

SESAR Solution PJ.10-W2-93 SPR/INTEROP-OSED for V3 - Part V - Performance Assessment Report (PAR)

Deliverable ID: D3.2.030
Dissemination Level: PU
Project Acronym: PJ10-W2 PROSA
Grant: 874464
Call: H2020-SESAR-2019-1
Topic: SESAR-IR-VLD-WAVE2-10-2019 PJ.10 W2 Separation Management and Controller Tools
Consortium coordinator: DFS
Edition date: 26th May 2023
Edition: 01.00.01
Template Edition: 00.00.09

Authoring & Approval

Authors of the document

Beneficiary	Date
ENAIRE	10/02/2023
ENAV	10/02/2023

Reviewers internal to the project

Beneficiary	Date
Skyguide	10/02/2023
ENAV	10/02/2023
COOPANS	10/02/2023
THALES	10/02/2023

Approved for submission to the S3JU By - Representatives of all beneficiaries involved in the project

Beneficiary	Date
DFS	08.02.2023
Eurocontrol	09.02.2023
Skyguide	10.02.2023
ENAIRE	13.02.2023
Thales Airsys	10.02.2023
Indra	09.02.2023
Frequentis	10.02.2023
ENAV	10.02.2023
Naviar	13.02.2023
NATS	13.02.2023
DSNA	13.02.2023
Leonardo	13.02.2023
Hungarocontrol	13.02.2023

Rejected By - Representatives of beneficiaries involved in the project

Beneficiary	Date
N/A	

Document History

Edition	Date	Status	Beneficiary	Justification
00.00.01	14/12/2023	Draft	ENAIRE	Document creation. Inclusion of preliminary results
00.01.00	10/02/2023	Final	ENAIRE	Ready for submission
00.01.01	13/02/2023	Final	ENAIRE	Final version for submission to the SJU
01.00.00	24.02.2023	Approved	DFS	Approved by the SJU
01.00.01	26.05.2023	Final	DFS	Final version for submission to SJU after Maturity Gate

Copyright Statement © 2023 – ENAIRE, skyguide, ENAV, COOPANS. All rights reserved. Licensed to SESAR3 Joint Undertaking under conditions.

PJ10-W2 PROSA

SEPARATION MANAGEMENT AND CONTROLLER TOOLS

This Performance Assessment Report is part of a project that has received funding from the SESAR3 Joint Undertaking under grant agreement No 874464 under European Union's Horizon 2020 research and innovation programme.



Abstract

This document provides the Performance Assessment Report at V3 level of Solution PJ.10-W2-93 Delegation of ATM services provision among ATSUs.

The performance assessment results comprise a combination of the performance benefits obtained through the PJ.10-W2-93 EXE-2, led by ENAIRE, EXE-3, led by skyguide, EXE-4 led by ENAV, and EXE-5 led by COOPANS/THALES.

Table of Contents

Abstract	3
1 Executive Summary.....	8
2 Introduction.....	<u>1614</u>
2.1 Purpose of the document.....	<u>1614</u>
2.2 Intended readership	<u>1614</u>
2.3 Inputs from other projects	<u>1614</u>
2.4 Glossary of terms.....	<u>1715</u>
2.5 Acronyms and Terminology	<u>191716</u>
3 Solution Scope	<u>2825</u>
3.1 Detailed Description of the Solution.....	<u>2825</u>
3.2 Detailed Description of relationship with other Solutions	<u>2825</u>
4 Solution Performance Assessment.....	<u>3128</u>
4.1 Assessment Sources and Summary of Validation Exercise Performance Results.....	<u>3128</u>
4.2 Conditions / Assumptions for Applicability	<u>3229</u>
4.3 Safety.....	<u>3431</u>
4.3.1 Safety Design drivers and Performance Mechanism	<u>3431</u>
4.3.2 Data collection and Assessment.....	<u>3431</u>
4.3.3 Extrapolation to ECAC wide.....	<u>4542</u>
4.3.4 Discussion of Assessment Result.....	<u>4643</u>
4.3.5 Additional Comments and Notes	<u>4643</u>
4.4 Environment: Fuel Efficiency / CO2 emissions.....	<u>4744</u>
4.4.1 Performance Mechanism	<u>4744</u>
4.4.2 Assessment Data (Exercises and Expectations).....	<u>4744</u>
4.4.3 Extrapolation to ECAC wide.....	<u>4744</u>
4.4.4 Discussion of Assessment Result.....	<u>4845</u>
4.4.5 Additional Comments and Notes	<u>4845</u>
4.5 Environment / Emissions, Noise and Local Air Quality.....	<u>4946</u>
4.6 Airspace Capacity (Throughput / Airspace Volume & Time).....	<u>5047</u>
4.6.1 Performance Mechanism	<u>5047</u>
4.6.2 Assessment Data (Exercises and Expectations).....	<u>5047</u>
4.6.3 Extrapolation to ECAC wide.....	<u>5148</u>
4.6.4 Discussion of Assessment Result.....	<u>5148</u>
4.6.5 Additional Comments and Notes	<u>5148</u>
4.7 Airport Capacity (Runway Throughput Flights/Hour)	<u>5249</u>
4.8 Resilience (% Loss of Airport & Airspace Capacity Avoided).....	<u>5350</u>
4.8.1 Performance Mechanism	<u>5350</u>
4.8.2 Assessment Data (Exercises and Expectations).....	<u>5350</u>
4.8.3 Extrapolation to ECAC wide.....	<u>5451</u>
4.8.4 Discussion of Assessment Result.....	<u>5552</u>

4.8.5	Additional Comments and Notes	5552
4.9	Flight Times	5653
4.9.1	Performance Mechanism	5653
4.9.2	Assessment Data (Exercises and Expectations)	5653
4.9.3	Extrapolation to ECAC wide	5653
4.9.4	Discussion of Assessment Result	5855
4.9.5	Additional Comments and Notes	5855
4.10	Predictability	5956
4.10.1	Performance Mechanism	5956
4.10.2	Assessment Data (Exercises and Expectations)	5956
4.10.3	Extrapolation to ECAC wide	5956
4.10.4	Discussion of Assessment Result	6158
4.10.5	Additional Comments and Notes	6158
4.11	Punctuality	6259
4.12	Civil-Military Cooperation and Coordination (Distance and Fuel)	6360
4.13	Flexibility	6461
4.13.1	Performance Mechanism	6461
4.13.2	Assessment Data (Exercises and Expectations)	6461
4.13.3	Extrapolation to ECAC wide	6461
4.13.4	Discussion of Assessment Result	6562
4.13.5	Additional Comments and Notes	6562
4.14	Cost Efficiency	6764
4.14.1	Performance Mechanism	6764
4.14.2	Assessment Data (Exercises and Expectations)	6764
4.14.3	Extrapolation to ECAC wide	6865
4.14.4	Discussion of Assessment Result	6966
4.14.5	Additional Comments and Notes	6966
4.15	Airspace User Cost Efficiency	7067
4.16	Security	7168
4.16.1	The SecRAM 2.0 methodology and the Security Performance Mechanism	7168
4.16.2	Security Assessment Data Collection	7168
4.16.3	Extrapolation to ECAC wide	7269
4.16.4	Discussion of Assessment Result	7269
4.16.5	Additional Comments and Notes	7269
4.17	Human Performance	7370
4.17.1	HP arguments, activities and metrics	7370
4.17.2	Extrapolation to ECAC wide	7471
4.17.3	Open HP issues/ recommendations and requirements	7471
4.17.4	Concept interaction	7471
4.17.5	Most important HP issues	7471
4.17.6	Additional Comments and Notes	7572
4.18	Other PIs	7673
4.19	Gap Analysis	7774
5	References	7976
Appendix A	Detailed Description and Issues of the OI Steps	8178

List of Tables

Table 1: KPI Assessment Results Summary	1211
Table 2 Mandatory PIs Assessment Summary	1513
Table 3. Glossary of terms	191716
Table 4: Acronyms and terminology	2018
Table 5: Terminology.....	2724
Table 6: Relationships with other Solutions.....	3027
Table 7: Pre-SESAR2020 Exercises.....	3128
Table 8: SESAR2020 Validation Exercises.....	3128
Table 9: Summary of Validation Results.....	3229
Table 10: Applicable Operating Environments.....	3330
Table 11. Solution Safety Validation results.....	4542
Table 12: Fuel burn and CO2 emissions saving for Mandatory KPIs /PIs.....	4845
Table 13: Fuel burn and CO2 emissions saving per flight phase.....	4845
Table 14: Airspace Capacity benefits per Exercise.....	5047
Table 15: Airspace Capacity relative benefits per OI step.....	5047
Table 16: Airspace benefits for Mandatory KPIs /PIs.....	5148
Table 17: Resilience benefits per Exercise	5350
Table 18: Resilience relative benefits per OI step.....	5350
Table 19: Resilience for Mandatory PIs.....	5451
Table 20: Flight Times benefits per Exercise	5653
Table 21: Flight Times relative benefits per OI step.....	5653
Table 22: Flight Times benefits for Mandatory KPIs /PIs	5754
Table 23: Flight times benefit per flight phase.....	5855
Table 24: Predictability benefits per Exercise	5956
Table 25: Predictability relative benefits per OI step.....	5956
Table 26: Predictability benefits for Mandatory KPIs /PIs	6057

Table 27: Predictability benefit per flight phase	6158
Table 28: Flexibility benefit per Exercise	6461
Table 29: Flexibility relative benefit per OI step	6461
Table 30: Flexibility benefit for Mandatory KPIs /PIs	6461
Table 31: Flexibility benefit per flight phase	6562
Table 32: Cost Efficiency benefit per Exercise	6764
Table 33: Cost Efficiency relative benefit per OI step	6865
Table 34: Cost Efficiency benefit for Mandatory KPIs /PIs	6966
Table 35 SESAR Solution PJ.10-W2-WP3 Scope and related OI step.....	7269
Table 36: Security benefit for Mandatory PIs	7269
Table 37: HP arguments, activities and metrics	7471
Table 38: Open HP issues/ recommendations and requirements	7471
Table 39: Most important HP issues	7572
Table 40: Gap analysis Summary.....	7875
Table 41: OI Steps allocated to the Solution	8178

List of Figures

Figure 1. Possible relationships between two solutions from a deployment perspective	2926
--	----------------------

1 Executive Summary

This document provides the Performance Assessment Report (PAR) for Solution PJ.10-W2-93 Delegation of ATM services provision among ATSU at V3.

The PAR is consolidating Solution performance validation results addressing KPIs/PIs and metrics from the SESAR2020 Performance Framework [3].

Description:

PJ.10-W2-WP3-Solution 93 is exploring operational concepts of the delegation of ATM services provision amongst ATSU. Delegations can be done either in normal conditions in order to improve the efficiency of ATM or it can be done in abnormal, i.e., contingency, conditions in order to improve resilience and minimise the impact of a system failure.

The Solution will investigate Use Cases for the Delegation of ATM services provision in nominal and contingency situations in conjunction with the Virtual Centre Technology, where the ATM Data Service Provider (ADSP) is geographically separated from the ATSU providing ATM services to a region of airspace.

Assessment Results Summary:

The following tables summarises the assessment outcomes per KPI.

Formatted: Font: 11 pt, Font color: Custom Color(RGB(89,102,109))

<u>KPI</u>	<u>Validation Targets – Network Level (ECAC Wide)</u>	<u>Performance Benefits at Network Level (ECAC Wide or Local depending on the KPI)</u>	<u>Confidence in Results</u>
<u>SAF1: Safety - Total number of estimated accidents with ATM Contribution per year</u>	<u>Yes</u>	<u>Yes</u>	<u>Low</u>
<u>FEFF1: Fuel Efficiency - Actual average fuel burn per flight</u>	<u>High</u>	<u>- 6.5 kg / flight (positive impact)</u>	<u>Low</u>
<u>CAP1: TMA Airspace Capacity - TMA throughput, in challenging airspace, per unit time.</u>	<u>High</u>	<u>+ 12.30 %</u>	<u>Low</u>
<u>CAP2: En-Route Airspace Capacity - En-route throughput, in</u>	<u>High</u>	<u>+ 10.4 %</u>	<u>Low</u>

<u>challenging airspace, per unit time</u>			
<u>CAP3: Airport Capacity – Peak Runway Throughput (Mixed mode).</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
<u>TEFF1: Gate-to-gate flight time</u>	<u>N/A</u>	<u>- 0.13 min / flight (positive impact)</u>	<u>Low</u>
<u>PRD1: Predictability – Average of Difference in actual & Flight Plan or RBT durations</u>	<u>Medium</u>	<u>PRD1 extrapolation at ECAC level not available, see Section 4.10.</u>	<u>N/A</u>
<u>PUN1: Punctuality – Average departure delay per flight</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
<u>CEF2: ATCO Productivity – Flights per ATCO -Hour on duty</u>	<u>High</u>	<u>+ 5.9% flights/ATCO-hour</u>	<u>Low</u>
<u>CEF3: Technology Cost – Cost per flight</u>	<u>High</u>	<u>-1.56% (positive impact)</u>	<u>Low</u>

Table 1111

<u>KPI</u>	<u>Validation Targets – Network Level (ECAC Wide)</u>	<u>Performance Benefits at Network Level (ECAC Wide or Local depending on the KPI)</u>	<u>Confidence in Results</u>
<u>SAF1: Safety - Total number of estimated accidents with ATM Contribution per year</u>	<u>Yes</u>	<u>Yes</u>	<u>Low</u>
<u>FEFF1: Fuel Efficiency - Actual average fuel burn per flight</u>	<u>High</u>	<u>- 6.5 kg / flight (positive impact)</u>	<u>Low</u>
<u>CAP1: TMA Airspace Capacity - TMA throughput, in challenging airspace, per unit time.</u>	<u>High</u>	<u>+ 12.30 %</u>	<u>Low</u>

<u>CAP2: En-Route Airspace Capacity - En-route throughput, in challenging airspace, per unit time</u>	<u>High</u>	<u>+ 10.4 %</u>	<u>Low</u>
<u>CAP3: Airport Capacity – Peak Runway Throughput (Mixed mode).</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
<u>TEFF1: Gate-to-gate flight time</u>	<u>N/A</u>	<u>- 0.13 min / flight (positive impact)</u>	<u>Low</u>
<u>PRD1: Predictability – Average of Difference in actual & Flight Plan or RBT durations</u>	<u>Medium</u>	<u>PRD1 extrapolation at ECAC level not available, see Section 4.10.</u>	<u>N/A</u>
<u>PUN1: Punctuality – Average departure delay per flight</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
<u>CEF2: ATCO Productivity – Flights per ATCO -Hour on duty</u>	<u>High</u>	<u>+ 5.9% flights/ATCo-hour</u>	<u>Low</u>
<u>CEF3: Technology Cost – Cost per flight</u>	<u>High</u>	<u>-1.56% (positive impact)</u>	<u>Low</u>

Table 11

KPI	Validation Targets – Network Level (ECAC Wide)	Performance Benefits at Network Level (ECAC Wide or Local depending on the KPI)	Confidence in Results
<u>SAF1: Safety – Total number of estimated accidents with ATM Contribution per year</u>	<u>Yes</u>	<u>Yes</u>	<u>Low</u>
<u>FEFF1: Fuel Efficiency – Actual average fuel burn per flight</u>	<u>High</u>	<u>-6.5 kg / flight (positive impact)</u>	<u>Low</u>
<u>CAP1: TMA Airspace Capacity – TMA throughput, in</u>	<u>High</u>	<u>+12.30%</u>	<u>Low</u>

challenging airspace, per unit time.			
CAP2: En-Route Airspace Capacity En-route throughput, in challenging airspace, per unit time	High	+10.4%	Low
CAP3: Airport Capacity Peak Runway Throughput (Mixed mode).	N/A	N/A	N/A
TEFF1: Gate to gate flight time	N/A	-0.13 min / flight (positive impact)	Low
PRD1: Predictability Average of Difference in actual & Flight Plan or RBT durations	Medium	PRD1 extrapolation at ECAC level not available, see Section 4.10.	N/A
PUN1: Punctuality Average departure delay per flight	N/A	N/A	N/A
CEF2: ATCO Productivity Flights per ATCO Hour on duty	High	+18.25.9% flights/ATCo hour	Low
CEF3: Technology Cost Cost per flight	High	-1.56% (positive impact)	Low

Table 1) and mandatory PI (Table 2222Table 22Table 2) puts them side-by side against Validation Targets in case of KPI from PJ19 [7]. The impact of a Solution on the performances are described in Benefit Impact Mechanism.

There are three cases:

1. An assessment result of 0 with confidence level other level High, Medium or Low indicates that the Solution is expected to impact in a marginal way the KPI or mandatory PI.
2. An assessment result (positive or negative) different than 0 with confidence level High, Medium or Low indicates that the Solution is expected to impact the KPI or mandatory PI.
3. An assessment result of N/A (Not Applicable) with confidence level N/A indicates that the Solution is not expected to impact at all the KPI or mandatory PI consistently with the Benefit Mechanism.

KPI	Validation Targets – Network Level (ECAC Wide)	Performance Benefits at Network Level (ECAC Wide or Local depending on the KPI) ¹	Confidence in Results ²
SAF1: Safety - Total number of estimated accidents with ATM Contribution per year	Yes	Yes	Low
FEFF1: Fuel Efficiency - Actual average fuel burn per flight	High	- 6.5 kg / flight (positive impact)	Low
CAP1: TMA Airspace Capacity - TMA throughput, in challenging airspace, per unit time.	High	+ 12.30 %	Low
CAP2: En-Route Airspace Capacity - En-route throughput, in challenging airspace, per unit time	High	+ 10.4 %	Low
CAP3: Airport Capacity – Peak Runway Throughput (Mixed mode).	N/A	N/A	N/A
TEFF1: Gate-to-gate flight time	N/A	- 0.13 min / flight (positive impact)	Low
PRD1: Predictability – Average of Difference	Medium	PRD1 extrapolation at ECAC level not	N/A

¹ Negative impacts are indicated in red.

² High – the results might change by +/-10%
 Medium – the results might change by +/-25%
 Low – the results might change by +/-50% or greater
 N/A – not applicable, i.e., the KPI cannot be influenced by the Solution

in actual & Flight Plan or RBT durations		available, see Section 4.10.	
PUN1: Punctuality – Average departure delay per flight	N/A	N/A	N/A
CEF2: ATCO Productivity – Flights per ATCO -Hour on duty	High	+ 18.25.9% flights/ATCo-hour	Low
CEF3: Technology Cost – Cost per flight	High	-1.56% (positive impact)	Low

Table 11114: KPI Assessment Results Summary

Mandatory PI	Performance Expectations at Network Level (ECAC Wide or Local depending on the KPI) ³	Confidence in Results ⁴
SAF1.X: Mid-air collision - En-Route	See section 4.3	Low
SAF2.X: Mid-air collision - TMA	See section 4.3	Low
SAF3.X: RWY-collision accident	N/A	N/A
SAF4.X: TWY-collision accident	N/A	N/A
SAF5.X: CFIT accident	N/A	N/A
SAF6.X: Wake related accident	N/A	N/A
SAF7.X: RWY-excursion accident	N/A	N/A
SAF8.X ...: Other SAF Risks	N/A	N/A
SEC1: A security risk assessment has been carried out	See section 4.16	N/A

³ Negative impacts are indicated in red.

⁴ High – the results might change by +/-10%
 Medium – the results might change by +/-25%
 Low – the results might change by +/-50% or greater
 N/A – not applicable, i.e., the KPI cannot be influenced by the Solution

SEC2: Risk Treatment has been carried out	See section 4.16	N/A
SEC3: Residual risk after treatment meets security objective.	See section 4.16	N/A
ENV1: Actual Average CO2 Emission per flight	20.5 kg CO2/flight saving	Low
NOI1: Relative noise scale	N/A	N/A
NOI2: Size and location of noise contours	N/A	N/A
NOI4: Number of people exposed to noise levels exceeding a given threshold	N/A	N/A
LAQ1: Geographic distribution of pollutant concentrations	N/A	N/A
CAP3.1: Peak Departure throughput per hour (Segregated mode)	N/A	N/A
CAP3.2: Peak Arrival throughput per hour (segregated mode)	N/A	N/A
CAP4: Un-accommodated traffic reduction	N/A	N/A
RES1: Loss of Airport Capacity Avoided	N/A	N/A
RES1.1: Airport time to recover from non-nominal to nominal condition	N/A	N/A
RES2: Loss of Airspace Capacity Avoided.	+2.5% - +10.4%	Low
RES2.1: Airspace time to recover from non-nominal to nominal condition.	- 98% (positive impact)	Low
RES4: Minutes of delays.	Not assessed	Not assessed
RES5: Number of cancellations.	Not assessed	Not assessed
TEFF2: Taxi in time	N/A	N/A
TEFF3: Taxi out time	N/A	N/A
TEFF4: TMA arrival time	N/A	N/A
TEFF5: TMA departure time	N/A	N/A
TEFF6: En-Route time	-0.13 min/flight positive impact	Low

PRD2: Variance of Difference in actual & Flight Plan or RBT durations	- 0.012 min ² (positive benefit)	Low
PUN2: % Flights departing within +/- 3 minutes of scheduled departure time due to ATM and weather related delay causes	N/A	N/A
CEF1: Direct ANS Gate-to-gate cost per flight	To be assessed by PJ19	To be assessed by PJ19
AUC3: Direct operating costs for an airspace user	N/A	N/A
AUC4: Indirect operating costs for an airspace user	N/A	N/A
AUC5: Overhead costs for an airspace user	N/A	N/A
CMC1.1: Allocated vs. Requested ARES duration	N/A	N/A
CMC1.2: Allocated vs. Requested ARES dimension	N/A	N/A
CMC1.3: Deviation of Transit Time to/from airbase to ARES	N/A	N/A
CMC 1.3.1: Allocated ARES duration vs. total mission duration	N/A	N/A
CMC 1.3.2: Deviation of total mission duration by iOAT FPL validation	N/A	N/A
CMC 1.4.1: Rate of iOAT FPLs acceptance by NM systems	N/A	N/A
CMC 1.4.2: Rate of iOAT FPLs acceptance by ATC systems	N/A	N/A
CMC2.1: Fuel and Distance saved by GAT	N/A	N/A
HP1: Consistency of human role with respect to human capabilities and limitations	See section 4.17	Medium
HP2: Suitability of technical system in supporting the tasks of human actors	See section 4.17	Medium
HP3: Adequacy of team structure and team communication in supporting the human actors	See section 4.17	Medium
HP4: Feasibility with regard to HP-related transition factors	See section 4.17	Medium
FLX1: Average delay for scheduled civil/military flights with change request and non-scheduled or late flight plan request	-1% - -1.5% positive impact	Low

Table [22222](#) Mandatory PIs Assessment Summary

2 Introduction

2.1 Purpose of the document

The Performance Assessment covers the Key Performance Areas (KPAs) defined in the SESAR2020 Performance Framework [3]. Assessed are at least the Key Performance Indicators (KPIs) and the mandatory Performance Indicators (PIs), but also additional PIs as needed to capture the performance impacts of the Solution. It considers the guidance document on KPIs/PIs [3] for practical considerations, for example on metrics.

The purpose of this document is to present the performance assessment results from the validation exercises at SESAR Solution level. The KPA performance results are used for the performance assessment at strategy level and provide inputs to the SESAR3 Joint Undertaking (S3JU) for decisions on the SESAR2020 Programme.

In addition to the results, this document presents the assumptions and mechanisms (how the validation exercises results have been consolidated) used to achieve this performance assessment result. One Performance Assessment Report shall be produced or iterated per Solution.

2.2 Intended readership

In general, this document provides the ATM stakeholders (e.g. airspace users, ANSPs, airports, airspace industry) and S3JU performance data for the Solution addressed.

Produced by the Solution project, the main recipient in the SESAR performance management process is PJ19, which will aggregate all the performance assessment results from the SESAR2020 solution projects PJ1-18, and provide the data to PJ20 for considering the performance data for the European ATM Master Plan. The aggregation will be done at higher levels suitable for use at Master Planning Level, such as deployment scenarios.

2.3 Inputs from other projects

The document includes information from the following SESAR 2020 Wave1 projects:

- PAGAR 2019: Performance Assessment and Gap Analysis Report (2019), where are collected the final benefits from SESAR 2020 Wave1.

PJ19 will manage and provide:

- SESAR Performance Framework (2019) [3], guidance on KPIs and Data collection supports.
- S2020 Common Assumptions, used to aggregate results obtained during validation exercises (and captured into validation reports) into KPIs at the ECAC level, which will in turn be captured in Performance Assessment Reports and used as inputs to the CBAs produced by the Solution projects. Where are also included performance aggregation assumptions, with traffic data items.
- For guidance and support PJ19 have put in place the Community of Practice (CoP) within STELLAR, gathering experts and providing best practices.

2.4 Glossary of terms

See the AIRM Glossary [1] [6] for a comprehensive glossary of terms.

Term	Definition	Source of the definition
ADSP	The ADSP is providing all the data necessary for an ATSU. An ATSU may use of multiple ADSP, e.g. one for ADSP data and one for Voice services. An ADSP may also provide to several ATSUs.	PJ.10-W2-93
Alliance Model	ANSPs could form alliances by creating a dedicated jointly-owned entity responsible for producing and providing the needed air traffic data for their airspace (e.g. COOPANS/iTEC like model);	Airspace Architecture Study Error! Reference source not found. Error! Reference source not found. Fehler! Verweisquelle konnte nicht gefunden werden.
Area of Interest	The airspace encompassing the AoR and a defined buffer zone within which airspace status and flight information are of operational interest to the system operators.	ATM Lexicon
Area of Responsibility	An airspace of defined dimensions within which an ATC unit provides air traffic services.	ATM Lexicon Error! Reference source not found. Error! Reference source not found. Fehler! Verweisquelle konnte nicht gefunden werden.
Collaborative Decision Making	A process focused on how to decide on a course of action articulated between two or more community members.	SESAR Concept of Operations Step 2 Edition 2014 (Ed. 01.01.00)
Delegating ATSU	A delegating ATSU is an ATSU that delegates parts of its airspace or even its entire airspace to the receiving ATSU.	PJ.10-W2-93
Delegation Procedure	The operational procedure describes the actors, their activities and their order of execution within the process of delegating the provision of ATM services amongst ATUs.	PJ.10-W2-93

Group of sectors	A set of sectors that belong together organisationally and in terms of licensing.	PJ.10-W2-93
Key Performance Indicator	<p>Current/past performance, expected future performance (estimated as part of forecasting and performance modelling), as well as actual progress in achieving performance objectives is quantitatively expressed by means of indicators (sometimes called Key Performance Indicators, or KPIs). To be relevant, indicators need to correctly express the intention of the associated performance objective. Since indicators support objectives, they should not be defined without having a specific performance objective in mind. Indicators are not often directly measured. They are calculated from supporting metrics according to clearly defined formulas, e.g. cost-per-flight-indicator = Sum(cost)/Sum(flights). Performance measurement is therefore done through the collection of data for the supporting metrics.”</p> <p>9.5.2013 EC Official Journal of Union definition: In the context EC Performance Implementing Regulation, Key Performance Indicator means specifically the performance indicators used for the purpose of performance target setting</p>	ICAO Doc 9883
Network Management Function	An integrated ATM activity with the aim of ensuring optimised Network Operations and ATM service provision meeting the Network performance targets.	ATM Lexicon
Rating	indicates the type of service which the licence holder is authorised to provide	Reg (EU) 2015-340
Receiving ATSU	A receiving ATSU is an ATSU that receives parts of the airspace or even the entire airspace from a delegating ATSU.	PJ.10-W2-93
Sector	Part of a control area and/or part of a flight information region or upper region	Reg (EU) 2015-340
Service	The contractual provision of something (a non-physical object), by one, for the use of one or more others. Services involve interactions between providers and consumers, which may be performed in a digital form (data exchanges) or through voice communication or written processes and procedures	EATMA Guidance Material
Virtual Centre	A virtual centre is a single Air Traffic Service Unit (ATSU) or a grouping of collaborative ATSUs using	PJ.16-03 solution

	<p>data services provided by ATM Data Service Provider (ADSP). The concept provides, at least, geographical decoupling between ADSP(s) and ATSU(s), through service interfaces defined in Service Level Agreements. One ATSU may use data services from multiple ADSPs, just as an ADSP may serve multiple ATSUs.</p>	
--	---	--

Table 3333. Glossary of terms

2.5 Acronyms and Terminology

Acronym	Definition
AAS	Airspace Architecture Study
ADSP	ATM Data Service Provider
ANSP	Air Navigation Service Provider
AoR	Area of Responsibility
ASM	Airspace Management
ATCO	Air Traffic Controller
ATFCM	Air Traffic Flow and Capacity Management
ATM	Air Traffic Management
ATS	Air Traffic Services
ATSU	Air Traffic Service Unit
CNS	Communication Navigation and Surveillance
CONOPS	Concept of Operations
CR	Change Request
EASA	European Union Aviation Safety Agency
EATMA	European ATM Architecture
E-ATMS	European Air Traffic Management System
FL	Flight level
HPAR	Human Performance Assessment Report
IFAV	Increased Flexibility in ATCO Validations

INTEROP	Interoperability Requirements
KPA	Key Performance Area
LoA	Letter of Agreement
LPR	Language Proficiency
NM	Network Manager
NMF	Network Managing Function
NMOC	Network Manager Operations Centre
NOV	NATO Operational View
NSA	National Supervisory Authority
OI	Operational Improvement
OJTI	On-the-Job Training Instructor
OPAR	Operational Performance Assessment Report
OSED	Operational Service and Environment Definition
PAR	Performance Assessment Report
PC	Planner Controller
PIRM	Programme Information Reference Model
QoS	Quality of Service
SAC	Safety Criteria
SAR	Safety Assessment Report
SecAR	Security Assessment Report
SESAR	Single European Sky ATM Research Programme
SJU	SESAR Joint Undertaking (Agency of the European Commission)
SMS	Safety Management System
SPR	Safety and Performance Requirements
SWIM	System Wide Information Model
TS	Technical Specification
VALP	Validation Plan

VALR	Validation Report
WAN	Wide Area Network

Table 4444: Acronyms and terminology

The following is a list of the concepts, terms or definitions introduced or commonly referred to in this document.

Term	Definition	Source
Airport Capacity Focus Area	Capture the peak runway throughput in the most challenging (or constrained) environments at busy hours, i.e. the capacity at a "maximum observed throughput" airport.	PAGAR
Airspace Capacity Focus Area	Capture the capability of a challenging volume of airspace to handle an increasing number of movements per unit time – through changes to the operational concept and technology.	PAGAR
Airspace Reservation/Restriction (ARES)	Airspace Reservation means a defined volume of airspace temporarily reserved for exclusive or specific use by categories of users (Temporary Segregated Area (TSA), Temporary Reserved Area (TRA), and Cross-Border Area (CBA)) whereas Airspace Restriction designates Danger, Restricted and Prohibited Areas.	EC Regulation No 2150/2005
Airspace User Cost-Efficiency Focus Area	Cost-Efficiency obtained by Airspace Users other than direct gate-to-gate ATS costs (CEF1) or AU cost improvements assessed through other KPIs: Fuel Efficiency, Punctuality, etc. Note: Benefits assessed through other KPIs should not be included in this focus area to avoid double counting of benefits. AU Cost-Efficiency includes reduction of direct (AUC3) and indirect (AUC4) operational costs of the AU, as well as overhead costs (AUC5). In addition there are two specific PIs, Strategic Delay (AUC1) and Sequence Optimisation Benefit (AUC2).	PAGAR
ARES Capacity	The ability of an ATM system to accommodate specific training events which require airspace reservations and/or restrictions during a specific period of time, taking into account the duration of the training events, ATM inefficiency, planning inefficiency and weather impact on training and operations.	Performance Framework 2017

Term	Definition	Source
ATM Master Plan	<p>The European ATM Master Plan is the agreed roadmap to bring ATM R&I to the deployment phase, introducing the agreed vision for the future European ATM system. It provides the main direction and principles for SESAR R&I, as well as the deployment planning and an implementation view with agreed deployment objectives. Through the SESAR Key Features, the ATM Master Plan identifies the Essential Operational Changes (both Essential Operational Changes featured in the Pilot Common Project and New Essential Operational Changes) and key R&I activities that support the identified performance ambition. The ATM Master Plan is updated on a regular basis in collaboration and consultation with the entire ATM community. Amendments are submitted to the S3JU Administrative Board for adoption.</p> <p>The content of the European ATM Master Plan is structured in three levels (Level 1 – Executive View, Level 2 – Planning and Architecture View, and Level 3 – Implementation View) to allow stakeholders to access the information at the level of detail that is most relevant to their area of interest. The intended readership for Level 1 is executive-level stakeholders. Levels 2 and 3 of the ATM Master Plan provide more detail on the operational changes and related elements and therefore the target audience is expert-level stakeholders.</p>	SESAR2020 Project Handbook, European ATM Master Plan (9 Edition)
Civil-military coordination and cooperation	The coordination between the civil and military parties authorised to make decisions and agree a course of action.	Performance Framework 2017
Cost-Benefit Analysis	<p>A Cost-Benefit Analysis is a process for quantifying in economic terms the costs and benefits of a project or a programme over a certain period, and those of its alternatives (within the same period), in order to have a single scale of comparison for unbiased evaluation.</p> <p>This process helps decision-makers to compare an investment with other possible investments and/or to make a choice between different options / scenarios and to select the one that offers the best value for money while considering all the key criteria affecting the decision.</p>	PAGAR
Deployment Scenario	Set of SESAR Solutions selected to satisfy the specific Performance Needs of operating environments in the European ATM System and based on the timescales in which their performance contribution is needed in the respective operating environments.	PAGAR
Flexibility KPA	<p>The ability of the ATM System and airports to respond to changes in planned flights and missions.</p> <p>It covers late trajectory modification requests as well as ATFCM measures and departure slot swapping and it is applicable to military and civil airspace users covering both scheduled and unscheduled flights. In terms of specific military requirements, it also covers the ability of the ATM System to address military requirements related to the use of airspace and reaction to short-notice changes.</p>	Performance Framework 2017

Term	Definition	Source
Focus Area	Within each KPA, a number of more specific “Focus Areas” are identified in which there are potential intentions to establish performance management. Focus Areas are typically needed where performance issues have been identified.	ICAO Doc 9883
Fuel Efficiency Focus Area	<p>The SESAR performance Focus Area concerned with fuel efficiency.</p> <p>How much fuel is used by aviation or by extension “Fuel efficiency” (how much fuel can be saved?) is one of the performance aspects.</p> <p>Note: Policy places considerable focus on this. Fuel efficiency contributes to 3 of the 11 KPAs defined by ICAO: Cost-efficiency, Efficiency, and Environment.</p>	PAGAR
Gap Analysis	<p>Difference between the validation targets and the performance assessment.</p> <p>It is used to:</p> <ol style="list-style-type: none"> 1. Anticipate any deviation from the design performance targets; 2. Identify the underlying reasons; 3. Derive the appropriate recommendations to be taken on board to redirect the R&D activities within the Programme towards the ultimate achievement of SESAR2020’s performance ambitions. 	PAGAR
G2G ANS Cost-Efficiency Focus Area	<p>One of the SESAR performance Focus Areas concerned with Cost Efficiency.</p> <p>Direct G2G ANS costs are those costs that are charged to Airspace Users via unit rates, including ATM/CNS costs, regulatory costs, Met costs and EUROCONTROL Agency costs.</p>	Performance Framework new
Human Performance (HP)	Human capabilities and limitations which have an impact on the safety, security and efficiency of aeronautical operations.	EUROCONTROL ATM Lexicon
Key Performance Area	A way of categorising performance subjects related to high level ambitions and expectations. ICAO Global ATM Concept sets out these expectations in general terms for each of the 11 ICAO defined KPAs.	EUROCONTROL ATM Lexicon

Term	Definition	Source
Key Performance Indicator	<p>Current/past performance, expected future performance (estimated as part of forecasting and performance modelling), as well as actual progress in achieving performance objectives is quantitatively expressed by means of indicators (sometimes called Key Performance Indicators, or KPIs). To be relevant, indicators need to correctly express the intention of the associated performance objective. Since indicators support objectives, they should not be defined without having a specific performance objective in mind. Indicators are not often directly measured. They are calculated from supporting metrics according to clearly defined formulas, e.g. cost-per-flight-indicator = Sum (cost)/Sum (flights). Performance measurement is therefore carried out through the collection of data for the supporting metrics.”</p> <p>In SESAR2020 Performance Framework, Key Performance Indicators are those that have a validation target associated derived from the corresponding Performance Ambition.</p>	ICAO Doc 9883 Performance Framework
Local Air Quality Focus Area	<p>One of the SESAR performance Focus Areas concerned with Environment.</p> <p>Local air quality is a term commonly used to designate the state of the ambient air to which humans and the ecosystem are typically exposed at a specific location. In the case of aviation, local air quality studies are generally conducted near airports.</p>	PAGAR
Noise Focus Area	<p>One of the SESAR performance Focus Areas concerned with Environment.</p> <p>The term Noise is used in this document to designate noise pollution, which is defined as unwanted sound. The impact of unwanted sounds on the recipients (in this case, people living around airports) causes adverse effects.</p>	PAGAR
Operational Environment (OE)	An environment with a consistent type of flight operations.	EUROCONTROL ATM Lexicon
Performance Ambitions	Performance capability that may be achieved if SESAR Solutions are made available through R&D activities, deployed in a timely and, when needed, synchronised way and used to their full potential.	EUROCONTROL ATM Lexicon
Performance assessment	This term relates to the quantitative estimate of the potential performance benefit of an operational improvement based on outputs from validation projects, collected and analysed by PJ19.04.02	ICAO Doc 9883 updated in PAGAR

Term	Definition	Source
Performance Framework	<p>1) The overall performance-driven development approach that is applied within the SESAR development programme to ensure that the programme develops the operational concept and technology needed to meet long-term performance expectations.</p> <p>2) The set of definitions and terminology describing the building blocks used by a group of ATM community members to collaborate on performance management activities.</p> <p>This set of definitions includes the levels in the global ATM performance hierarchy, the eleven Key Performance Areas, a set of process capability areas, focus areas, performance objectives, indicators, targets, supporting metrics, lists of dimension objects, their aggregation hierarchies and classification schemes.</p>	EUROCONTROL ATM Lexicon
Performance Indicator	<p>PIs are defined in the SESAR performance framework and relate to performance benefits in specific KPAs. However, no validation targets are assigned to PIs. SESAR Solutions projects use the results of validation exercises to report performance assessment in terms of the PIs, reporting the expected positive and negative impacts. Certain PIs are mandatory for measurement and reporting by Solution projects.</p>	SESAR2020 Project Handbook
Performance metrics	<p>Sometimes proxies may be used in a validation exercise when it is not possible to measure an impact directly using the specified KPIs and PIs. In these cases, other metrics may be used provided the solution project later converts the results into the reporting KPIs and PIs.</p>	SESAR2020 Project Handbook
Predictability Focus Area	<p>Predictability is focused on in-flight (i.e. off-block to on-block) variability of flight duration compared to the planned duration. It is expected that this area will be extended in the future to reflect the improvement derived from better planning in pre-tactical phase.</p>	Performance Framework 2019
Punctuality Focus Area	<p>Refers to “ATM Punctuality”. It captures ATM issues as well as events related to ATM that cause a temporal perturbation to airspace user schedules.</p>	PAGAR
Resilience Focus Area	<p>Resilience focuses on the ability to withstand and recover from planned and unplanned events and conditions which cause a loss of nominal performance.</p>	Performance Framework updated
Safety	<p>The state to which the possibility of harm to persons or damage to property is reduced, and maintained at or below, an acceptable level through a continuing process of hazard identification and risk management.</p>	EUROCONTROL ATM Lexicon

Term	Definition	Source
Security	<p>(aviation) Safeguarding civil aviation against acts of unlawful interference. This objective is achieved by a combination of measures and human and material resources.</p> <p>Note: ATM Security is concerned with those threats that are aimed at the ATM System directly, such as attacks on ATM assets, or where ATM plays a key role in the prevention of or response to threats aimed at other parts of the aviation system (or national and international assets of high value). ATM security aims to limit the effects of a threats on the overall ATM Network. ATM Security is a subset of Aviation Security (as defined by ICAO in Annex 17).</p>	EUROCONTROL ATM Lexicon, Note are from PAGAR
SESAR2020	The Programme for SESAR2020 was created with a clear and agreed need for continuing research and innovation in ATM beyond the SESAR 1 development phase. SESAR2020 is structured into three main research phases, starting with Exploratory Research, which is then further expanded within a Public-Private-Partnership (PPP) to conduct Industrial Research and Validation. Finally, it further exploits the benefits of the PPP in Demonstrating at Large Scale the concepts and technologies in representative environments to firmly establish the performance benefits and risks.	Performance Framework 2017
SESAR Programme	The programme which defines the Research and Development activities and Projects for the S3JU.	EUROCONTROL ATM Lexicon
SESAR Solution	A term used when referring to both SESAR ATM Solution and SESAR Technological Solution.	SESAR2020 Project Handbook
SESAR ATM Solution	<p>SESAR Solutions relate to either an Operational Improvement (OI) step or a group of OI steps with associated Enablers (technical system, procedure or human), which have been designed, developed and validated in response to specific Validation Targets and that are expected deliver operational and/or performance improvements to European ATM, when translated into their effective realisation.</p> <p>SESAR Technological Solutions relate to verified technologies proven to be feasible and profitable, which may therefore be considered to enable future SESAR Solutions.</p>	SESAR2020 Project Handbook
Single European Sky High Level Goals	The SES High Level Goals are political targets set by the European Commission. Their scope is the full ATM performance outcome resulting from the combined implementation of the SES pillars and instruments, as well as industry developments not driven directly by the EU.	SESAR2020 Project Handbook
Sub-OE	A subcategory of an Operating environment, classified according to its complexity (e.g. high complexity TMA, medium complexity TMA, low complexity TMA).	EUROCONTROL ATM Lexicon
Validation targets	<p>Validation targets are the targets that focus on the development of enhanced capabilities by the SESAR Solutions. They aim to secure from R&D the required performance capability to contribute to the achievement of the Performance Ambitions and, thus, to the SES high-level goals.</p> <p>In SESAR2020 validation targets are associated with a KPI.</p>	EUROCONTROL ATM Lexicon

Table [5555](#): Terminology

3 Solution Scope

3.1 Detailed Description of the Solution

PJ.10-W2-WP3-Solution 93 is exploring operational concepts of the delegation of ATM services provision amongst ATSUs. Delegations can be done either in normal conditions in order to improve the efficiency of ATM or it can be done in abnormal, i.e. contingency, conditions in order to improve resilience and minimise the impact of a system failure.

The Solution will investigate Use Cases for the Delegation of ATM services provision in nominal and contingency situations in conjunction with the Virtual Centre Technology, where the ATM Data Service Provider (ADSP) is geographically separated from the ATSU providing ATM services to a region of airspace.

Based on the new operational opportunities offered by the Virtual Centre concept, a preliminary set of Delegation and Contingency Uses Cases have been selected, with the aim to further investigate and develop dynamic airspace configuration and advanced ATFCM capabilities. These will allow a completely new architecture to provide Air Traffic Services. These Use Cases will consider the operational procedures and resource management to support static and dynamic delegation of ATS, and will be identified before defining the Operational Requirements for different ATSU and ADSP configurations

This agility will lead to greater opportunities to provide Air Traffic Services, both from a technical and operational context, leading to flexible use of resources, which in turn leads to improved overall Performance.

This solution considers potential improvements in ATM by developing detailed Use Cases for the Delegation of ATM services provision between ATSUs in normal conditions and in the event of a Contingency.

Additionally, in the context of Virtual Centre, the Virtual Centre ATSUs may use Data Services from multiple ATM Data Service Providers.

3.2 Detailed Description of relationship with other Solutions

From a deployment perspective in 2014-2035, there are two types of possible relationships between two Solutions—they are either ‘compatible’ or ‘incompatible’.

Where Solutions are ‘incompatible’, they are mutually exclusive of each other as one and only one can be deployed at the same time in the same Operational Environment; where Solutions are ‘compatible’ and ‘dependent’ on the other, it is necessary to understand how they should be deployed—one after the other, or the reverse. In the case where both Solutions depend on each other, the relationship would be qualified as ‘interdependent’.

There are cases where two ‘compatible’ and ‘independent’ Solutions deployed could result in a greater or a lesser benefit than the sum of the benefits that these Solutions could provide on their own. This is considered as a ‘cross-effect’ relationship. On the contrary, a ‘no cross effect’ relationship is either explicitly declared by the Solutions or deduced by the questionnaire analyst.

The case 'preferable' has been created to describe where Sx 'prefers' to use Sy due to the benefits (e.g. reduced costs) it provides but Sx can also be deployed with or without Sy.

The figure below shows types of relationship that can exist between Solutions.

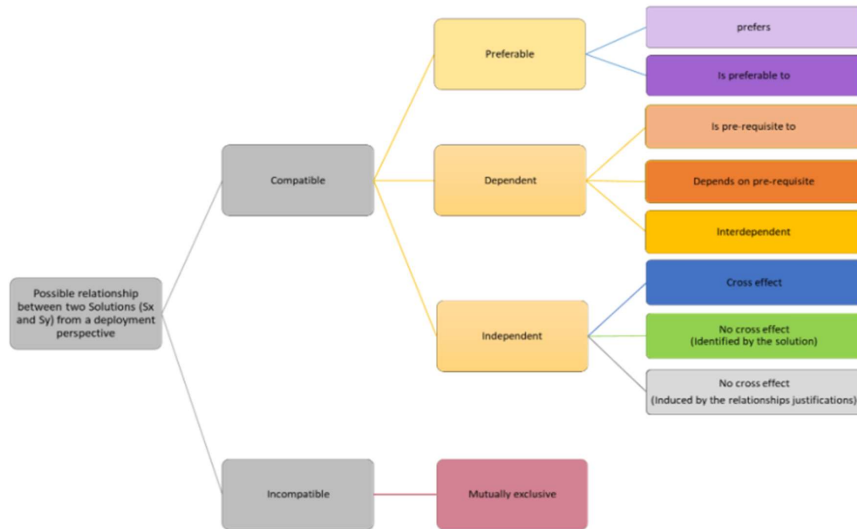


Figure 11114. Possible relationships between two solutions from a deployment perspective

Considering the context above, the list the Solutions identified as having a relationship with the Solution assessed (PJ.10-W2-93) is provided below, along with the proper justification.

Solution Number	Solution Title	Relationship	Rational for the relationship
PJ.09-W2-44	Dynamic Airspace Configurations (DAC)	Cross-effect	Solution PJ.09-W2-44 will boost the benefits obtained by PJ.10-W2-93 at least in terms of capacity, cost efficiency and fuel efficiency.
PJ.32-W3	Virtual Centre	Same ANSP – Interdependent / cross effect: 20% PJ.32, 80% PJ.10-W2-93 Different ANSP – Dependent (PJ.32 is a prerequisite)	Solution PJ.32-W3 provides procedural and technology improvements, complementing PJ.10-W2-93 solution.

		30% PJ.32, 70% PJ.10-W2-93	
PJ.10-W2-73 IFAV	Increased Flexibility in ATCO Validation	Preferable	PJ.10-W2-93 will benefit from increased flexibility in ATCo endorsements. However, the solution can be deployed as stand-alone.
PJ.33-W3-01	Increased Flexibility in ATCO Validation	Preferable	PJ.10-W2-93 will benefit from increased flexibility in ATCo endorsements. However, the solution can be deployed as stand-alone.

Table 6666: Relationships with other Solutions

4 Solution Performance Assessment

4.1 Assessment Sources and Summary of Validation Exercise Performance Results

Previous Validation Exercises (pre-SESAR2020 Wave 2, etc.) relevant for this assessment are listed below.

Organisation	Document Title	Publishing Date
SJU	SESAR Solution 16-03 Contextual Note TRL6	December 2019
SJU	SESAR Solution 15-09 Contextual Note V1	December 2019

Table 7777: Pre-SESAR2020 Exercises

SESAR Validation Exercises of this Solution (completed ones and planned ones) are listed below.

Exercise ID	Exercise Title	Release	Maturity	Status
EXE-PJ.10-W2-93-V2-VALP-002	Delegation of ATM services provision among ATSUs - ENAIRE	R13	V3	Completed
EXE-PJ.10-W2-93-V2-VALP-003	Delegation of ATM services provision among ATSUs - skyguide	R13	V3	Completed
EXE-PJ.10-W2-93-V2-VALP-004	Delegation of ATM services provision among ATSUs - ENAV	R13	V3	Completed
EXE-PJ.10-W2-93-V2-VALP-005	Delegation of ATM services provision among ATSUs - COOPANS	R13	V3	Completed

Table 8888: SESAR2020 Validation Exercises

The following table provides a summary of information collected from available performance outcomes.

Exercise	OI Step	Exercise scenario & scope	Performance Results	Notes
EXE-PJ.10-W2-93-V2-VALP-002	SDM-0217	Sub-OEs: En-Route MC and TMA VHC Use Cases: - Delegation of ATM services provision at night	Positive benefit	Results can be extrapolated to all sub-OEs

		<ul style="list-style-type: none"> - Delegation of ATM services provision at fixed time - Delegation of ATM services provision on-demand 		
EXE-PJ.10-W2-93-V2-VALP-003	SDM-0217	<p>Sub-OEs: En-Route VHC</p> <p>Use Cases:</p> <ul style="list-style-type: none"> - Delegation of ATM services provision at night - Delegation of ATM services provision in case of contingency 	Positive benefit	Results can be extrapolated to all sub-OEs
EXE-PJ.10-W2-93-V2-VALP-004	SDM-0217	<p>Sub-OEs: En-Route MC</p> <p>Use Cases:</p> <ul style="list-style-type: none"> - Delegation of ATM services provision at night - Delegation of ATM services provision at fixed time - Delegation of ATM services provision on-demand - Delegation of ATM services provision in case of contingency - Delegation of ATM services provision between Civil and Military ATSUs 	Positive benefit	Results can be extrapolated to all sub-OEs
EXE-PJ.10-W2-93-V2-VALP-005	SDM-0217	<p>Sub-OEs: En-Route MC</p> <p>Use Cases:</p> <ul style="list-style-type: none"> - Delegation of ATM services provision on-demand 	Positive benefit	Results can be extrapolated to all sub-OEs

Table 9999: Summary of Validation Results.

4.2 Conditions / Assumptions for Applicability

The following [Table 10101010Table 1010Table 10](#) summarises the applicable operating environments.

OE	Applicable sub-OE	Special characteristics
En-Route	From low to very high complexity.	Airspace concerning one or more ANSPs.
Terminal	From low to very high complexity.	Airspace concerning one or more ANSPs.

Table [1010101010](#): Applicable Operating Environments.

4.3 Safety

The information reported here refers to the V3 phase outcomes of Wave 2 PJ.10-W2-93; it has been collected from the Safety Assessment Plan [21], Safety Assessment Report [22] and Validation Report [20].

4.3.1 Safety Design drivers and Performance Mechanism

According to the SESAR Safety guidance [10], from a safety assessment perspective, solution 93 is an ATS operational solution and the design safety drivers are the Safety Criteria (SAC).

Safety Criteria define the acceptable level of safety (i.e., accident and incident risk level) to be achieved by the Solution under assessment, considering its impact on ATM/ANS functional system and its operation.

The SAC setting is driven by the analysis of the impact of the Change on the relevant AIM models and it needs to be consistent with the SESAR safety performance targets defined by PJ 19.04 [7]. The following AIM model has been considered relevant for this solution:

- Mid-Air Collision Risk in En-Route (MAC-ER).

The following Safety Criteria have been defined in the Safety Assessment Plan [21] and here briefly reported:

SAC#01: With the introduction of PJ.10-W2-93 concept, the number of planning conflicts shall not increase.

The AIM precursor considered is "Planning Conflicts" (MF5.1).

SAC#02: With the introduction of PJ.10-W2-93 concept, the number of ATC induced conflicts shall not increase.

The AIM precursor considered is "ATC induced conflict" (MF7.1).

SAC#03: With the introduction of PJ.10-W2-93 concept, the number of imminent infringements shall not increase, according to the AoR.

The AIM precursor considered is "Imminent Infringement" (MF5.9).

The OI step being addressed in PJ.10-W2-93 is: SDM-0217. It is fully covered in the safety assessment for the Delegation of ATM services provision among ATSU.

4.3.2 Data collection and Assessment

In accordance with the SESAR Safety Reference Materia [9][10], the impact of safety of the PJ.10-W2-93 solution has been assessed considering a two-fold approach:

- A **success approach** which is concerned with the safety of the solution operations in the absence of failure;
- A **conventional failure approach** which is concerned with the safety of the solution operations in the event of failures.

A safety assessment has been performed basing on safety results coming from the V3 validation exercises executed into the solution. From the Safety Criteria detailed in section 3.4 of the SAR [22], and following the SRM process, the Safety Requirements at ATS service level and Operational Hazards have been developed and identified. Therefore, the Safety Criteria are implicitly achieved through the demonstration of the before mentioned. Furthermore, the Safety Requirements at Design level have been defined.

The Validation Report captured the Safety Validation Objectives, among others. These Safety Validation Objectives were covered by the Validation exercises.

The safety-related outcomes of the validation exercises (traced back to the safety validation objectives) bring an essential contribution to the demonstration of the Safety Criteria achievability by the Solution design. Appendix H of the SAR [22] presents the achievability of the SAFETY Criteria.

The validation results are summarized in the table below, whilst indicating the level of safety evidence that has been obtained for each of the applicable validation safety objective. For further details on the results, please refer to the VALR [20].

Exercise ID, Name, Goals	Exercise Safety Validation Objective & related SAC(s)	Success criterion	Coverage (SRS and/or SRD)	Validation results & Level of safety evidence
<p>EXE-PJ.10-W2-93-V3-VALP-002 Delegation of ATM services provision among ATSUs – ENAIRE.</p> <p>The objective is to validate the operational thread of the delegation of ATM services provision among ATSUs in nominal conditions. In particular, this validation activity aims at demonstrating the operational feasibility, operational</p>	<p>EX2-OBJ-PJ.10-W2-93-V3-VALP-009 To assess the impact in terms of Safety of the ATM services provision delegation concept in nominal conditions</p> <p>SAC#01 SAC#02 SAC#03</p>	<p>EX2-CRT-PJ.10-W2-93-V3-VALP-049 The level of safety remains at an acceptable level according to ATCo’s expert judgment before, during and after the delegation of ATM services provision in nominal conditions.</p>	<p>SRS-001 SRS-003 SRS-005 SRS-006 SRS-007 Partially Covered SRS-008 Partially Covered SRS-009 Partially Covered SRS-015 SRS-016 Partially Covered SRD-001 SRD-002 SRD-003 Partially Covered SRD-004 SRD-005 SRD-006 SRD-007 SRD-008 SRD-009 Partially Covered SRD-010 SRD-011 SRD-012 Partially Covered SRD-013 SRD-014</p>	<p>Overall, there is an agreement for the night use case and fix time use case with regards to the level of safety being maintained during and after the delegation procedure.</p> <p>For the on-demand (cross-border and ATFM) there are disagreements with regards to the level of safety being maintained during and after the delegation procedure.</p>

Exercise ID, Name, Goals	Exercise Safety Validation Objective & related SAC(s)	Success criterion	Coverage (SRS and/or SRD)	Validation results & Level of safety evidence
<p>acceptance, and performance benefits of the PJ.10-W2-93 concept for the following use cases:</p> <ul style="list-style-type: none"> • Delegation of ATM services provision at night • Delegation of ATM services provision at fixed time • Delegation of ATM services provision on-demand 		<p>EX2-CRT-PJ.10-W2-93-V3-VALP-050</p> <p>Impact remains acceptable according to ATCo expert judgment in terms of the management and provision of aircraft separation before, during and after the delegation of ATM services provision in nominal conditions are identified.</p>	<p>SRD-015 SRD-016 SRD-017 SRD-018 Partially Covered SRD-019 SRD-020 Partially Covered SRD-021 Partially Covered SRD-022 SRD-023 SRD-024 Partially Covered SRD-030 SRD-034 Partially Covered SRD-036 Partially Covered</p>	<p>Overall, there is an agreement for the night use case and fix time use case with regards to the management and provision of aircraft separation, being this acceptable.</p> <p>For the on-demand (cross-border and ATFM) there are disagreements on this matter.</p>
<p>EXE-PJ.10-W2-93-V3-VALP-003</p> <p>Delegation of ATM services provision among ATSU – skyguide</p> <ul style="list-style-type: none"> • Validate the concept of delegation of ATM services provision among ATSU in 	<p>EX3-OBJ-PJ.10-W2-93-V3-VALP-008</p> <p>To assess the impact in terms of Safety of the ATM services provision delegation concept in nominal conditions</p> <p>SAC#01 SAC#02 SAC#03</p>	<p>EX3-CRT-PJ.10-W2-93-V3-VALP-043</p> <p>The level of safety remains at an acceptable level according to ATCo’s expert judgment before, during and after the delegation of ATM services provision in nominal conditions.</p>	<p>SRS-001 SRS-002 SRS-003 partially covered SRS-004 partially covered SRS-005 SRS-006 SRS-007 partially covered SRS-008 partially covered SRS-009 SRS-011 SRS-012 SRS-013 SRS-014 SRS-015 SRD-001 SRD-002 SRD-003</p>	<ul style="list-style-type: none"> • During the simulation runs, situational awareness and prescribed separation could be maintained. • The execution of the delegation procedure was found to support a safe delegation process. • According to ATCOs

Exercise ID, Name, Goals	Exercise Safety Validation Objective & related SAC(s)	Success criterion	Coverage (SRS and/or SRD)	Validation results & Level of safety evidence
<p>nominal and abnormal conditions, contributing to the maturity V3 of the Solution PJ.10-W2-93.</p> <ul style="list-style-type: none"> Validate the three architectural options (Y, U and D) of Virtual Centre based platforms, as well as the increase of Maturity of the Virtual Centres and related services, while involving multiple ATSUs connected to one or several ADSPs. This part is being supported by another project SESAR W3 PJ32-VC W3. <p>EXE-PJ.10-W2-93-V3-VALP-003 exercise selected two delegation scenarios from the PJ.10-W2-93</p>		<p>EX3-CRT-PJ.10-W2-93-V3-VALP-044</p> <p>Impact remains acceptable according to ATCo expert judgment in terms of the management and provision of aircraft separation before, during and after the delegation of ATM services provision in nominal conditions are identified.</p>	<p>SRD-004 SRD-005 SRD-008 SRD-009 SRD-010 SRD-011 SRD-012 partially covered SRD-013 SRD-014 SRD-015 SRD-016 SRD-017 SRD-018 SRD-019 SRD-020 SRD-021 SRD-022 SRD-023 SRD-024 SRD-025 partially covered SRD-026 SRD-028 SRD-033 partially covered SRD-035</p>	<p>feedback, they were generally able to manage traffic in a safe way, although some potential safety related issues were detected mainly due to the lack of several supporting & conflict detection tools that are commonplace for ATS provision, and the level of sector knowledge for the receiving ATCOs.</p> <ul style="list-style-type: none"> Use cases with Dynamic AoR (delegated sector collapsed with receiving sector) could lead to potential selective attention from the receiving ATCOs due to gained processing fluency: receiving ATCOs inadvertently directing more of their attention to their usual sector rather than the entire AoR/ collapsed sectors. While the delegation procedure was found to support a safe delegation process, the interoperability limitations, particularly associated with

Exercise ID, Name, Goals	Exercise Safety Validation Objective & related SAC(s)	Success criterion	Coverage (SRS and/or SRD)	Validation results & Level of safety evidence
<p>V3 SPR-INTEROP_OSED, which were played in a VC platform of different architectures Y/U/D:</p> <ul style="list-style-type: none"> • Delegation of ATM services provision at night. • Delegation of ATM services provision in contingency (case of ATSU failure). 				<p>the U architecture, were found to lack the required maturity: clearances entered by the delegating ATSU were not visible on the receiving ATSU's CWP. The receiving ATCO team had to remember all these clearances (verbally coordinated during the exchange of traffic situation), and re-enter them for each flight after they were in operational mode.</p> <ul style="list-style-type: none"> • In general, the exchange of traffic situation phase needs to be complemented by adequate supporting tools in order to minimize, to the furthest extent practicable, the probability of information (or flights) being omitted/ misheard/ misinterpreted.

Exercise ID, Name, Goals	Exercise Safety Validation Objective & related SAC(s)	Success criterion	Coverage (SRS and/or SRD)	Validation results & Level of safety evidence
	<p>EX3-OBJ-PJ.10-W2-93-V3-VALP-009 Safety assessment in abnormal conditions To assess the impact in terms of Safety of the ATM services provision delegation concept in abnormal conditions</p> <p>SAC#01 SAC#02 SAC#03</p>	<p>EX3-CRT-PJ.10-W2-93-V3-VALP-045 The level of safety remains at an acceptable level according to ATCo's expert judgment before, during and after the delegation of ATM services provision in abnormal conditions.</p> <p>EX3-CRT-PJ.10-W2-93-V3-VALP-046 Impact remains acceptable according to ATCo's expert judgment in terms of the management and provision of aircraft separation before, during and after the delegation of ATM services provision in abnormal conditions are identified.</p>		<ul style="list-style-type: none"> • During the simulation runs, situational awareness and prescribed separation could be maintained. • The execution of the delegation procedure was found to support a safe delegation process. • According to ATCOs feedback, they were generally able to manage traffic in a safe way, although some potential safety related issues were detected mainly due to the lack of several supporting & conflict detection tools that are commonplace for ATS provision, and the level of sector knowledge for the receiving ATCOs. • Use cases with Dynamic AoR (delegated sector collapsed with receiving sector) could lead to potential selective attention from the receiving ATCOs due to gained processing fluency: receiving ATCOs

Exercise ID, Name, Goals	Exercise Safety Validation Objective & related SAC(s)	Success criterion	Coverage (SRS and/or SRD)	Validation results & Level of safety evidence
				<p>inadvertently directing more of their attention to their usual sector rather than the entire AoR/ collapsed sectors.</p> <ul style="list-style-type: none"> • While the delegation procedure was found to support a safe delegation process, the interoperability limitations, particularly associated with the U architecture, were found to lack the required maturity: clearances entered by the delegating ATSU were not visible on the receiving ATSU's CWP. The receiving ATCO team had to remember all these clearances (verbally coordinated during the exchange of traffic situation), and re-enter them for each flight after they were in operational mode. • In general, the exchange of traffic situation phase needs to be complemented by adequate supporting tools in order to

Exercise ID, Name, Goals	Exercise Safety Validation Objective & related SAC(s)	Success criterion	Coverage (SRS and/or SRD)	Validation results & Level of safety evidence
				minimize, to the furthest extent practicable, the probability of information (or flights) being omitted/ misheard/ misinterpreted.
<p>EXE-PJ.10-W2-93-V3-VALP-004 Delegation of ATM services provision among ATSU – ENAV The objective is to validate the delegation of ATM services provision among ATSU in nominal conditions and no normal conditions in a Virtual Centre platform.</p> <p>In particular, this validation activity aimed at demonstrating the operational feasibility, operational acceptance, and performance benefits of the PJ.10-W2-93 concept for the following use cases:</p>	<p>EX4-OBJ-PJ.10-W2-93-V3-VALP-014 To assess the impact in terms of Safety of the ATM services provision delegation concept in nominal conditions</p> <p>SAC#01 SAC#02 SAC#03</p>	<p>EX4-CRT-PJ.10-W2-93-V3-VALP-067</p> <p>The level of safety remains at an acceptable level according to ATCo’s expert judgment before, during and after the delegation of ATM services provision in nominal conditions.</p>	<p>SRS-001 SRS-005 SRS-006 SRS-008 SRS-009 SRS-010 SRS-011 SRS-012 SRS-013 SRS-014 SRS-015 Partially covered SRS-016 SRS-017 Partially covered SRD-001 SRD-002 SRD-004 SRD-005 SRD-006 SRD-007 SRD-008 SRD-010 SRD-011 SRD-013 SRD-014 SRD-015 SRD-016 SRD-017 SRD-018 SRD-019 SRD-022 SRD-023 SRD-026</p>	<p>In general, the level of safety was maintained acceptable throughout the runs. The procedure itself was considered quite safe. Overall, although the global level of safety was felt quite good, the controllers expressed some safety concerns. However, these concerns were more linked to specific situations in which controllers experienced difficulties with the use of system rather than attributable to a specific working technique or whether the traffic was delegated or not</p>

Exercise ID, Name, Goals	Exercise Safety Validation Objective & related SAC(s)	Success criterion	Coverage (SRS and/or SRD)	Validation results & Level of safety evidence
<ul style="list-style-type: none"> Delegation of ATM services provision at night Delegation of ATM services provision at fixed time Delegation of ATM services provision on-demand Delegation of ATM services provision between Civil and Military ATSUs 		<p>EX4-CRT-PJ.10-W2-93-V3-VALP-068</p> <p>Impact remains acceptable according to ATCo expert judgment in terms of the management and provision of aircraft separation before, during and after the delegation of ATM services provision in nominal conditions are identified.</p>	<p>SRD-028 SRD-029 SRD-030 SRD-032 SRD-033 SRD-034 SRD-036 Partially covered</p>	<p>According to ATCOs feedback, they were able to manage traffic in a quite safe way during all the phases of the delegation process ensuring a safe aircraft separation.</p>
	<p>EX4-OBJ-PJ.10-W2-93-V3-VALP-015 To assess the impact in terms of Safety of the ATM services provision delegation concept in abnormal conditions</p> <p>SAC#01 SAC#02 SAC#03</p>	<p>EX4-CRT-PJ.10-W2-93-V3-VALP-069</p> <p>The level of safety remains at an acceptable level according to ATCo's expert judgment before, during and after the delegation of ATM services provision in abnormal conditions.</p>		<p>Overall, the level of safety was maintained at acceptable levels throughout the contingency run. In fact, while the occurrence of contingency situation (e.g. VCS failure) prevented the controller to have access to all functionalities required to safely manage traffic, the possibility to delegate the traffic to another fully operating unit can be considered as a mitigations protecting against</p>

Exercise ID, Name, Goals	Exercise Safety Validation Objective & related SAC(s)	Success criterion	Coverage (SRS and/or SRD)	Validation results & Level of safety evidence
		<p>EX4-CRT-PJ.10-W2-93-V3-VALP-070 Impact remains acceptable according to ATCo's expert judgment in terms of the management and provision of aircraft separation before, during and after the delegation of ATM services provision in abnormal conditions are identified.</p>		<p>propagation of effects.</p> <p>During contingency runs, ATCOs were able to safely manage traffic. No major issues to be reported on the occurrence of some potential tactical conflicts. ATCOs stated that they would have felt more confident in case of conflict management tools availability. Controllers were able to manage traffic in a safe way during all the phases of the delegation process also in case of contingency events.</p>

Exercise ID, Name, Goals	Exercise Safety Validation Objective & related SAC(s)	Success criterion	Coverage (SRS and/or SRD)	Validation results & Level of safety evidence
EXE-PJ.10-W2-93-V3-VALP-005 Delegation of ATM services provision among ATSU – COOPANS The objective is to validate the delegation of ATM services provision among ATSU considering the following Use Cases: <ul style="list-style-type: none"> Delegation of ATM services provision in case of contingency Delegation of ATM services provision on-demand 	EXE5-OBJ-PJ.10-W2-93-V3-VALP-014 To assess the impact in terms of Safety of the ATM services provision delegation concept in nominal conditions SAC#01 SAC#02 SAC#03	EXE5-CRT-PJ.10-W2-93-V3-VALP-014-001 The level of safety remains at an acceptable level according to ATCo’s expert judgment before, during and after the delegation of ATM services provision in nominal conditions.	SRS-001 SRS-003 SRS-005 SRS-006 SRS-007 Partially covered SRS-009 SRS-015 Partially covered SRD-001 SRD-002 SRD-005 SRD-006 Partially covered SRD-007 SRD-008 SRD-009 SRD-010 SRD-011 SRD-012 Partially covered SRD-013 SRD-014	According to expert opinion, safety was not impaired even though ATCOs stated they missed some tools and warnings from their “normal” operational system. There was a varying delay in system inputs/outputs due to limited communication bandwidth with the ADSP which contributed to higher workload, but was not considered to affect safety.
		EXE5-CRT-PJ.10-W2-93-V3-VALP-014-002 Impact remains acceptable according to ATCo expert judgment in terms of the management and provision of aircraft separation before, during and after the delegation of ATM services provision in nominal conditions.	SRD-015 Partially covered SRD-016 Partially covered SRD-023 Partially covered SRD-030 SRD-035	ATCOs were able to ensure the management and provision of aircraft separation thanks to a good situational awareness and efficient coordination between planner and executive ATCOs.

Exercise ID, Name, Goals	Exercise Safety Validation Objective & related SAC(s)	Success criterion	Coverage (SRS and/or SRD)	Validation results & Level of safety evidence
EXE-PJ.10-W2-93-V3-VALP-006 Delegation of ATM services provision among ATSU – PANSA The objective is to validate the delegation of ATM services provision among ATSU considering the following Use Cases: <ul style="list-style-type: none"> Delegation of provision of ATS services – Cross Border; Night delegation of provision of ATS services. 	EXE6-OBJ-PJ.10-W2-93-V3-VALP-014 To assess the impact in terms of Safety of the ATM services provision delegation concept in nominal conditions. SAC#01 SAC#02 SAC#03	EXE6-CRT-PJ.10-W2-93-V3-VALP-014-001 The level of safety remains at an acceptable level before, during and after the delegation of ATM services provision in nominal conditions.	SRS-001 Partially covered SRS-008 Partially covered SRD-007 Partially covered SRD-030 Partially covered	Controllers agreed that the level of safety remained acceptable with the introduction of the new operating method particularly in terms of coordination between executive and planner ATCOs.
		EXE6-CRT-PJ.10-W2-93-V3-VALP-014-002 No negative impacts in terms of the management and provision of aircraft separation before, during and after the delegation of ATM services provision in nominal conditions are identified.		ATCOs were able to ensure the management and provision of aircraft separation thanks to a good situational awareness and efficient coordination between planner and executive ATCOs. ATCO should be trained to handle high traffic density in case of delegation of ATM services provision for emergency reason.

Table 1111111111. Solution Safety Validation results

4.3.3 Extrapolation to ECAC wide

The results obtained from the V3 exercises are limited to the specific environments the concept has been simulated in. Some limitations of validation exercises results are documented in the VALR [20]. Hence, further consolidated results need to be obtained from the future validation exercises, as not enough evidence is still available to extrapolate at ECAC level the impact of the new OI in terms of safety.

4.3.4 Discussion of Assessment Result

The available data obtained in terms of Safety were based on feedback provided by ATCOs involved in the Validation exercise. In some exercises the simulation environment was not completely representative for the controllers as there were some tools lacking (e.g., CD&R). Safety and Situation Awareness could be improved by additional controller support tools such as Safety Nets, MTCD or Smart traffic views during the Preview mode. Also, the obtained results are strongly related to the scenarios and traffic conditions tested within the exercises, not focusing on stressing the delegation procedure in case of higher workload. Hence, based on the data collected in the exercises and due to the limited number of exercises runs, no meaningful statistical analysis could be performed. The obtained results do give an indication of trends. Thus, this safety data/results obtained from the V3 exercises in combination with other safety related activities (e.g., workshops) enables us to conclude that safety is not negatively impacted although the concept needs to be further assessed considering a set of recommendations included in the VALR [22].

4.3.5 Additional Comments and Notes

No additional comments and notes.

4.4 Environment: Fuel Efficiency / CO2 emissions

Does the Solution impact this KPA? Yes

4.4.1 Performance Mechanism

The delegation of the provision of ATM services among ATSUs due to load balancing purposes will allow AUs to fly more efficient trajectories, as the number of airspace disruptions and flight constraints originated by ATFCM measures might decrease. This could lead to a reduction of the fuel burnt and consequently, a reduction in the CO₂ emissions.

4.4.2 Assessment Data (Exercises and Expectations)

The benefits obtained for FEEF1 have been gathered through RTS.

- EXE-PJ.10-W2-93-V2-VALP-002, for En-Route MC – 44.65 kg / flight saved (-9.60%, positive impact).
- EXE-PJ.10-W2-93-V2-VALP-004, for En-Route MC – 19.79 kg / flight saved (-1.53% positive impact).

Average value (local): -32 kg / flight saved (-5.6% positive impact)

4.4.3 Extrapolation to ECAC wide

According to PJ.19, the airspace under analysis is considered as En-Route MC. However, the actual classification of this airspace in the context of Network Operations is En-Route HC and VHC. The project considers, as reported in the VALR, that the results obtained are representative of high and very high complexity environments. Therefore, the extrapolation is performed on this basis with the following assumptions:

- En-Route VHC represents a 31.33% of the total ECAC traffic 2035.
- En-Route HC represents a 27.98% of the total ECAC traffic 2035.
- En-Route MC represents a 37.89% of the total ECAC traffic 2035.
- En-Route peak traffic hours (high-density En-Route airspace) – situations where the benefit described is relevant – represent 5 h out of 24 h (20.8%).
- Average fuel burn per flight 5,280.00 kg

The benefit extrapolation results as follows:

- Absolute terms: (-32 kg/flight) x (97.2%) x (20.8%) – 6.5 kg of fuel burnt saved / flight
- Relative terms: (6.5 kg saved/flight / 5,280 kg/flight)*100 – 0.12%

KPIs / Pls	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
FEEF1 Actual Average fuel burn per flight	Kg fuel per movement	Total amount of actual fuel burn divided by the number of movements	YES	- 6.5 kg / flight (positive impact)	- 0.12% (positive impact)

KPIs / PIs	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
ENV1 Actual Average CO2 Emission per flight	Kg CO2 per flight	Amount of fuel burnt x 3.15 (CO2 emission index) divided by the number of flights	YES	- 20.5 kg / flight (positive impact)	- 0.12% (positive impact)

Table [1212121242](#): Fuel burn and CO2 emissions saving for Mandatory KPIs /PIs

	Taxi out	TMA departure	En-route	TMA arrival	Taxi in
FEFF1 Actual Average fuel burn per flight	Not available	Not available	- 6.5 kg / flight (positive impact)	Not available	Not available
ENV1 Actual Average CO2 Emission per flight	Not available	Not available	- 20.5 kg / flight (positive impact)	Not available	Not available

Table [1313131313](#): Fuel burn and CO2 emissions saving per flight phase.

Were there any benefits obtained in SESAR2020 Wave1 for this Solution? No.

4.4.4 Discussion of Assessment Result

The benefits obtained at V3 are based on a limited number of runs of only two validation activities. Shadow mode activities and fast-time simulations are recommended in order to confirm these benefits.

4.4.5 Additional Comments and Notes

N/A.

4.5 Environment / Emissions, Noise and Local Air Quality

Does the Solution impact this KPA? No impact is expected in Noise and Local Air Quality.

4.6 Airspace Capacity (Throughput / Airspace Volume & Time)

Does the Solution impact this KPA? Yes

4.6.1 Performance Mechanism

In those cases of lack of capacity in a sector or more sectors of an ATSU due to resource limitations, full transfer of responsibility of any of these sectors to a less overloaded ATSU will improve the use of spare capacity and therefore the throughput will increase. The potential higher availability of ATCOs in peak periods could lead to a better use of spare capacity.

On the other hand, the simplification and standardisation of the ATC procedures when delegating the provision of Air Traffic Services amongst different ATSUs should not imply any kind of negative impact on ATCO workload nor in Capacity. Therefore, a trade-off between more common and simpler procedures and Capacity should be considered

The use of the spare capacity will be improved due to the increase of En-Route throughput and maintenance of ATCO workload at acceptable levels.

4.6.2 Assessment Data (Exercises and Expectations)

Exercise ID or Expert judgement	Benefits contribution to CAP1	Benefits contribution to CAP2
EXE-PJ.10-W2-93-V2-VALP-002	+ 12.30 (VHC)	+ 19.50% (MC)
EXE-PJ.10-W2-93-V2-VALP-004	N/A	+ 3.51% (MC)
EXE-PJ.10-W2-93-V2-VALP-005	N/A	+ 8.10% (MC)

Table [1414141414](#): Airspace Capacity benefits per Exercise

Average value (local):

- TMA (CAP1): + 12.30 %
- En-Route (CAP2): + 10.4 %

OI step	Relative benefits contribution to CAP1	Relative benefits contribution to CAP2
SDM-0217	100%	100%
TOTAL	100%	100%

Table [1515151515](#): Airspace Capacity relative benefits per OI step

KPIs / PIs	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
CAP1 TMA throughput, in challenging airspace, per unit time	Relative change of movements (% and number of movement)	% and also total number of movements per volume of TMA airspace per hour for specific traffic mix and density, for High and Medium Complexity TMAs. TMA at peak demand hours.	YES	+ 12.30 %	+ 12.30 %
CAP2 En-route throughput, in challenging airspace, per unit time	Relative change of movements (% and number of movement)	% and also total number of movements, per volume of En-Route airspace per hour for specific traffic mix and density, for High and Medium Complexity TMAs.airspace at peak demand hours.	YES	+ 10.4 %	+ 10.4 %

Table 1616161616: Airspace benefits for Mandatory KPIs /PIs

Were there any benefits obtained in SESAR2020 Wave1 for this Solution? No

4.6.3 Extrapolation to ECAC wide

There is no ECAC wide extrapolation required for this KPI in the Performance Assessment Report.

4.6.4 Discussion of Assessment Result

The benefits obtained at V3 are based on a limited number of runs of only two validation activities. Shadow mode activities and fast-time simulations are recommended in order to confirm these benefits.

4.6.5 Additional Comments and Notes

According to PJ.19, the airspace under analysis is considered as En-Route MC. However, the actual classification of this airspace in the context of Network Operations is En-Route HC and VHC. The project considers, as reported in the VALR, that the results obtained are representative of high and very high complexity environments.

4.7 Airport Capacity (Runway Throughput Flights/Hour)

Does the Solution impact this KPA? No.

4.8 Resilience (% Loss of Airport & Airspace Capacity Avoided)

Does the Solution impact this KPA? Yes

4.8.1 Performance Mechanism

The delegation of the provision of ATM services in case of contingency will reduce the time needed to recover from an ATC system failure or degradation, since the movement of Air Traffic Controllers from the ATSU in contingency to the Contingency Centers will not be needed. Instead, in case of contingency, the ATM services provision will be delegated to another ATSU where controllers will be already prepared to take control of the contingency situation.

En-Route Throughput will be increased as the duration and loss of airspace capacity will be reduced enabled by the delegation of ATM services provision.

4.8.2 Assessment Data (Exercises and Expectations)

EXE-PJ.10-W2-93-V2-VALP-003 has determined that the delegation procedure takes, on average, between 1 min and 3 min. Without the delegation procedure, the time to recover is at least 2 hours.

The following results consider a full delegation of the airspace that, in current operations, would be closed or partially closed until the full recovery.

Exercise ID or Expert judgement	Benefits contribution to RES1	Benefits contribution to RES1.1	Benefits contribution to RES2	Benefits contribution to RES2.1	Benefits contribution to RES4	Benefits contribution to RES5
EXE-PJ.10-W2-93-V2-VALP-003	N/A	N/A	+2.5% +10.4%	- - 98% (positive impact)	Not assessed	Not assessed

Table 1717171717: Resilience benefits per Exercise

OI step	Relative benefits contribution to RES1	Relative benefits contribution to RES1.1	Relative benefits contribution to RES2	Relative benefits contribution to RES2.1	Relative benefits contribution to RES4	Relative benefits contribution to RES5
SDM-0217	N/A	N/A	100%	100%	Not assessed	Not assessed
TOTAL	100%	100%	100%	100%	100%	100%

Table 1818181818: Resilience relative benefits per OI step

PIs	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
RES1 Loss of Airport Capacity Avoided	% and Movements per hour	Loss of Airport Capacity with the concept divided by the loss of Airport Capacity without the concept.	YES	N/A	N/A

PIs	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
RES 1.1 Airport time to recover from non-nominal to nominal condition	Minutes	Duration of Airport lost capacity from non-nominal to nominal condition.	YES for Airport OE Solutions	N/A	N/A
RES2 Loss of Airspace Capacity Avoided	% and Movements per hour	Loss of Airspace Capacity with the concept divided by the loss of Airspace Capacity without the concept	YES	+2.5% - +10.4%	+2.5% - +10.4%
RES2.1 Airspace time to recover from non-nominal to nominal condition	Minutes	Duration of Airspace lost capacity compared to non-nominal to nominal condition.	YES for Airspace OE Solutions	- 98% (positive impact)	- 98% (positive impact)
RES4 Minutes of delays	Minutes	Impact on AUs measured through delays resulting from capacity degradation ⁵ . RES1 and RES2 KPIs drive this PI, though the PI may need to be measured on a condition-by-condition basis (e.g. fog, wind, system outage).	YES	Not assessed	Not assessed
RES5 Number of cancellations	No flights	Impact on AUs measured through Cancellations resulting from capacity degradation ⁶ . RES1 and RES2 KPIs drive this PI, though the PI may need to be measured on a condition-by-condition basis (e.g. fog, wind, system outage).	YES	Not assessed	Not assessed

Table 1919191919: Resilience for Mandatory PIs

Were there any benefits obtained in SESAR2020 Wave1 for this Solution? No.

4.8.3 Extrapolation to ECAC wide

There is no ECAC wide extrapolation required for this KPI in the Performance Assessment Report.

⁵ Reactionary delay out of the scope since they could be due to many different reasons other than capacity degradation, in addition the cause of reactionary delay are not recorded in detail.

⁶ Reactionary delay out of the scope since they could be due to many different reasons other than capacity degradation, in addition the cause of reactionary delay are not recorded in detail.

4.8.4 Discussion of Assessment Result

The benefits obtained at V3 are based on a limited number of runs of only two validation activities. Shadow mode activities and fast-time simulations are recommended in order to confirm these benefits.

4.8.5 Additional Comments and Notes

According to PJ.19, the airspace under analysis is considered as En-Route MC. However, the actual classification of this airspace in the context of Network Operations is En-Route HC and VHC. The project considers, as reported in the VALR, that the results obtained are representative of high and very high complexity environments.

4.9 Flight Times

Does the Solution impact this KPA? Yes.

4.9.1 Performance Mechanism

The delegation of the provision of Air Traffic Services amongst ATSUs in periods of low demand or due to load balancing purposes will allow AUs to fly more efficient trajectories, as the number of airspace disruptions and flight constraints originated by ATFCM measures might decrease. This will lead to improved flight durations.

4.9.2 Assessment Data (Exercises and Expectations)

Exercise ID or Expert judgement	Benefits contribution to TEFF1	Benefits contribution to TEFF2	Benefits contribution to TEFF3	Benefits contribution to TEFF4	Benefits contribution to TEFF5	Benefits contribution to TEFF6
EXE-PJ.10-W2-93-V2-VALP-002	- 0.78 min	N/A	N/A	N/A	N/A	- 0.78 min
EXE-PJ.10-W2-93-V2-VALP-004	- 0.53 min	N/A	N/A	N/A	N/A	- 0.53 min

Table 2020202020: Flight Times benefits per Exercise

Average value (local): - 0.66 min (TEFF1, TEFF6)

OI step	Relative benefits contribution to TEFF1	Relative benefits contribution to TEFF2	Relative benefits contribution to TEFF3	Relative benefits contribution to TEFF4	Relative benefits contribution to TEFF5	Relative benefits contribution to TEFF6
SDM-0217	100%	N/A	N/A	N/A	N/A	100%
TOTAL	100%	N/A	N/A	N/A	N/A	100%
TOTAL	100%	100%	100%	100%	100%	100%

Table 2121212124: Flight Times relative benefits per OI step

4.9.3 Extrapolation to ECAC wide

According to PJ.19, the airspace under analysis is considered as En-Route MC. However, the actual classification of this airspace in the context of Network Operations is En-Route HC and VHC. The project considers, as reported in the VALR, that the results obtained are representative of high and very high complexity environments. Therefore, the extrapolation is performed on this basis with the following assumptions:

- En-Route VHC represents a 31.33% of the total ECAC traffic 2035.
- En-Route HC represents a 27.98% of the total ECAC traffic 2035.
- En-Route MC represents a 37.89% of the total ECAC traffic 2035.
- En-Route peak traffic hours (high-density En-Route airspace) – situations where the benefit described is relevant – represent 5 h out of 24 h (20.8%).
- Average ECAC flight duration – 1.7 h (102 min)

The benefit extrapolation results as follows:

- Absolute terms: $(-0.66 \text{ min/flight}) \times (97.2\%) \times (20.8\%) = 0.13 \text{ min saved / flight}$
- Relative terms: $(-0.13 \text{ min saved/flight} / 102 \text{ min/flight}) \times 100 = 0.13\%$

KPIs / Pls	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
TEFF1 Gate-to gate flight time	Min/flight	Average of the distribution of actual gate-to-gate flight durations	YES	- 0.13 min / flight (positive impact)	- 0.13% (positive impact)
TEFF2 Taxi in time	Min/flight	Average of the distribution of actual taxi-in (including ground queuing during taxi-in) durations	When relevant	N/A	N/A
TEFF3 Taxi out time	Min/flight	Average of the distribution of actual taxi-out (including ground queuing during taxi-out) durations	When relevant	N/A	N/A
TEFF4 TMA arrival time	Min/flight	Average of the distribution of actual TMA arrival (including holdings) durations	When relevant	N/A	N/A
TEFF5 TMA departure time	Min/flight	Average of the distribution of actual TMA departure durations	When relevant	N/A	N/A
TEFF6 En-Route time	Min/flight	Average of the distribution of actual en-route durations	When relevant	- 0.13 min / flight (positive impact)	- 0.13% (positive impact)

Table 2222222222: Flight Times benefits for Mandatory KPIs /Pls

Table 23232323Table 2323Table 23 is showing the impact on flight phases (provided when it is possible).

	Taxi out	TMA departure	En-route	TMA arrival	Taxi in
TEFF1 Gate-to gate flight time	N/A	N/A	-0.13 min/flight	N/A	N/A
TEFF2	N/A	N/A	N/A	N/A	N/A

⁷ Although no major time inefficiencies occur during climb, this phase has been included for consistency.

Taxi in time					
TEFF3 Taxi out time	N/A	N/A	N/A	N/A	N/A
TEFF4 TMA arrival time	N/A	N/A	N/A	N/A	N/A
TEFF5 TMA departure time	N/A	N/A	N/A	N/A	N/A
TEFF6 En-Route time	N/A	N/A	-0.13 min/flight	N/A	N/A

Table ~~2323232323~~: Flight times benefit per flight phase.

Were there any benefits obtained in SESAR2020 Wave1 for this Solution? No.

4.9.4 Discussion of Assessment Result

The benefits obtained at V3 are based on a limited number of runs of only two validation activities. Shadow mode activities and fast-time simulations are recommended in order to confirm these benefits.

4.9.5 Additional Comments and Notes

N/A.

4.10 Predictability

Does the Solution impact this KPA? Yes.

4.10.1 Performance Mechanism

The ATFCM delays will be reduced on those cases where regulations are potential mitigations to solve capacity problems due to resource limitations meaning that airspace configurations with more sectors can be opened. The transfer of responsibility of one or more overloaded sectors to a different ATSU with spare capacity will avoid the application of regulations and therefore the imposition of delays. This will lead to a reduction of the number of DCB measures imposed and to a better use of the spare capacity. In addition, the application of demand measures will be reduced on those cases where trajectory measures are potential mitigations to solve capacity problems due to resource limitations, meaning that airspace configurations with more sectors can be opened. This will lead to a reduction of the number of DCB measures imposed.

Therefore, the number of DCB measures to solve traffic peaks may decrease if there is a decrease in the number of regulations and demand measures when delegating airspace due to traffic load balancing purposes. This will improve predictability.

Finally, a better Civil-Military coordination will be enabled by the delegation of ATM services provision between civil and military units, increasing the flexibility and predictability of the airspace usage.

4.10.2 Assessment Data (Exercises and Expectations)

Exercise ID or Expert judgement	Benefits contribution to PRD1	Benefits contribution to PRD2
EXE-PJ.10-W2-93-V2-VALP-002	- 0.60 min	- 0.059 min ²
EXE-PJ.10-W2-93-V2-VALP-004	- 0.57 min	Not available

Table 2424242424: Predictability benefits per Exercise

Average value (local):

- -0.59 min (PRD1)
- -0.059 min² (PRD2)

OI step	Relative benefits contribution to PRD1	Relative benefits contribution to PRD2
SDM-0217	100%	100%
TOTAL	100%	100%

Table 2525252525: Predictability relative benefits per OI step

4.10.3 Extrapolation to ECAC wide

According to PJ.19, the airspace under analysis is considered as En-Route MC. However, the actual classification of this airspace in the context of Network Operations is En-Route HC and VHC. The project

considers, as reported in the VALR, that the results obtained are representative of high and very high complexity environments. Therefore, the extrapolation is performed on this basis with the following assumptions:

- En-Route VHC represents a 31.33% of the total ECAC traffic 2035.
- En-Route HC represents a 27.98% of the total ECAC traffic 2035.
- En-Route MC represents a 37.89% of the total ECAC traffic 2035.
- En-Route peak traffic hours (high-density En-Route airspace) – situations where the benefit described is relevant – represent 5 h out of 24 h (20.8%).
- B2B variability – 49 min²

The benefit extrapolation results as follows:

- Absolute terms: $(-0.059 \text{ min}^2) \times (97.2\%) \times (20.8\%) = 0.012 \text{ min}^2$ (positive benefit)
- Relative terms: $(-0.012 \text{ min}^2 / 49 \text{ min}^2) \times 100 = 0.02\%$ (positive benefit)

KPIs / PIs	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
PRD1 Average of Difference in actual & Flight Plan or RBT durations	Minutes	Average of the distribution of the differences between flown trajectories & Flight Plans or RBT durations	YES	<i>Only local value available. Extrapolation at ECAC level cannot be performed due to the lack of common assumptions for this KPI</i>	
PRD2 Variance ⁸ of Difference in actual & Flight Plan or RBT durations	Minutes ²	Variance of the distribution of the differences between flown trajectories & Flight Plans or RBT durations	YES	- 0.012 min ² (positive benefit)	- 0.02% (positive benefit)

Table 2626262626: Predictability benefits for Mandatory KPIs /PIs

Table 27272727Table 2727Table 27 is showing the impact on flight phases (provided when it is possible).

	Taxi out	TMA departure	En-route	TMA arrival	Taxi in
PRD1 Average of Difference in actual & Flight Plan or RBT durations	N/A	N/A	Only local value available. Extrapolation at ECAC level cannot be performed due to the lack of common assumptions for this KPI	N/A	N/A

⁸ Standard Deviation is also accepted (in minutes).

	Taxi out	TMA departure	En-route	TMA arrival	Taxi in
PRD2 Variance of Difference in actual & Flight Plan or RBT durations	N/A	N/A	-0.012 min ²	N/A	N/A

Table ~~2727272727~~: Predictability benefit per flight phase

Were there any benefits obtained in SESAR2020 Wave1 for this Solution? No.

4.10.4 Discussion of Assessment Result

The benefits obtained at V3 are based on a limited number of runs of only two validation activities. Shadow mode activities and fast-time simulations are recommended in order to confirm these benefits.

4.10.5 Additional Comments and Notes

PRD1 cannot be extrapolated at ECAC level due to the lack of common assumptions defined at programme level for this KPI.

4.11 Punctuality

Does the Solution impact this KPA? No.

4.12 Civil-Military Cooperation and Coordination (Distance and Fuel)

Does the Solution impact this KPA? No.

4.13 Flexibility

Does the Solution impact this KPA? Yes.

4.13.1 Performance Mechanism

A better Civil-Military coordination will be enabled by the delegation of ATM services provision between civil and military units, increasing the flexibility and predictability of the airspace usage.

The Contingency Plans are also expected to be more flexible, since more contingency solutions will be available for the ANSPs.

4.13.2 Assessment Data (Exercises and Expectations)

The benefits of FLX1 included in this report have been obtained from PJ.10-W2-93 V2 Performance Assessment Report, that were based on expert judgment. No further assessments were made at V3 exercise level.

Exercise ID or Expert judgement	Benefits contribution to FLX1
Expert judgment	-1% - -1.5% positive impact

Table 2828282828: Flexibility benefit per Exercise

OI step	Relative benefits contribution to FLX1
SDM-0217 (CR 03600)	100%
TOTAL	100%

Table 2929292929: Flexibility relative benefit per OI step

4.13.3 Extrapolation to ECAC wide

PIs	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
FLX1 Average delay for scheduled civil/military flights with change request and non-scheduled or late flight plan request	Minutes	Total delay for scheduled flights with change request and non-scheduled or late filling flights [AOBT – SOBT], divided by number of movements	YES	Not assessed	-1% - 1.5% positive impact

Table 3030303030: Flexibility benefit for Mandatory KPIs /PIs

Table 3131313131 Table 31 is showing the impact on flight phases (provided when it is possible).

	Taxi out	TMA departure	En-route	TMA arrival	Taxi in
FLX1 Average delay for scheduled civil/military flights with change request and non-scheduled or late flight plan request	N/A	Not assessed	-1% - -1.5% positive impact	Not assessed	N/A

Table ~~3131313131~~31: Flexibility benefit per flight phase.

Were there any benefits obtained in SESAR2020 Wave1 for this Solution? No.

4.13.4 Discussion of Assessment Result

The benefits presented are just an expectation based on expert judgment (V2 phase). These benefits shall be confirmed with shadow mode activities and fast-time simulations.

4.13.5 Additional Comments and Notes

N/A.

4.14 Cost Efficiency

Does the Solution impact this KPA? Yes.

The Cost Efficiency performance metric is the direct gate-to-gate ANS cost per flight. It is being assessed by means of the following two KPIs:

- ATCO Productivity improvement (%) – En-Route or TWR/APP, assessing the reduction of workload per controlled flight hour.
- Technology Related Cost-Efficiency Improvement (%) – by assessing the contributions of the technology enablers to a change in asset costs and/or operating costs (maintenance, etc), including support costs improvements (support personnel productivity).

4.14.1 Performance Mechanism

When traffic demand is low, full transfer of responsibility of one of more sectors from one ATSU to another ATSU will improve the Cost-Efficiency as the number of ATCOs on duty might decrease.

The Delegation of Air Traffic Services amongst ATSUs might imply ATCOs to be trained to control in different sectors of different ATSUs, increasing therefore the training times and costs to keep the competences and licenses considering the current competence and licensing model. In a future environment, ATCOs should be trained for a set of tools, and therefore they should be able to manage more sectors.

In addition, the delegation of ATM services provision amongst ATSUs (both from the same or different ANSP) will impact the ANSP Resources Management capabilities, and in particular, will have an impact on ANSP cost optimisation. The contingency solutions enabled by the delegation of ATM services provision will reduce the need of having contingency centres, and thus, the ANSP resources could be optimised.

4.14.2 Assessment Data (Exercises and Expectations)

Exercise ID or Expert judgement	Benefits contribution to CEF2	Benefits contribution to CEF3	Benefits contribution to CEF1
EXE-PJ.10-W2-93-V2-VALP-002	+24.70%	N/A	To be assessed by PJ19
EXE-PJ.10-W2-93-V2-VALP-003	+40%	Not assessed	To be assessed by PJ19
EXE-PJ.10-W2-93-V2-VALP-004	Not assessed	+11.72%	To be assessed by PJ19
EXE-PJ.10-W2-93-V2-VALP-005	+6%	Not assessed	To be assessed by PJ19

Table 3232323232: Cost Efficiency benefit per Exercise

Average value (local):

- CEF2: + 23.6 %
- CEF3: + 11.72 %

OI step	Relative contribution to CEF2 benefits	Relative contribution to CEF3 benefits	Relative contribution to CEF1 benefits
SDM-0217	100%	100%	To be assessed by PJ19
TOTAL	100%	100%	100%

Table 3333333333: Cost Efficiency relative benefit per OI step

4.14.3 Extrapolation to ECAC wide

According to PJ.19, the airspace under analysis is considered as En-Route MC (ENAI, COOPANS, ENAV) and VHC (skyguide). However, the actual classification of this airspace in the context of Network Operations is En-Route HC and VHC. The project considers, as reported in the VALR, that the results obtained are representative of high and very high complexity environments.

Therefore, the extrapolation is performed for CEF2 on this basis with the following assumptions:

- En-Route VHC represents a 31.33% of the total ECAC traffic 2035.
- En-Route HC represents a 27.98% of the total ECAC traffic 2035.
- En-Route MC represents a 37.89% of the total ECAC traffic 2035.
- In addition, it is considered that most of the CEF2 benefit is obtained with low and medium traffic demand levels. Bearing in mind that En-Route peak traffic hours (high-density En-Route airspace) represent 5 h out of 24 h (20.8%), the benefit under analysis is mostly applicable for the rest of the day, i.e., 19 h (79.2%).

The CEF2 benefit extrapolation results as follows:

- Absolute terms: (23.6%) x (97.2%) x (79.2%) – +18.2%

The Aggregation of the benefits at ECAC level:

- Overall benefit in CEF2 → 3.3 + 1.8 + 0.8 → + 5.9%

Formatted: Font: Skeena, 10 pt, Underline, Font color: Custom Color(RGB(31,73,125))

Formatted: Normal, Indent: Left: 0.25", No bullets or numbering

Formatted: Normal, No bullets or numbering

The extrapolation for CEF2 is performed based on the following assumptions:

- Eligible ATSUs: 241
- Applicable ATSUs: 32

The CEF3 benefit extrapolation results as follows:

- Absolute terms: (11.72%) x 32 / 241 – +1.56%

KPIs / PIs	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
CEF2 ⁹ Flights per ATCO-Hour on duty	No	Count of Flights handled divided by the number of ATCO-Hours applied by ATCOs on duty.	YES	+0.205%	+0.205%
CEF3 Technology cost per flight	EUR / flight	G2G ANS cost changes related to technology and equipment.	YES	-1.56% (positive impact)	-1.56% (positive impact)
CEF1 Direct ANS Gate-to-gate cost per flight	EUR / flight	Derived by PJ19, taking into account results for the other two KPIs as contributing factors.	Yes but derived from the other two KPIs below	To be assessed by PJ19	To be assessed by PJ19

Table 3434343434: Cost Efficiency benefit for Mandatory KPIs /PIs

Were there any benefits obtained in SESAR2020 Wave1 for this Solution? No.

4.14.4 Discussion of Assessment Result

The benefits obtained at V3 are based on a limited number of runs of only two validation activities. Shadow mode activities and fast-time simulations are recommended in order to confirm these benefits.

4.14.5 Additional Comments and Notes

N/A.

⁹ The benefits are determined by converting workload reduction to a productivity improvement, and then scale it to peak traffic in the applicable sub-OE category. It has to be peak traffic because there must be demand for the additional capacity (note that in this case the assumption is that the additional capacity is used for additional traffic).

4.15 Airspace User Cost Efficiency

Does the Solution impact this KPA? No.

4.16 Security

4.16.1 The SecRAM 2.0 methodology and the Security Performance Mechanism

Security Assessment was performed using SecRAM (SESAR ATM security risk assessment methodology) but, due to the confidentiality of the results, they cannot be shared in this document, except for Security Requirements (listed in 4.16.4 “Discussion on Assessment results” section).

Security risk assessment is a process to identify and mitigate the consequences of an attack. It defines a set of security requirements to ensure that if an attack takes place the consequences have been estimated and can be managed and may contribute to the recovery of normal operations in a reasonable time.

The steps of security risk assessment are:

- Define the scope of the risk assessment (description of involved roles, equipment, systems...) and the identification of dependencies on other systems and infrastructure.
- Identify assets and value possible impacts on assets: assets form the targets of security attacks.
- Identify vulnerabilities, threats and likely threat combinations: it comprises the identification of possible (or credible) threat sources and related threat scenarios.
- Identify a set of security controls that act upon the supporting assets, that will reduce the impact on Primary Assets.
- Determine the likelihood of the impact on Primary Assets to occur
- Assess the security risk
- Determine whether the security risk is within the acceptable level set by the Cyber Security Objectives – if not, it is necessary to go back in the process to identify how the situation can be improved.

4.16.2 Security Assessment Data Collection

SESAR Solution PJ.10-W2-93 aims at exploring operational concepts of the delegation of ATM services provision amongst ATSUs. Delegations can be done either in nominal operating conditions in order to improve the overall efficiency of the ATM system or in abnormal conditions (i.e., contingency situations) in order to improve the resilience of the network and to minimise the impact of a system failure.

The delegation of ATM services provision concept applies when one ATSU delegates a portion of its airspace, or the entire airspace, to another ATSU based on a particular condition. The Solution will investigate Use Cases for the Delegation of ATM services in conjunction with the Virtual Centre Technology, where the ATM Data Service Provider is geographically decoupled from the ATSU providing ATS to a region of airspace.

SESAR Solution ID	SESAR Solution Title	OI Steps ID	OI Steps Title	OI Step/Enabler Coverage
PJ.10-W2-93	Delegation of ATM services provision between ATSUs	SDM-0217	Delegation of ATM Services between ATSUs	Fully

Table 3535353535 SESAR Solution PJ.10-W2-WP3 Scope and related OI step

PIs	Unit	Calculation	Mandatory	Current value
SEC1 A security risk assessment has been carried out	Binary Vector – with maximum 7 components with Y/N (according to the prioritization and maturity level of the solution)	A security risk assessment has been carried out applying SecRAM 2.0, and the following steps have each been carried out : The identification of Primary Assets, Supporting Assets, Threat Scenarios and Vulnerabilities; The evaluation of Impacts, Likelihoods and Risks.	YES (different steps are strongly recommended for different maturity levels)	Y,Y,Y,Y,Y;Y
SEC2 Risk Treatment has been carried out	Binary Vector – 2 components with Y/N	Following SecRAM 2.0, Security controls have been identified by Security Experts and implemented in the Solution.	YES (implementation just at higher maturity levels – V4)	Y,N
SEC3 Residual risk after treatment meets security objective.	Risk Level – 2 levels are possible: medium or low	After Security Controls have been implemented, the Risk Level achieved per Supporting Asset decreases (H → M, M→L, H→L). It is important to notice that according to SecRAM the Risk Level achieved should be “Low” otherwise justifications must be provided.	YES	The Risk Level achieved for each Supporting Asset always decreases

Table 3636363636: Security benefit for Mandatory PIs

For confidentiality reasons we cannot explicitly express the Risk Level after controls: we just reported that it is decreased in all relevant cases.

4.16.3 Extrapolation to ECAC wide

There is not ECAC extrapolation for this KPI.

4.16.4 Discussion of Assessment Result

Results presented in OSED – Part I as security requirements.

4.16.5 Additional Comments and Notes

N/A.

4.17 Human Performance

4.17.1 HP arguments, activities and metrics

The information reported in the table below refers to the outcomes of PJ.10-W2-93 Real Time Simulations. It has been collected from the Human Performance Assessment Plan, Human Performance Assessment Report and Validation Report.

PIs	Activities & Metrics	Second level indicators	Covered
HP1 Consistency of human role with respect to human capabilities and limitations	Real Time Simulation	HP1.1 Clarity and completeness of role and responsibilities of human actors	Closed
		HP1.2 Adequacy of operating methods (procedures) in supporting human performance	Closed
		HP1.3 Capability of human actors to achieve their tasks in a timely manner, with limited error rate and acceptable workload level	Closed
HP2 Suitability of technical system in supporting the tasks of human actors	Real Time Simulation	HP2.1 Adequacy of allocation of tasks between the human and the machine (i.e. level of automation).	Closed
		HP2.2 Adequacy of technical systems in supporting Human Performance with respect to timeliness of system responses and accuracy of information provided	Closed
		HP2.3 Adequacy of the human machine interface in supporting the human in carrying out their tasks.	Closed
HP3 Adequacy of team structure and team communication in supporting the human actors	Real Time Simulation	HP3.1 Adequacy of team composition in terms of identified roles	Closed
		HP3.2 Adequacy of task allocation among human actors	Closed
		HP3.3 Adequacy of team communication with regard to information type, technical enablers and impact on situation awareness/workload	Closed
HP4 Feasibility with regard to HP-related transition factors	Real Time Simulation	HP4.1 User acceptability of the proposed solution	Closed
		HP4.2 Feasibility in relation to changes in competence requirements	Not covered
		HP4.3 Feasibility in relation to changes in staffing levels, shift organization and workforce relocation.	Not covered

PIs	Activities & Metrics	Second level indicators	Covered
		HP4.4 Feasibility in relation to changes in recruitment and selection requirements .	Not covered
		HP4.5 Feasibility in terms of changes in training needs with regard to its contents, duration and modality.	Closed

Table ~~37373737~~: HP arguments, activities and metrics

4.17.2 Extrapolation to ECAC wide

There is no ECAC wide extrapolation required for this KPI.

4.17.3 Open HP issues/ recommendations and requirements

PIs	Number of open issues/ benefits	Nr. of recommendations	Number of requirements
HP1 Consistency of human role with respect to human capabilities and limitations	5	7	1
HP2 Suitability of technical system in supporting the tasks of human actors	1	4	2
HP3 Adequacy of team structure and team communication in supporting the human actors	4	2	0
HP4 Feasibility with regard to HP-related transition factors	3	2	1

Table ~~38383838~~: Open HP issues/ recommendations and requirements

4.17.4 Concept interaction

For the V3 phase, a particular interaction was identified with SESAR Solution PJ.32-W3 Virtual Centre.

4.17.5 Most important HP issues

PIs	Most important issue of the solution	Most important issues due to solution interdependencies
HP1 Consistency of human role with respect to human capabilities and limitations	During the normal operating conditions, the level of workload might be maintained, but during the delegation the Workload could increase (e.g. if the occupancy is high in the delegated airspace).	

PIs	Most important issue of the solution	Most important issues due to solution interdependencies
HP2 Suitability of technical system in supporting the tasks of human actors	The level of trust in the system was not satisfactory. In fact, some problems raised during the validation related to the fact that the simulation environment was not the operational system the controllers are used to. ATCOs proposed a list of improvements for HMI and platform.	
HP3 Adequacy of team structure and team communication in supporting the human actors	No issue concerning team structure and team communication	
HP4 Feasibility with regard to HP-related transition factors	According to the controllers' feedback, gathered during the debriefing session, adequate training is needed. In addition, licensed and appropriately skilled ATCOs are needed in the receiving units.	

Table 3939393939: Most important HP issues

4.17.6 Additional Comments and Notes

N/A.

4.18 Other PIs

N/A.

4.19 Gap Analysis

The objective of the gap analysis is a comparison between the validation targets and the performance assessment.

KPI	Validation Targets – Network Level (ECAC Wide)	Performance Benefits at Network Level (ECAC Wide or Local depending on the KPI) ¹⁰	Rationale ¹¹
SAF1: Safety - Total number of estimated accidents with ATM Contribution per year	SAF assessment required.	Safety assessment conducted.	N/A
FEFF1: Fuel Efficiency - Actual average fuel burn per flight	High	- 6.5 kg / flight (positive impact)	N/A
CAP1: TMA Airspace Capacity - TMA throughput, in challenging airspace, per unit time.	High	+ 12.30 %	N/A
CAP2: En-Route Airspace Capacity - En-route throughput, in challenging airspace, per unit time	High	+ 10.4 %	N/A
CAP3: Airport Capacity – Peak Runway Throughput (Mixed mode).	N/A	N/A	N/A
TEFF1: Gate-to-gate flight time	N/A	- 0.13 min / flight (positive impact)	The delegation of the provision of Air Traffic Services amongst ATSUs in periods of

¹⁰ Negative impacts are indicated in red.

¹¹ Discuss the outcome if the gap indicates a different understanding of the contribution of the Solution (for example, the Solution is enabling other Solutions and therefore is not contributing a direct benefit).

			low demand or due to load balancing purposes will allow AUs to fly more efficient trajectories, as the number of airspace disruptions and flight constraints originated by ATFCM measures might decrease. This will lead to improved flight durations.
PRD1: Predictability – Average of Difference in actual & Flight Plan or RBT durations	Not V.T allocated to PRD1, only PRD2.	PRD1 extrapolation at ECAC level not available, see Section 4.10.	N/A
PUN1: Punctuality – Average departure delay per flight	N/A	N/A	N/A
CEF2: ATCO Productivity – Flights per ATCO -Hour on duty	High	+ 18.5 9.92%	N/A
CEF3: Technology Cost – Cost per flight	High	- 1.56% (positive impact)	N/A

Table [4040404040](#): Gap analysis Summary

5 References

- [1] 08.01.03 D47: AIRM v4.1.0
- [2] B05 Performance Assessment Methodology for Step 1 PJ19.04.01 Methodology for Performance Assessment Results Consolidation (2020)¹²
- [3] SESAR Performance Framework (2019), Edition 01.00.01, Dec 2019
<https://stellar.sesarju.eu/?link=true&domainName=saas&redirectUrl=%2Fjsp%2Fproject%2Fproject.jsp%3FobjId%3Dxrn%3Adatabase%3Aondb%2Frecord%2F16414675>
- [4] Performance Assessment and Gap Analysis Report (2019), Edition 00.01.02, Dec 2019
- [5] Methodology for the Performance Planning and Master Plan Maintenance, Edition 0.13, Dec 2017

Content Integration

- [6] SESAR ATM Lexicon

Performance Management

- [7] PJ19.04 D4.1 Validation Targets - Wave 2 (2020)¹³

Validation

- [8] European Operational Concept Validation Methodology (E-OCVM) - 3.0 [February 2010]

Safety

- [9] SESAR, Safety Reference Material, Edition 4.0, April 2016
<https://stellar.sesarju.eu/jsp/project/qproject.jsp?objId=1795089.13&resetHistory=true&stateInfo=Ogp&domainName=saas>
- [10] SESAR, Guidance to Apply the Safety Reference Material, Edition 3.0, April 2016
<https://stellar.sesarju.eu/jsp/project/qproject.jsp?objId=1795102.13&resetHistory=true&stateInfo=Ogp&domainName=saas>
- [11] SESAR, Final Guidance Material to Execute Proof of Concept, Ed00.04.00, August 2015

¹² At the time of the creation of the PAR template, the Methodology (PJ19.04 Internal Document) is foreseen to be update in 2020.

¹³ At the time of the creation of the PAR template the Validation Target is foreseen to be delivered in June 2020

[12]Accident Incident Models – AIM, release 2017

https://stellar.sesarju.eu/servlet/dl/ShowDocumentContent?doc_id=3658775.13&att=attachment&statEvent=Download

Human Performance

[13]16.06.05 D 27 HP Reference Material D27

[14]16.04.02 D04 e-HP Repository - Release note

Environment Assessment

[15]SESAR, Environment Assessment Process (2019), PJ19.4.2, Deliverable D4.0.080, Sep 2019.

<https://stellar.sesarju.eu/servlet/dl/DownloadServlet?downloadKey=xrn%3Adatabase%3Aondb%2Frecord%2F14665451&resuming=true&zip=true&disposition=attachment&domainName=saas&domainName=saas>

[16]ICAO CAEP – “Guidance on Environmental Assessment of Proposed Air Traffic Management Operational Changes” document, Doc 10031.

<https://www.icao.int/publications/pages/publication.aspx?docnum=10031>

Security

[17]16.06.02 D103 SESAR Security Ref Material Level

[18]16.06.02 D137 Minimum Set of Security Controls (MSSCs).

[19]16.06.02 D131 Security Database Application (CTRL_S)

PJ.10-W2-93 Deliverables

[20] SESAR 2020 PJ.10-W2-93 V3 Validation Report

[21] SESAR2020 PJ.10-W2-93 V3 Validation Plan Part II – Safety Assessment Plan

[22] SESAR2020 PJ.10-W2-93 V3 SPR-INTEROP/OSED Part II – Safety Assessment Report

Appendix A Detailed Description and Issues of the OI Steps

OI Step ID	Title	Consistency with latest Dataset
SDM-0217	Delegation of ATM Services between ATSUUs	OK

Table [414141414141](#): OI Steps allocated to the Solution