Very Large Demonstrations

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SESAR SOLUTION Dynamic RAD – TRL6 CONTEXTUAL NOTE

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SESAR SOLUTION DYNAMIC RAD TRL6

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Abstract

This TRL6 Contextual Note (CN) provides the SESAR solution description for deployment consideration.

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1 Purpose

Please read this disclaimer[1].

This Contextual Note 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.

When the technological solution is at TRL6 level, it contains as well additional activities to be conducted during the final implementation and deployment phases.

[1] The opinions expressed herein reflect the author's view only. Under no circumstances shall the SESAR3 Joint Undertaking be responsible for any use that may be made of the information contained herein.

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2 Improvements in Air Traffic Management (ATM)

The objective of the SESAR solution Dynamic RAD is to support the deployment of the new concept of dynamic management of RAD restrictions aiming to allow the utilisation of restriction only when required through a daily collaborative decision making (CDM) process. The temporary relaxation of the restrictions allows AUs to file more efficient trajectories whenever the opportunities are provided.

The validated process identified the Airspace Use Plan/Updated Airspace Use Plan (AUP/UUP) process as the feasible mean for supporting the CDM process between local actors/role Airspace Management Cell/ Flow Management Position (AMC/FMP) and Network Manger (NM) while the European AUP/European UUP as an efficient way to ensure appropriate notification to the airspace users.

The usage of NM systems, including the Network Operation Portal (NOP), supports the entire process, while the utilisation of NM Business to Business (B2B) service, SWIM Yellow Profile (YP) compliant, grants the required interoperability with external systems, both for Air Navigation Service Providers (ANSPs) and Centralised Flight Plan Service Providers/Airspace Users (CFSPs/AUs).

The selection of eligible RAD restrictions for a dynamic management remains a prerogative of ANSPs. However, strategic coordination with NM helps to select the restrictions with more potential benefits in terms of trajectory improvements as well as to verify the consistency of relaxation across the network. Proposal for interesting restrictions could be anticipated by AUs as well.

The selected RADs restrictions are properly notified on the NOP portal (RAD home page) with a clear reference to the activation via EAUP/EUUP (Information available also via B2B).

Daily AUP/UUP processes allow ANSPs to select the eligible RAD and the definition of the proposed period of relaxation (partial or entire period according to the availability time published on the NOP Portal). The AUP process is used to provide the initial information at D-1 while the UUP can be used to fine tune the initial proposal, providing additional relaxation or restrictions according to the traffic demand evolution.

The CDM process for the finalisation of the AUP/UUP allows NM to perform a Network Impact Assessment (NIA) to evaluate potential network effects due to the proposed relaxation. The feedback is provided to the relevant ANSPs to facilitate the final decision.

The final selection notified via AUPs and UUPs (status READY) is consolidated by NM for the daily publication of the EAUP and EUUPs whenever required.

The publication (via NOP Portal or via B2B service) allows AUs/CFSPs to receive the broadcasted information to facilitate the submission of FPLs with more efficient trajectories, according to the relaxations provided.

In case of the information is not processed by AUs/CFSPs, the day of operation NM system through the Opportunity tool (OPP tool) is able to detect FPLs that could be eligible for additional improvements generated by the published restriction relaxations and advice the relevant FPL originators of the potential opportunities. It remains responsibility of the AUs to accept the proposals and re-file the FPLs.

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Being operational live trials, the demonstrations was based on the existing technical capabilities. This is the case for the Yellow Profile (YP) defined by the EUROCONTROL SWIM-TI YP 1.1 specification with a Full Operational Capability (FOC) by end-2025 as stated in Common Project One (CP1), but already deployed to support the trials according to the exchange of data required.

Main Operational Environments (OEs) applicable to this technological solution are: en-route, terminal airspace and network.

Main concerned systems at the civil side are planning systems and NM ones used to received information but local ASM tools and those involved in the distribution of EAUP/EUUP. AOs/CFSPs planning system are also concerned.

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3 Performance Operational Improvement Steps (POIs) & System Enablers (SYS ENs)

Discussion with SJU during the Maturity Gate held in Brussels on 26/04/23 allowed to agree the creation of the following OI steps and Enabler:

- OI Step for Dynamic RAD process at D-1
- System Enabler for NM System
- Human Enabler for FMP
- Human Enabler for NM Operator
- Human Enabler for FOC
- One system Enabler for FMP
- One system Enabler for FOC

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4 Background and validation process

Open VLD2 call (Albatross VLD)

The solution performed operational validation in TRL6.

The Dynamic RAD concept has been validated during the Albatross very Large Demonstrations (VLDs) demonstration flights.

With the agreement of Albatross partners, mainly ANSPs (DSNA) and Aircraft Operators (AOs) (Air France), synergies with a more general live trials validation of the dynamic management of RAD restrictions was launched in 2021.

The live trials covered a period from August to December 2021. The live trials involved several ANSPs and AUs even external to the Albatross Consortium to support an overall operational validation of the Dynamic RAD management concept.

DSNA provided a daily publication of relaxed selected RAD restrictions from August to end of November. AF and the other AUs interested by the proposed relaxation filed FPLs accordingly, based on their capability/interests.

Other ANSPs (ENAV, ENAIRE, SKYGUIDE) from August to December 2021 provided a daily publication of the selected RAD whenever relaxation was possible. AUs, including AF, filed the FPLs accordingly, based on their capability/interests.

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5 Results and performance achievements

Results and performance achievements are expressed at TRL6 level, thus reflecting operational validation objectives together with live trials validation results associated with ad hoc technological validation objectives (TRL6 operational utilisation of available technological solutions).

The demonstrations aimed to prove the feasibility of the concept not only in terms of management of dynamic RAD restrictions but also in terms of concrete contribution to the reduction of CO2 emissions thanks to more efficient trajectories filed and flown by the AOs.

The measurement of CO2 reductions was done comparing "planned against planned" and were only measured for the flights interested by the limited number of restrictions used during the live trials."

The opportunity to get the trajectory improvements already at FPL level was a key factor to promote the increase as well of predictability of the traffic. This is an essential element to ensure improvements of the capacity performance therefore a potential reduction of delays.

However, the demonstrations aimed to measure the number of flights that took benefits from the relaxed RAD restrictions filing the FPLs accordingly, but not the indirect effects on the ACC capacity involved.

Being the validation executed through a VLD, the technological solutions used took benefits on existing systems support, including deployed NM B2B services for the interoperability between local systems, ATM and AOs/CFSPs, and NM.

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6 Recommendations and additional activities

The EUROCONTROL SWIM TI YP 1.1 specification is the baseline for first YP deployments (initial SWIM whose Full Operational Capability (FOC) is end-2025.

The final report of the Operational Validation of the executed live trial contains **recommendations for the industrialization and deployment phases, summarized and completed as follows**:

- Dynamic RAD concept proved to be feasible;
    - the TRL6 live trials validation demonstrated that dynamic RAD restrictions management it is operationally feasible, both from ATM stakeholders, NM and ANSPs, and AUs, CFSPs and FOCs.
- The selection of RAD eligible for a dynamic management needs to be duly assessed by relevant stakeholders. In this respect, a pre-validation is deemed necessary to verify their effectiveness in case of relaxation.
- The Dynamic RAD process is feasible at D-1. Further evaluation are required to assess its applicability at D-OPS. In this case, full involvement of relevant AOs is necessary.
    - The live trials demonstrated the feasibility of the CDM process between ANSPs and NM to daily exchange information about the proposed relaxation via AUPs.
    - The possibility to extend the dynamic RAD process at D-OPS to daily exchange information about restrictions relaxation via UUPs requires additional live trials, with the involvement of the relevant AUs to ensure a proper awareness.
- Proper notification process is required, exploiting all the possibility to improve awareness of AOs/CFSPs on the opportunity offered.
    - The notification process on the selected restriction relaxation via EAUPs demonstrated its feasibility, especially using B2B NM service for the automatic exchange of information between NM and AUs/CFSPs systems. The extension of the Dynamic RAD process at D-OPS will require the validation of the EUUP as notification process. Being an iteration of the same process and using the same B2B service, the TRL6 maturity is granted, while the capability of AUs/CFSPs to process this dynamic information is quite related to their operational readiness.
    - The utilisation of NM OPP Tool to get information of any restriction relaxation not directly captured by the AUs/CFSPs via EAUPs/EUUPs is also linked to the operational readiness as well as the capability to process information via NM B2B service or directly via NM systems.
- AUP/UUP process as interim solution seems appropriate. Short-term technical changes should be considered to improve its utilisation.
    - AUP/UUP mechanism has demonstrated its feasibility to support operational management of dynamic RAD restriction relaxations. Short terms technical

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improvements have been identified and expected to be implemented with NM release 27.0 (May 2023). For the ATM stakeholders planning to use NM system, they will reach TRL8 operational deployment together with NM. For those ATM stakeholders using their local systems as well as AUs/CFSPs systems, it will be necessary to implement the changes in their systems with expected deployment by 2024 (TRL6).

  - For the transition period, the interim solutions adopted for the live trials demonstrations will continue being used to grant an early operational implementation involving all relevant Stakeholders (TRL6). Being on voluntary basis, the deployment is subject to the ANSPs decision of utilising the interim solutions to provide early opportunities of RAD restrictions relaxations.

- Long-term solutions should be addressed in the frame of iNM to implement a common platform to promote ASM/ATFCM processes integration.

  - Future evolution of the dynamic RAD management will be investigated in the frame of further developments of the ASM/ATFCM integration under SESAR 3 associated to the DAC/CDB solutions. The aim of these solutions will be to reach V3 at the end of the validation process to support a pre-industrialisation of the improvements identified (TRL 4/5). The iNM programme will take on board those improvements expected for NM systems.

The definition of the dynamic RAD as SESAR solution highlights the need to add additional recommendation for future SESAR activities:

- To improve the monitoring report to provide a more comprehensive assessment with aggregation at ECAC levels and estimation of savings considering actual trajectories (KEA).
- To investigate how to manage the Dynamic RAD using the FF-ICE Flight Plan and FF-ICE processes.

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7 Actors impacted by the SESAR solution

Operational-level stakeholders directly and indirectly impacted by the SESAR solution (add a GP TS in relevant CCs, develop new GP related SWIM services, train concerned actors etc.), they correspond at minimum to:

- Air Navigation Service Providers (ANSPs)
    - Local Airspace and Air Traffic Flow and capacity management – identification and selection of the RAD restrictions to daily manage dynamically.
- Civil/military Airspace Users (AUs) flying GAT
    - Civil Flight Operations Centre ➔ CC: Civil AU Operations Centre (encompassing a Civil AU Flight Operations Centre (FOC) – evaluate the proposed modification of the FPLs according to the OPP tool notifications.
    - Computer Flight Plan Service Providers – file or re-file FPLs according to the notification of dynamic RAD published in EAUP/EUUP.
- Network Manager (NM) ➔ CC: Regional Airspace and Air Traffic Flow and Capacity Management (ATFCM[2])
    - Provide advise to the local FMP on the proposed relaxation of the selected RAD in case of Network effects;
    - Publish EAUP/EUUP to notify to AUs/CFSPs the relaxation of the selected restrictions;
    - Identify the flights that could take benefits by the published relaxed restrictions through the OPP tool.

[2] Today, the ATFCM technical system of the Regional ATFCM CC corresponds to IFPS (see section 6).

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8 Impact on aircraft system

This SESAR solution has no impact on aircraft systems.

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9 Impact on ground systems

NM system for the processing of dynamic RAD notified via EAUP/EUUP and their publication via EAUP/EUUP on NOP Portal and via B2B service. Evolution of the OPP Tool for visualisation of proposals linked to dynamic RAD relaxation.

AMC/FMP that are used to coordinate/cooperate with the NM SWIM-enabled applications, **will be impacted in case of local tools are used instead of NM system**.

It is granted that some AUs (FOC) systems using the SWIM services / SWIM-enabled applications will be impacted by this solution:

- Relevant existing SWIM services, e.g.:
    - use of NM B2B services to get information from EAUP/EUUP publication;
    - use of B2B service to get proposals of better routing generated by NM Opportunity tool (OPP tool).

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10 Regulatory framework considerations

This SESAR solution does not have any impact on existing regulatory framework.

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11 Standardization framework considerations

No specific needs to update existing standards.

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12 Technological solution Data Pack

Being a new SESAR solution, specific SESAR technological data pack is limited to the following deliverables to support industrialisation/deployment.:

- Albatross Demo report, final version (Appendix A). NM Dynamic RAD validation final report ed. 1.0.NM 27.0 release notes.Relevant B2B documentation.

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