

Release 5 SESAR Solution #33

Free Route through the use of Free Routing for flights both in cruise and vertically evolving for cross ACC/FIR borders and within permanently low to medium complexity environments

Contextual note – SESAR Solution description form for deployment planning

Purpose:

This contextual note introduces SESAR Solution #33 (for which maturity has been assessed as sufficient to support a decision for industrialization) with a summary of the results stemming from R&D activities contributing to deliver it. It provides to any interested reader (external and internal to the SESAR programme) an introduction to the SESAR Solution in terms of scope, main operational and performance benefits, relevant system impacts as well as additional activities to be conducted during the industrialization phase or as part of deployment. This contextual note complements the technical data pack comprising the SESAR deliverables required for further industrialization/deployment.

Improvements in Air Traffic Management (ATM)

The SESAR Solution #33 relates to **“Free Route through the use of Free Routing for flights both in cruise and vertically evolving for cross ACC/FIR borders and within permanently low to medium complexity environments”**.

Free routing is the ability of an Airspace User to plan/re-plan route according to the User-defined segments (i.e. segments of great circle connecting any combination of two user-defined or published waypoints).

Free Routing Airspace (FRA) is an “Airspace defined laterally and vertically, allowing Free routing with a set of entry/exit features”.

This solution thus provides Airspace Users with the opportunity to plan flight (and fuel) for optimal flight trajectories within cross ACC/FIR boundary and in permanently low to medium complexity environments, in line with individual operator business needs and military user requirements.

SESAR Solution #33 focuses on the operational needs for Airspace Users and ATS units to support safe and efficient Free Routing operations for cross ACC/FIR borders and in permanently low to medium complexity environments. It documents for:

- Airspace Users: Adapted operational procedures and support tools to plan and conduct Free Routing operations.
- Air Traffic Controllers: Adapted operational procedures and support tools to provide safe and efficient Air Traffic Services.

This Solution builds on the baseline Free Routing concept implemented at local ACC/FIR level and aims at enabling seamless operations cross ACC/FIR boundaries. It is nevertheless an initial step towards the whole concept of Free Routing, as SESAR Solution #33 operating

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environment is limited to En-Route Airspace of permanently low to medium complexity (traffic complexity score lower than 6¹, including during peaks of traffic demand).

Operational Improvement Steps (OIs) & Enablers

Note: Reference Data Set is DS16².

This SESAR Solution scope is supported by the following Master Plan:

- Operational Improvement Step:
 - *AOM-0501: Free Routing for Flights both in cruise and vertically evolving within low to medium complexity environments*
- Enablers:
 - *AOC-ATM-10: Modification of AOC/WOC-ATM trajectory management system (or new systems) to allow quality of service requested by NOP for pre-flight trajectory with dynamic routing;*
 - *ER APP ATC 75³: Enhance FDP for Direct Route and Free Route Operations*
 - *ER ATC 91: ATC System Support for Advanced Conformance Monitoring in En-route Airspace;*
 - *PRO-085: ATC procedures to cover issues such as hand-off, transfer of control, and for defining trajectory changes necessitated by changes in airspace availability, weather constraints and other non-nominal events.*

This SESAR Solution partially covers the scope of this OI Step and enablers.

Background and validation process

The SESAR Solution #33 has been validated through a series of V2 and V3 validations. In addition, demonstration activities have also been conducted through a SESAR Demo project and a Large Scale Demonstration.

The following validation activities contributed to the maturity of this SESAR Solution:

- First validation campaign consisted in a live trial evaluating free routing for few flights in cruise above FL285.

¹ As defined in Performance Review Report 2013.

² CRs have been identified to adapt the definition of OI steps and enablers to the scope of SESAR Solution #32 (they will be implemented in DS17)

³ As a predecessor, ER APP ATC 129 (Upgrade FDP and provide Controller Tools to provide assistance to ATC Planning for Preventing Conflicts in En Route Airspace) has to be considered implemented as part of the baseline.

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- Widest integrated V2 and V3 validations took place in order to focus on ATC tools and G-G IOP in Free Routing environment. Trajectory based flight planning process in a large scale FRA was also assessed at V2 level with industrial CFSP prototype.
- A Demo project (FRAMaK) and a Large Scale Demonstration (FREE Solutions) aimed to demonstrate the feasibility of Free Routing operations respectively for some distinct flights in FRAMaK airspace and for a large scale cross-border implementation (FREE Solutions); unfortunately these demonstrations took place with the participation of only one airline and a limited set of city pairs, and therefore do not provide sufficient evidence of the ability of ANSPs to manage the traffic complexity created by the concept if all operators were able to participate at once.

Results and performance achievements

The various performed exercises demonstrated that:

- More flexible Flight Planning is made possible thanks to the ability given to plan and re-plan routes according to user defined segments, which should positively affect predictability of flights (provided that complexity remains permanently low to medium);
- Airspace Users cost effectiveness and fuel effectiveness are improved. Quantitative results depend directly on the structural limits associated to the FRA (e.g. maximum segment length, possible use of LAT, LON points...). The more freedom the Airspace Users are given in flight planning, the higher are the achievable benefits;
- Environment sustainability (reduced fuel burnt and emissions) is also improved;
- Implementation of FRA trajectories over a very wide area creates high traffic variability, convergence phenomenon of traffic flows, and a large number of “hotspots”;
- Free Routing operations increase traffic complexity and Controllers’ workload, conflicts are more difficult to detect and manage, situation awareness is more difficult.

Nevertheless, the negative impacts described in the two bullet points above are mitigated if the Free Routing operations take place in permanently low to medium complexity environments and are supported by appropriate helping tools for ATCOs (e.g. by Conflict Detection, tactical trajectories monitoring tools...). In such conditions, which correspond to Solution #33 scope:

- Safety remains at an acceptable level
- Airspace Capacity is not degraded
- ATCOs Workload remains acceptable as well as Situational Awareness which nevertheless requires more cognitive resources

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Recommendations and Additional activities

The FOC system requirements to support safe and efficient Flight Planning in FRA were validated in V2 with identified acceptable issues to support this Solution #33 (some limitations in the vertical connectivity between ATS Route Network and FRA). These issues shall be addressed during the industrialization phase.

In the scope of the Free Route OFA activities:

- No additional Cost estimation and CBA have been undertaken beyond the ones supporting the PCP IR 716/2014.

It is likely that there will be some costs to support Free Routing operations

- for ANSP related to the upgrade of FDPS and ATC support tools, together with costs related to Airspace redesign and ATCOs training which costs will have to be evaluated before implementation considering local environment specificities.
- for AUs related to the upgrade of FOC Systems which costs will have to be evaluated to support decision to equip.
- No Security assessment has been performed. It is recommended to perform security assessment of the operational use of ATC/AU support tools in Free Routing environment prior to the deployment phase considering local environment characteristics.

Besides, it is highly recommended prior to operational deployment to pay attention to the design of FRA with a comparative analysis of different design options (e.g. max DCT segment length, possible use of LAT, LON points...), in order to determine the best possible scenario allowing safe and efficient operations taking into account local environment characteristics.

Free Routing operations are a paradigm shift in ATCO's everyday life. FRA impacts almost all of the Controller's tasks, from route identification to conflict detection and resolution. Adequate Controllers training shall be considered prior to implementation.

Before deploying the Solution, and considering that Free Routing operations can induce peaks of high traffic demand even in medium complexity airspace, it is recommended to conduct further validation to assess the impact at Network level of FRA implementation.

Actors impacted by the SESAR Solution

Airspace Users and En-Route Air Traffic Controllers – both planner and tactical – are directly impacted by the SESAR Solution #33.

Impact on Aircraft System

No Aircraft Systems capabilities are impacted by this SESAR Solution.

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Impact on Ground Systems

Flight Data Processing system on the ground shall be able to process all necessary information associated to Free Route (e.g. include all points of interest for the ATCO, also some points of neighbouring area).

ATC Ground system shall be upgraded with Advanced Conformance Monitoring functionality.

AU systems (Flight Planning system) shall be able to generate and process free route.

Regulatory Framework Considerations

Following Release 5 SE#3, this Solution is no longer considered as contributing to the Pilot Common Project (PCP) ATM Functionality AF#3-2 as it is not applicable ECAC wide.

Standardization Framework Considerations

There is no specific topic in the field of the standardization framework to be considered within the SESAR Solution #33, beyond the applicable standards currently existing.

Considerations of Regulatory Oversight and Certification Activities

There is no specific topic in the field of the regulatory oversight and certification activities to be considered within the SESAR Solution #33, beyond the applicable regulatory oversight and certification activities currently existing.

Solution Data pack

The Data pack for this SESAR Solution includes the following documents:

- P04.07.02-D63 (Free Route Step 1 SPR);
- P10.02.01-D88 (ATC Trajectory Management Requirements);
- P10.04.02-D44 (Consolidated conformance monitoring system requirements);
- P11.01.03-D24 (Technical Specification Step 1 and Step 2 for FOC systems including IRS requirements).

Intellectual Property Rights (foreground)

The foreground of this SESAR Solution and documents in the Solution Data pack is owned by the SJU.

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