven that, by working together with a range of stakeholders, real changes in the ATM domain are achievable.

The results of Release 2 represent a significant milestone for the SESAR Programme and the ATM community at large. Not only do these results highlight that the programme is delivering, these intermediate results will also feed into the working processes of the next waves of development: Releases 3, 4 and 5.

The Results of Release 2, along with those results captured through the Release 1 validation activities, clearly show SESAR's ability to deliver a solid stream of solutions for the modernisation of Europe's ATM system.

Figure 4: The link between Releases and the ATM Master Plan

05

Glossary of terms and abbreviations

1P	1 Planner
2T	2 Tactical Controllers
ACC	Area Control Centre
AFUA	Advanced Flexible use of Airspace
AMAN	Arrival Manager
ANSP	Air Navigation Service Provider
AoR	Area of Responsibility
A-SMGCS	Advanced Surface-Management Guidance and Control System
ASPA	Airborne Spacing
ATC	Air Traffic Control
ATCO	Air Traffic Controller
ATM	Air Traffic Management
ATS	Air Traffic Service
CDA	Continuous Descent Approach
CWP	Controller Working Position
DBS	Distance-Based Separation
FMP	Flow Management Position
FOC	Flight Operations Centre
H24/7	Hours 24: Availability 24 hours/day, 7 days/week
HMI	Human Machine Interface
IFPS	Integrated Initial Flight Plan Processing System
LTM	Local Traffic Manager
MSP	Multi Sector Planning
MTCD	Medium Term Conflict Detection
MUAC	Maastricht Upper Area Control Centre
NM	Network Manager
R&D	Research and Development
SESAR	Single European Sky Air Traffic Management Research
TBS	Time Based Separation
TMA	Terminal Manoeuvring Area
TP	Trajectory Prediction
UPR	User Preferred Routing

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

KEY FEATURE	RELEASE 1 (25 Exercises)[2]
Moving from Airspace to 4D Trajectory Management	• Approach procedures with vertical guidance (APV) • Integrated controller working position
Traffic Synchronisation	• 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
Network Collaborative Management & Dynamic/Capacity Balancing	• Short-term Air Traffic Flow and Capacity Management (ATFCM) measures improvements
System Wide Information Management	
Airport Integration & Throughput	• Controller working position - Data entry to CFMU • Remote Tower
Conflict Management & Automation	• Sector Team Organisation & task sharing • Enhanced Short Term Conflict Alert (STCA) • Complexity Assessment & Resolution • Controller working position enhancements

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

RELEASE 2 (30 Exercises)[2]	RELEASE 3 (19 Exercises)[2]
• Free Routing • Business and Mission Trajectory Flight Planning	• ATS coordination procedures for ATS Units including coordination & transfer of flights
• 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)	• 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
• Airspace Management and Advanced Flexible use of Airspace – sharing of real time airspace usage	• 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
• 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	• 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 Conflict Detection & Resolution tools for high density operations • Tooling for complexity and density assessment related to capacity • Sector Team Operations – multi-sector planner	• Enhanced Ground Based Safety Nets using aircraft derived data in Short Term Conflict Alert (STCA)

STEP ONE to STEP 2*

* www.atmmasterplan.eu

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