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SESAR Solution PJ.02-W2-21.4 SPR/INTEROP-OSED for V3 - Part V - Performance Assessment Report (PAR)

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AART

AIRPORT AIRSIDE AND RUNWAY THROUGHPUT

This ***Performance Assessment Report*** is part of a project that has received funding from the SESAR Joint Undertaking under grant agreement No 874477 under European Union's Horizon 2020 research and innovation programme.

Abstract

This document is the ***Performance Assessment Report*** for the Solution ***PJ.02-W2-21.4*** - *"Full Guidance Assistance to mobiles using 'Follow the Greens' procedures based on Airfield Ground Lighting"*.

It provides a synthesis of essential information (qualitative and quantitative) related to the assessment of the *Operational Performances* that Solution PJ.02-W2-21.4 could have when implemented.

Among the expected technological enhancements allocated by SJU to SESAR 2020-W2-PJ02 "***AIRPORT AIRSIDE AND RUNWAY THROUGHPUT***", it is expected to deploy the relevant information on how the OI addressed to the Solution and how it is expected to reach the planned V3 maturity level at the end of Wave 2.

Then, by adding the consideration related to the development of Airport Technology and the new human machine interface (HMI) interaction modes and technologies, how the new OI will support the scope to maintain high level of Safety of Operation in LVC, with the aim to minimize the load and the workload both for ATCO and Pilots and the other stakeholders involved, in several sub-Operating Environments.

The high-level improvements addressed in the scope, defined above, may be applicable in current operations as well as in future operational concepts linked with the actual ones.

The Operational Improvements identified have been allocated to the Solutions, under PJ.02-W2:

- ✓ PJ.02-W2-21_4 *"Full Guidance Assistance to mobiles using 'Follow the Greens' procedures based on Airfield Ground Lighting"*

The validation activities planned for the Solutions comprise ***one*** Validation Exercise. The main objective of the validation exercise is to assess the operational concepts under investigation and their impact on the relevant KPAs. Qualitative and quantitative performance benefits will be collected and analysed to assess the maturity of the solutions under evaluation.

This ***Performance Assessment Report*** document presents the Performance Management Process that follows the post analysis phase at the end of the Validation Exercises.
The Performance Management Process is used to quantify benefits calculated from the KPAs' assessment and reported into the VALR Deliverable.
The objective is to validate, or better, to be consistent with the expected performances' feasibility of the Solutions at maturity level V3/TRL6, as reported from the expectations reported within the SESAR ATM Master Plan.

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1 Executive Summary

This document provides the Performance Assessment Report (PAR) for Solution PJ.02-W2-21.4 *Full Guidance Assistance to mobiles using 'Follow the Greens' procedures based on Airfield Ground Lighting* (aprons/taxiways/runways).

The PAR is consolidating Solution performance validation results addressing KPIs/PIs and metrics from the PJ19_04_D4_4 Performance Framework_ v00_00_11 – Edition January 2022[3].

Description:

SESAR SolutionPJ.02-W2-21.4 *Full Guidance Assistance to mobiles using 'Follow the Greens' procedures based on Airfield Ground Lighting* (aprons/taxiways/runways).

This solution intends to automate the prioritization of mobiles along their cleared route on the whole movement area. The Guidance Service considers other traffic to guide the mobile as it progresses along its assigned route and at the holding points. It allocates priorities between mobiles based on local operating rules (e.g., runway exit versus parallel taxiways, aircraft versus vehicle, aircraft converging or crossing at intersections and taxiways passing close to push back routes or other taxiways where insufficient wingtip separation exists) as well as known constraints from the surface management system. Automatic Guidance will be provided using “Follow the Green” concept on the Airfield Ground Lighting infrastructure.

Assessment Results Summary:

The following tables summarises the assessment outcomes per KPI (Table 1) and mandatory PI (Table 2) puts them side-by side against Validation Targets in case of KPI from PJ19 [8].

The impact of a Solution on the performances are described in Benefit Impact Mechanism.

All the KPI and mandatory PI from the Benefit Mechanism were the Solution potentially impact have to be assessed via validation results, expert judgment etc.

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.

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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	***14,8 kg***	***N/A***	***N/A***
CAP1: TMA Airspace Capacity - TMA throughput, in challenging airspace, per unit time.	**N/A**	***N/A***	***N/A***
CAP2: En-Route Airspace Capacity - En-route throughput, in challenging airspace, per unit time	**N/A**	***N/A***	***N/A***
CAP3: Airport Capacity – Peak Runway Throughput (Mixed mode).	**N/A**	**N/A**	**N/A**
TEFF1: Gate-to-gate flight time	***0,12 mins***	***N/A***	***N/A***
PRD1: Predictability – Average of Difference in	***2,49%***	***N/A***	***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

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actual & Flight Plan or RBT durations			
PUN1: Punctuality – Average departure delay per flight	***N/A***	***N/A***	***N/A***
CEF2: ATCO Productivity – Flights per ATCO - Hour on duty	***0,35%***	***1,39%***	***Medium***
CEF3: Technology Cost – Cost per flight		***N/A***	***N/A***

Table 1: KPI Assessment Results Summary

Mandatory PI	**Performance Benefits Expectations at Network Level (ECAC Wide or Local depending on the KPI)[3]**	**Confidence in Results[4]**
SAF1.X: Mid-air collision - En-Route	N/A	N/A
SAF2.X: Mid-air collision - TMA	N/A	N/A
SAF3.X: RWY-collision accident	SB	LOW
SAF4.X: TWY-collision accident	SB	LOW
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	YES	Medium
SEC2: Risk Treatment has been carried out	YES	Medium

[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

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SEC3: Residual risk after treatment meets security objective.	YES	LOW
ENV1: Actual Average CO2 Emission per flight	N/A	N/A
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.	N/A	N/A
RES2.1: Airspace time to recover from non-nominal to nominal condition.	N/A	N/A
RES4: Minutes of delays.	N/A	N/A
RES5: Number of cancellations.	N/A	N/A
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	N/A	N/A
PRD2: Variance of Difference in actual & Flight Plan or RBT durations	N/A	N/A

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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	N/A	N/A
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	YES	Medium
HP2: Suitability of technical system in supporting the tasks of human actors	YES	High
HP3: Adequacy of team structure and team communication in supporting the human actors	YES	High
HP4: Feasibility with regard to HP-related transition factors	YES	High
FLX1: Average delay for scheduled civil/military flights with change request and non-scheduled or late flight plan request	N/A	N/A

Table 2 Mandatory PIs Assessment Summary

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Additional Comments and Notes:

N/A

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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 SESAR Joint Undertaking (SJU) 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.

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

Moreover, other inputs to this document are provided by PJ19, namely:

- PJ19_04_D4_4 Performance Framework_ v00_00_11[3], guidance on KPIs and Data collection supports.
- S2020 Common Assumptions [6], 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)[5] within STELLAR, gathering experts and providing best practices.

2.4 Glossary of terms

Term	Definition	Source of the definition
Advanced Routing	In addition to the "basic routing" investigated during SESAR 1, the advanced routing function of SESAR 2020 is expected to suggest alternative routes to the cleared routes of one or more of the mobiles, to remove the potential deadlock / conflicting situations or to dynamically adapt routing to known operational constraints or traffic behaviour situation.	SESAR 2020 PJ03a-01 and PJ.02-W2-21.6
Advanced Surface Movement Guidance and Control System (A-SMGCS)	A system providing as a minimum Surveillance and can include Airport Safety Support, Routing and Guidance to aircraft and vehicles in order to maintain the airport throughput under all local weather conditions whilst maintaining the required level of safety.	EUROCONTROL A-SMGCS Specification No171 V2.0 Dated 22 April 2020
Alternative route-choice function	Means for the controller to choose a route from a provided list of alternative routes, e.g. via a menu	PJ03a-01 definition

[5] Go to "Advanced Portfolio Manager" on the left navigation menu, and select "Coordination Group – ATM Performance Assessment (APA)" in STELLAR:

https://stellar.sesarju.eu/?link=true&domainName=saas&redirectUrl=%2Fjsp%2Fproject%2Fproject.jsp%3FobjId%3Dxrn%3Aview%3Axrn%3Adatabase%3Aondb%2Ftable%2FSYS_MESSAGE%402333834.13%40xrn%3AprototypeView%3Adatabase.view.message.private.AllMyMessages

A-SMGCS Guidance service	The Guidance Service provides individual guidance information using visual aids to any mobile which has a cleared taxi route. It comprises the following three functions: • Automated switching of Taxiway Centreline Lights (TCL). • Automated switching of stop bars. Automated activation of Advanced-Visual Guidance Docking Systems (A-VDGS).	EUROCONTROL A-SMGCS Specification No171 V2.0 Dated 22 April 2020
A-SMGCS Routing service	The Routing Service generates individual routes for mobiles based on known aerodrome parameters and constraints or following an interaction by the Controller and is a key enabler for the Guidance Service and some elements of the Airport Safety Support Service.	EUROCONTROL A-SMGCS Specification No171 V2.0 Dated 22 April 2020
Electronic Clearance Input (ECI)	A generic term used to describe the means for a Controller to input Clearances or instructions.	EUROCONTROL A-SMGCS Specification No171 V2.0 Dated 22 April 2020
Intermediate Holding Position	A designated position intended for traffic control at which taxiing aircraft and vehicles shall stop and hold until further cleared to proceed, when so instructed by the aerodrome control tower	ICAO Annex 14
Routing	The planning and assignment of a route to individual aircraft and vehicles to provide safe, expeditious and efficient movement from its current position to its intended position.	EUROCONTROL A-SMGCS Specification No171 V2.0 Dated 22 April 2020
Visibility Condition 3 (VIS 3)	Visibility enough for the pilot to taxi but insufficient for the pilot to avoid collision with other	ICAO Doc 9830 (Advanced Surface Movement Guidance

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	traffic on taxiways and at intersections by visual reference, and insufficient for personnel of control units to exercise control over all traffic based on visual surveillance. For taxiing, this is normally taken as visibilities equivalent to an RVR of less than 400 m but more than 75.	and Control Systems (A-SMGCS) Manual).
Low Visibility Operations (LVOs)	Approach or take-off operations on a runway with any RVR less than 550 m or taxiing at an aerodrome at which any RVR is less than 550 m.	Regulation (EU) 2017/373, Air Traffic Management/Air Navigation Services
Manoeuvring area	Part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons.	Regulation (EU) 2017/373, Air Traffic Management/Air Navigation Services
Movement area	Part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, consisting of the manoeuvring area and the apron.	Regulation (EU) 2017/373, Air Traffic Management/Air Navigation Services

Table 2: Glossary

2.5 Acronyms and Terminology

Term	Definition
ANS	Air Navigation Service
ANSP	Air Navigation Service Provider
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
BAD	Benefits Assessment Date

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BAER	Benefit Assessment Equipment Rate
CBA	Cost Benefit Analysis
DOD	Detailed Operational Description
E-ATMS	European Air Traffic Management System
ECAC	European Civil Aviation Conference
DB	Deployment Baseline
KPA	Key Performance Area
KPI	Key Performance Indicator
N/A	Not Applicable
OI	Operational Improvement
PAR	Performance Assessment Report
PI	Performance Indicator
PRU	Performance Review Unit
QoS	Quality of Service
RBT	Reference Business / Mission Trajectory
SESAR	Single European Sky ATM Research Programme
S3JU	SESAR3 Joint Undertaking (Agency of the European Commission)
SESAR2020 Programme	The programme which defines the Research and Development activities and Projects for the S3JU.

Table 3: 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

Term	Definition	Source
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
ATM Master Plan	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. 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.	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

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Term	Definition	Source
Cost-Benefit Analysis	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. 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.	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	The ability of the ATM System and airports to respond to changes in planned flights and missions. 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.	Performance Framework 2017
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	The SESAR performance Focus Area concerned with fuel efficiency. How much fuel is used by aviation or by extension “Fuel efficiency” (how much fuel can be saved?) is one of the performance aspects. Note: Policy places considerable focus on this. Fuel efficiency contributes to 3 of the 11 KPAs defined by ICAO: Cost-efficiency, Efficiency, and Environment.	PAGAR
Gap Analysis	Difference between the validation targets and the performance assessment. It is used to: 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

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Term	Definition	Source
G2G ANS Cost-Efficiency Focus Area	One of the SESAR performance Focus Areas concerned with Cost Efficiency. 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.	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
Key Performance Indicator	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." In SESAR2020 Performance Framework, Key Performance Indicators are those that have a validation target associated derived from the corresponding Performance Ambition.	ICAO Doc 9883 Performance Framework
Local Air Quality Focus Area	One of the SESAR performance Focus Areas concerned with Environment. 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.	PAGAR
Noise Focus Area	One of the SESAR performance Focus Areas concerned with Environment. 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.	PAGAR
Operational Environment (OE)	An environment with a consistent type of flight operations.	EUROCONTROL ATM Lexicon

Term	Definition	Source
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
Performance Framework	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. 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. 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.	EUROCONTROL ATM Lexicon
Performance Indicator	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.	SESAR2020 Project Handbook
Performance metrics	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.	SESAR2020 Project Handbook
Predictability Focus Area	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.	Performance Framework 2019
Punctuality Focus Area	Refers to “ATM Punctuality”. It captures ATM issues as well as events related to ATM that cause a temporal perturbation to airspace user schedules.	PAGAR
Resilience Focus Area	Resilience focuses on the ability to withstand and recover from planned and unplanned events and conditions which cause a loss of nominal performance.	Performance Framework updated

Term	Definition	Source
Safety	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.	EUROCONTROL ATM Lexicon
Security	(aviation) Safeguarding civil aviation against acts of unlawful interference. This objective is achieved by a combination of measures and human and material resources. 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).	EUROCONTROL ATM Lexicon, Notes 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. 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.	SESAR2020 Project Handbook
SESAR Technological Solution	SESAR Technological Solutions relate to verified technologies proven to be feasible and profitable, which may therefore be considered to enable future SESAR Solutions.	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

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Term	Definition	Source
Validation targets	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. In SESAR2020 validation targets are associated with a KPI.	EUROCONTROL ATM Lexicon

Table 4: Terminology

3 Solution Scope

3.1 Detailed Description of the Solution

It is an enhancement of SESAR1 Solution 47

This solution intends to automate the prioritisation of mobiles along their cleared route on the whole movement area. The Guidance Service considers other traffic for spacing to guide the mobile as it progresses along its assigned route and at the holding points. It allocates priorities between mobiles based on local operating rules (e.g., runway exit versus parallel taxiways, aircraft versus vehicle, aircraft converging or crossing at intersections and taxiways passing close to push back routes or other taxiways where insufficient wingtip separation exists), as well as known constraints from the surface management system. Automatic Guidance will be provided using "Follow the Greens" concept on the Airfield Ground Lighting infrastructure.

3.2 Detailed Description of relationship with other Solutions

The possible relationships of the Solution have been analysed looking at the W2 Solutions in Airport Operational Environment and all the relationships have been judged as "*Compatible/Independent/No cross effect*". Thus, these relationships are not mentioned except for the following, being part of the same project:

Solution Number	Solution Title	Relationship	Rational for the relationship
PJ.02-W2-21.1	Extended Airport Safety Nets for Controllers at A-SMGCS Airports	Independent / No cross effect	Solution PJ.02-W2-21.1 could provide additional Safety Nets to the solution 21.4
PJ.02-W2-21.3	Digital surface management for airport vehicles	Independent / No cross effect	Solution PJ.02-W2-21.3 could provide additional support to the solution 21.4 for vehicles management operations
PJ.02-W2-21.5	Enhanced Safety in LVP through use of Dynamic Virtual Block Control (aprons/taxiways/runways)	Independent / No cross effect	Solution PJ.02-W2-21.5 could provide additional Guidance assistance to the solution 21.4
PJ.02-W2-21.6	Surface Route Planning and Management operations	Independent / No cross effect	Solution PJ.02-W2-21.6 could provide enhanced taxi routing to the solution 21.4

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W2.PJ5.97.1 with W2.PJ5.97.2	ASR at the TWR CWP supported by AI and Machine Learning	Compatible/Independent / No Cross Effect	Automatic speech recognition tool has no effect neither is affected by the Virtual/ augmented reality device in tower environment

Table 5: Relationships with other Solutions

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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
SESAR	VP759 – Validation Report. SESAR1 Deliverable D153 Project 06.03.01 (SESAR1 - 2015)	
SESAR	Validation exercise Phase 1 exe 649 (AGL-SEAC) SESAR1 Deliverable D062 Project 06.07.03 (SESAR1 - 2014)	
SESAR	Preliminary Validation exercises Phase 2 (D-TAXI – ECTL – NATMIG) SESAR1 Deliverable D64 Project 06.07.03 (SESAR1 - 2015)	

Table 6: Pre-SESAR2020 Exercises

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

Exercise ID	Exercise Title	Release	Maturity	Status
TVAL.21.5	Exercise 5 – Validation of Integrated Surface Management Budapest (V3) – (AO-0222-B).	R12	V3	Completed

Table 7: SESAR2020 Validation Exercises

This validation exercise will cover validation objectives, requirements and use cases from Wave-2 solution PJ.02-W2-21.4.

The exercise objective is to assess and validate advanced A-SMGCS Guidance functions (Follow the Greens) aiming to avoid potential conflicting situations, especially in low visibility conditions.

The Validation exercise will be executed via real time simulation technique on the industrial based platform provided by Indra. The operational environment used as validation scenario is a typical European medium airport with a parallel runway layout (Budapest, Hungary), operated by HungaroControl (ANSP).

Operational controllers from HungaroControl will be involved in the design and execution of the validation exercise.

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

Exercise	OI Step	Exercise scenario & scope	Performance Results	Notes
TVAL.21.5	AO-0222-B	The exercise objective was to assess and validate advanced A-SMGCS Routing and Guidance functions (Follow the Greens) aiming to avoid potential conflicting situations, especially in low visibility conditions. The Validation exercise was be executed via real time simulation technique on the industrial based platform provided by Indra. The operational environment used as validation scenario is a typical European medium airport with a parallel runway layout (Budapest, Hungary), operated by HungaroControl (ANSP).	Operationally accepted. Reducing Controller workload.	AO-0222-B is an enhancement of AO-0222A validated in SESAR 1. The enhancement was scope. However complete solution was found operationally acceptable, and reducing controller workload was in addition to the AO-0222-A performance improvements.

Table 8: Summary of Validation Results.

4.2 Conditions / Assumptions for Applicability

The benefit of automatic guidance and prioritization is assumed to be largest for large, complex and busy environment. When it become hard for the flight crew to copy the large and detailed taxi instructions, and the chances for making mistakes increase. In such an environment the GND controller(s) will also have to work hard to identify conflicting taxi routing, make prioritisations, issue taxi instruction updates, and ensuring the flight crew understand and comply.

In Low Visibility conditions when Low Visibility Procedures are in in use, the solution can be alternative to other means for ATC to ensure prevent collisions between aircraft, and between aircraft and obstructions. Other means of controlling the traffic is often by use of stop bars along the taxiways. The magnitude of the performance benefit will depend on if such control by stop bars are in place or not.

The following Table 9 summarises the applicable operating environments.

OE	Applicable sub-OE	Special characteristics

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Very Large and Large airports	low to high complexity	Taxiway system equipped with taxiway centreline lights (TCL)

Table 9: Applicable Operating Environments.

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4.3 Safety

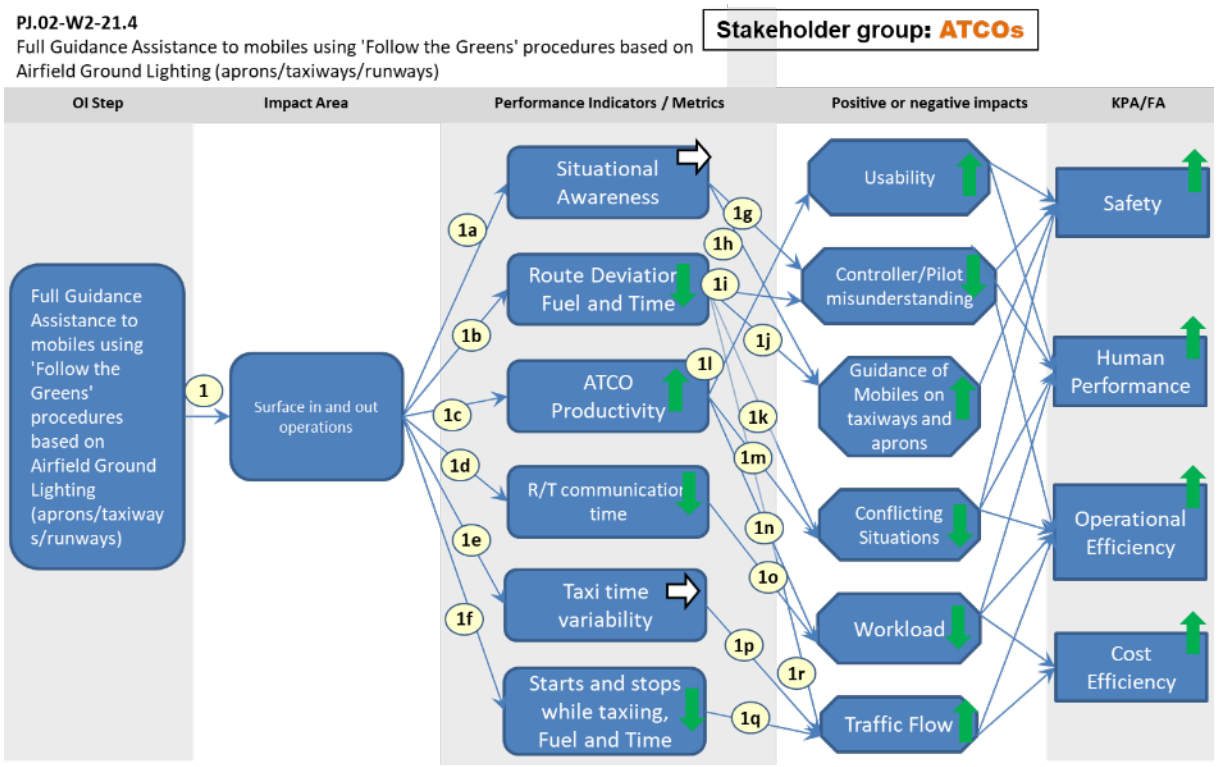
This safety assessment is conducted as per the SESAR Safety Reference Material (SRM) which itself is based on a twofold approach:

- ✓ a success approach which is concerned with the safety of the Solution operations in the absence of failure within the end-to-end Solution functional system, encompassing both Normal operation and Abnormal conditions,
- ✓ a conventional failure approach which is concerned with the safety of the Solution operations in the event of failures within the end-to-end Solution functional system.

These two approaches are applied to the derivation of safety properties at each of the successive lifecycle stages of the Solution development (Safety Requirements at service level and at design level).

4.3.1 Safety Design drivers and Performance Mechanism

Full Guidance Follow the Greens concept aims to provide guidance for mobiles on taxiways and aprons and is expected to reduce the likelihood of misunderstandings between ATCOs and pilots or vehicle drivers and also the number of conflicting situations on the manoeuvring area while improving usability. Safety Benefit is expected especially in LVP conditions in terms of Runway and Taxiway accidents due to the enhanced situational awareness of pilots and airport vehicle drivers .



The solution addressed in this Safety Assessment Report is:

- Solution PJ.02-W2-21.4: Full Guidance Assistance to mobiles using 'Follow the Greens' procedures based on Airfield Ground Lighting (aprons/taxiways/runways)

The OI step addressed in this Safety Assessment Report is:

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- AO-0222-B: Full Guidance Assistance to mobiles using "Follow the Greens" procedures based on Airfield Ground Lighting

For PJ.02-W2-21.4 Solution based on the analysis the following Safety Criteria were selected:

SAC	Contribution to the Safety performance of the solution	Barrier/precursor
SAC#1	With A-SMGCS Routing and Planning and Guidance functionalities introduced in the context of the Solution PJ.02-W2-21.4, there shall be no increase in the frequency of Runway Conflicts (RP2).	B4: **Runway Incursion Monitoring** aiming to mitigate the "(AC/Vehicle) Induced Incursion" B5: **Runway Crossing Management** aiming to mitigate the "(ATC) Induced Incursion" B6: **Line-up/Take-off Management** aiming to mitigate the "(ATC) Induced Incursion"
SAC#2	With A-SMGCS Routing and Planning and Guidance functionalities introduced in the context of the Solution PJ.02-W2-21.4, there shall be no increase in the frequency of Imminent Taxiway Infringements (TP2).	B3: **Taxiway Conflict Management**, aiming to prevent the "Imminent Taxiway Infringement"

4.3.2 Data collection and Assessment

From the Safety Criteria listed in the previous section and following the SRM process, Safety Requirements at Service level (SRS) and Operational Hazards have been developed and identified. The achievability of the Safety Criteria has been demonstrated through the satisfaction of the success criteria of the safety validation objectives defined in relation to the Solution planned validation exercises and other specific validation means (Safety and HP workshop).

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. Decision for deriving (or not) additional Safety Requirements might be taken from these results. Indeed, an SRS functionality & performance addressing human factors or procedures might be covered by a validation exercise but the validation outcome might be that it can be satisfied only partially or even not satisfied, in which case the design should ensure adequate risk mitigation.

The safety-relevant results of the validation exercises and of any other specific validation means (Safety and HP workshop) are summarized in SESAR 2020 Wave 2 SPR INTEROP OSED Part II - Safety Assessment Report - PJ02-W2-21_4 Guidance H, whilst indicating for each safety validation objective / success criteria the extent to which the relevant SRS have been covered.

Safety data collection and then safety assessment have been developed and built on safety workshops conducted with various operational and validation experts, e.g., ATCOs, airport vehicle drivers from HungaroControl. The assessment based also on the results obtained from validation phase during Real Time Simulation (RTS) at INDRA Navia in Asker through questionnaires and debriefings conducted among the participants.

Results are provided in the following documents:

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- PJ.02-W2-21.4 Validation Report V3
- PJ.02-W2-21.4 SPR-INTEROP/OSED Part II V3 (Safety assessment report)

4.3.3 Extrapolation to ECAC wide

An extrapolation is not possible based on the nature of the results, but it can be concluded that subjective feedback and objective measures indicate that safety is maintained.

4.3.4 Discussion of Assessment Result

Results and conclusions were mainly based on the results of the Post Exercise Questionnaires and the Post Simulation Questionnaire. The analysis shows that safety level can be maintained after implementation of Full Guidance Follow the Greens. The results of the simulation along with experts' judgment can be a formal confirmation of this statement. Quantifiable indicators such as numbers of imminent taxiway infringements, numbers of runway incursions, and the timeliness of conflict resolution by controllers, can show a trend of increasing safety which corroborates the subjective feedback given by controllers.

A significant factor that would change the safety level while using Full Guidance FtG in day-to-day operations is the increased trust in the system. After getting used to the function ATCO intervention is expected to be slower in case of a possible failure of the Full Guidance FtG.

The experiences of other ANSPs which have already operationally implemented Full Guidance FtG can be also considered as evidence that implementation is acceptably safe.

4.3.5 Additional Comments and Notes

No additional comments or notes.

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4.4 Environment: Fuel Efficiency / CO2 emissions

Does the Solution impact this KPA? ***No***

The SESAR1 Solution "*Guidance assistance through airfield ground lighting" impacted and improve this KPA*. Instead of for this Solution the new Full guidance does not further improve this KPA. The PJ19-W2 Validation Targets SESAR 2020 Wave 2&3 [6] included a validation target for this KPA. However, when performance change compared to SESAR1 is only considered, there should be no performance change, and in the exercise no measurement was performed for this KPA.

4.4.1 Performance Mechanism

Is there a Benefit Mechanism available? ***YES***.

You can look at the BIM both at SAF paragraph and CEF paragraph too.

4.4.2 Assessment Data (Exercises and Expectations)

The Solution is not able to measure this KPA. There are not data and enough information that allow the Performance PoC to relay any output.

So, a GAP Analysis has been produced at the end of this Report with the aim to underline the lack of performance for this KPA.

4.4.3 Extrapolation to ECAC wide

KPIs / PIs	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% Expected performance benefit in SESAR2020
FEFF1 Actual Average fuel burn per flight	Kg fuel per movement	Total amount of actual fuel burn divided by the number of movements	YES	**14,8 kg x AC**	**N/A**
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	**N/A**	**N/A**

Table 10: Fuel burn and CO2 emissions saving for Mandatory KPIs /PIs

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	Taxi out	TMA departure	En-route	TMA arrival	Taxi in
FEFF1 Actual Average fuel burn per flight	N/A	N/A	N/A	N/A	N/A
ENV1 Actual Average CO2 Emission per flight	N/A	N/A	N/A	N/A	N/A

Table 11: Fuel burn and CO2 emissions saving per flight phase.

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

If yes, does the S2020 Wave2 performance comes in addition to S2020 Wave1 or replace it? ***N/A***

4.4.4 Discussion of Assessment Result

N/A

4.4.5 Additional Comments and Notes

N/A

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4.5 Environment / Emissions, Noise and Local Air Quality

Does the Solution impact this KPA? ***No***

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4.5.1 Performance Mechanism

Is there a Benefit Mechanism available? ***No***.

4.5.2 Assessment Data (Exercises and Expectations)

N/A

PIs	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% Expected performance benefit in SESAR2020
NOI1 Relative noise scale	-2 to +2	It is a qualitative scale based on expert judgment. -2 very negative effect or benefit, 0 neutral and +2 very positive effects or benefit. The objective of this metric is to provide a global assessment of the noise impact. This metric is built upon the other quantitative noise PIs (NOI2, NOI3, NOI4, NOI5)	YES for Airport OE Solutions	***N/A***	***N/A***
NOI2 Size and location of noise contours	Contours of noise level thresholds (e.g., LDEN 55 see ERM document for the list of recommended PIs). Surface of these contours (Km^2)	Noise contours to be calculated according to the ECAC Doc.29 methodology. Surface of the noise contours calculated using a GIS tool or modules. Suggest the use of IMPACT tool.	YES for Airport OE Solutions	***N/A***	***N/A***
(NOI4) Number of people exposed to noise levels exceeding a given threshold	Number of people inside noise contours.	Population counts inside the contours calculated above. Need the availability of population census data. Calculated using a GIS tool or modules. IMPACT tool includes this functionality, using the EEA population database.	YES for Airport OE Solutions	***N/A***	***N/A***

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PIs	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% Expected performance benefit in SESAR2020
LAQ1 Geographic distribution of pollutant concentrations	Airport Local Air Quality Studies (ALAQS) inventory method generally uses mg/m³ for each pollutant	Measurement to be performed within LTO cycle. • NOx: Nitrogen oxides, including nitrogen dioxide (NO2) and nitrogen oxide (NO). • VOC: Volatile organic compounds (including non-methane hydrocarbons (NMHC)). • CO: Carbon monoxide. • PM: Particulate matter (fraction size PM2.5 and PM10); • SOx: Sulphur oxides. • Recommended tools: Open-ALAQS	YES for Airport OE Solutions relative to LTO (=>below 3000ft)	***N/A***	***N/A***

Table 12: Noise and Local Air Quality benefit for Mandatory PIs

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

If yes, does the S2020 Wave2 performance comes in addition to S2020 Wave1 or replace it? ***N/A***

4.5.3 Extrapolation to ECAC wide

N/A

4.5.4 Discussion of Assessment Result

N/A

4.5.5 Additional Comments and Notes

N/A

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4.6 Airspace Capacity (Throughput / Airspace Volume & Time)

Does the Solution impact this KPA? ***No***

4.6.1 Performance Mechanism

Is there a Benefit Mechanism available? ***No***.

4.6.2 Assessment Data (Exercises and Expectations)

N/A

Exercise ID or Expert judgement	Benefits contribution to CAP1	Benefits contribution to CAP2
EXE-xx	***N/A***	***N/A***
Add additional rows for all the Exercises from your Solution		

Table 13: Airspace Capacity benefits per Exercise

OI step	Relative benefits contribution to CAP1	Relative benefits contribution to CAP2
XX-XXXX	**N/A**	**N/A**
Add additional rows for all the OIs from your Solution		
TOTAL	100%	100%

Table 14: Airspace Capacity relative benefits per OI step

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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	*N/A*	*N/A*
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	*N/A*	*N/A*

Table 15: Airspace benefits for Mandatory KPIs /PIs

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

If yes, does the S2020 Wave2 performance comes in addition to S2020 Wave1 or replace it? ***N/A***

4.6.3 Extrapolation to ECAC wide

N/A

4.6.4 Discussion of Assessment Result

N/A

4.6.5 Additional Comments and Notes

N/A

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4.7 Airport Capacity (Runway Throughput Flights/Hour)

Does the Solution impact this KPA? ***No***

4.7.1 Performance Mechanism

Is there a Benefit Mechanism available? ***No***.

4.7.2 Assessment Data (Exercises and Expectations)

N/A

Exercise ID or Expert judgement	Benefits contribution to CAP3	Benefits contribution to CAP3.1	Benefits contribution to CAP3.2	Benefits contribution to CAP4
EXE-xx	***N/A***	***N/A***	***N/A***	***N/A***
Add additional rows for all the Exercises from your Solution				

Table 16: Airport Capacity benefits per Exercise

OI step	Relative benefits contribution to CAP3	Relative benefits contribution to CAP3.1	Relative benefits contribution to CAP3.2	Relative benefits contribution to CAP4
XX-XXXX	***N/A***	***N/A***	***N/A***	***N/A***
Add additional rows for all the OIs from your Solution				
TOTAL	100%	100%	100%	100%

Table 17: Airport Capacity relative benefits per OI step

KPIs / PIs	**Unit**	**Calculation**	**Mandatory**	**Absolute expected performance benefit in SESAR2020**	**% expected performance benefit in SESAR2020**
CAP3 Peak Runway Throughput (Mixed mode)	% and Flight per hour	% and also total number of movements per one runway per one hour for specific traffic mix and density (in mixed mode RWY operations). The percentage change is measured against the maximum observed throughput during peak demand hours in the mixed-mode RWY operations airports group.	YES	N/A	N/A
CAP3.1 Peak Departure throughput per hour	% and Flight per hour	% and also total number of departures per one runway per one hour for specific traffic mix and density (in segregated mode of operations). The percentage change is measured against the maximum observed throughput during peak demand	YES	N/A	N/A

KPIs / PIs	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
(Segregated mode)		hours in the segregated-mode RWY operations airports group.			
CAP3.2 Peak Arrival throughput per hour (Segregated mode)	% and Flight per hour	% and also total number of arrivals per one runway per one hour for specific traffic mix and density (in segregated mode of operations). The percentage change is measured against the maximum observed throughput during peak demand hours in the segregated-mode RWY operations airports group.	YES	**N/A**	**N/A**
CAP4 Un-accommodated traffic reduction	Flights/year	Reduction in the number of un-accommodated flights i.e. a flight that would have been scheduled if there were available slots at the origin/destination airports. NB: Supports CBA Inputs. NB: Relates to Airport Capacity because this is STATFOR computation. CBA calculate this based on the assessment of the runway throughput we provide with and without the solutions and STATFOR data.	YES For CBA.	**N/A**	**N/A**

Table 18: Airport Capacity for Mandatory KPIs /PIs

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

If yes, does the S2020 Wave2 performance comes in addition to S2020 Wave1 or replace it? ***N/A***

4.7.3 Extrapolation to ECAC wide

N/A

4.7.4 Discussion of Assessment Result

N/A

4.7.5 Additional Comments and Notes

N/A

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

Does the Solution impact this KPA? ***NO***

In low visibility conditions the airport capacity is often reduced (a loss of airport capacity). There are several solutions available to avoid loss of airport capacity. And for that scope several different solutions are needed.

Depending on what other solutions that already exist on an airport, the Full guidance Solution may influence this KPA.

Under doubts it is concluded that the Solution does not impacts this KPA. Other research into airport resilience to poor visibility conditions could shed some light in this.

Both SJU within the Master Plan and PJ19.4 within the assessment of VTs for the Wave 2 of SESAR 2020 have never claimed to expect any impact from this PI, and so, consequently, no Validation Targets had been set. So, for that reason, within the BIM, the RES Performance Target was not requested to be covered in validation.

But as the Solution is used when LVP are applied, and as known LVP often put a low limit on Airport Capacity especially if the airport is not equipped with stop bars (apart from RWY holding), for the same reason and for the same scope the LV Procedure rules used with the Solution for controlling the taxiing traffic will be “improved” while reducing the lack of Capacity and will support an increment and positive effect when impacting the airport capacity under LVP.

4.8.1 Performance Mechanism

Is there a Benefit Mechanism available? ***No***

4.8.2 Assessment Data (Exercises and Expectations)

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-xx		N/A	N/A	N/A	N/A	N/A
Add additional rows for all the Exercises from your Solution						

Table 19: 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

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XX-XXXX	***100%***	N/A	N/A	N/A	N/A	N/A
Add additional rows for all the OIs from your Solution						
TOTAL	100%	N/A	N/A	N/A	N/A	N/A

Table 20: 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**
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	**N/A**	**N/A**
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	**N/A**	**N/A**
RES4 Minutes of delays	Minutes	Impact on AUs measured through delays 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	**N/A**	**N/A**

[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.

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PIs	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
RES5 Number of cancellations	No flights	Impact on AUs measured through Cancellations resulting from capacity degradation[7]. 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	**N/A**	**N/A**

Table 21: Resilience for Mandatory PIs

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

If yes, does the S2020 Wave2 performance comes in addition to S2020 Wave1 or replace it? ***N/A***

4.8.3 Extrapolation to ECAC wide

This PI is not possible to be extrapolate at ECAC Level

As assessed by PJ19.4 Performance Framework, there is no ECAC wide extrapolation required for this KPI in the Performance Assessment Report. However, if this benefit is monetised in the Solution CBA, then ECAC wide extrapolation will be required in the CBA report, contact the PJ19.04 CBA Champion for more information.

4.8.4 Discussion of Assessment Result

To complement the output provided here above, see the HP output reported for CEF KPI at para 4.14.7.The HP post analysis reported the positive benefits, by reducing the ATCO Workload, that the implementation of the Enabler (tested for the Solution's scope) provides to the entire traffic scenario of the Airport.Then, by considering the output, it is possible to obtain the RES Performance benefit as above provided.

4.8.5 Additional Comments and Notes

N/A.

[7] 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.

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4.9 Flight Times

Does the Solution impact this KPA? ***No***

The PJ19-W2 Validation Targets SESAR 2020 Wave 2&3 [6] included a validation target for this KPA. However, when performance change compared to SESAR1 is only considered, there should be no performance change, and in the exercise no measurement was performed for this KPA.

4.9.1 Performance Mechanism

The SESAR1 solution "Guidance assistance through airfield ground lighting" does impact and improve this KPA, but the new Full guidance solution does not further improve this KPA

Is there a Benefit Mechanism available? ***YES***.

You can look at the BIM both at SAF paragraph and CEF paragraph too.

4.9.2 Assessment Data (Exercises and Expectations)

The Solution is not able to measure this KPA. There are not data and enough information that allow the Performance PoC to relay any output.

So, a GAP Analysis has been produced at the end of this Report with the aim to underline the lack of performance for this KPA.

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-xx	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***
Add additional rows for all the Exercises from your Solution						

Table 22: Flight Times benefits per Exercise

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
XX-XXXX	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***
Add additional rows for all the OIs from your Solution						
TOTAL	100%	100%	100%	100%	100%	100%

Table 23: Flight Times relative benefits per OI step

4.9.3 Extrapolation to ECAC wide

KPIs / PIs	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	***0,12 mins***	***N/A***
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[8] 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	***N/A***	***N/A***

Table 24: Flight Times benefits for Mandatory KPIs /PIs

Table 25 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***	***N/A***	***N/A***	***N/A***
TEFF2 Taxi in time	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***

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

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***	***N/A***	***N/A***	***N/A***

Table 25: Flight times benefit per flight phase.

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

If yes, does the S2020 Wave2 performance comes in addition to S2020 Wave1 or replace it? ***N/A***

4.9.4 Discussion of Assessment Result

N/A

4.9.5 Additional Comments and Notes

N/A

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4.10Predictability

Does the Solution impact this KPA? ***No***

4.10.1Performance Mechanism

The SESAR1 solution "Guidance assistance through airfield ground lighting" does impact and improve this KPA, but the new Full guidance solution does not further improve this KPA

The PJ19-W2 Validation Targets SESAR 2020 Wave 2&3 [6] included a validation target for this KPA. However, when performance change compared to SESAR1 is only considered, there should be no performance change, and in the exercise no measurement was performed for this KPA.

Is there a Benefit Mechanism available? ***YES***.

You can look at the BIM both at SAF paragraph and CEF paragraph too.

4.10.2Assessment Data (Exercises and Expectations)

The Solution is not able to measure this KPA. There are not data and enough information that allow the Performance PoC to relay any output.

So, a GAP Analysis has been produced at the end of this Report with the aim to underline the lack of performance for this KPA.

Exercise ID or Expert judgement	Benefits contribution to PRD1	Benefits contribution to PRD2
EXE-xx	***N/A***	***N/A***
Add additional rows for all the Exercises from your Solution		

Table 26: Predictability benefits per Exercise

OI step	Relative benefits contribution to PRD1	Relative benefits contribution to PRD2
XX-XXXX	***N/A***	***N/A***
Add additional rows for all the OIs from your Solution		
TOTAL	100%	100%

Table 27: Predictability relative benefits per OI step

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4.10.3Extrapolation to ECAC wide

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	***2,49%***	***N/A***
PRD2 Variance[9] 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	***N/A***	***N/A***

Table 28: Predictability benefits for Mandatory KPIs /PIs

Table 29 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***	***N/A***	***N/A***	***N/A***
PRD2 Variance of Difference in actual & Flight Plan or RBT durations	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***

Table 29: Predictability benefit per flight phase

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

If yes, does the S2020 Wave2 performance comes in addition to S2020 Wave1 or replace it? ***N/A***

4.10.4Discussion of Assessment Result

N/A

4.10.5Additional Comments and Notes

N/A

[9] Standard Deviation is also accepted (in minutes).

4.11Punctuality

Does the Solution impact this KPA? ***No***

4.11.1Performance Mechanism

Is there a Benefit Mechanism available? ***No***.

4.11.2Assessment Data (Exercises and Expectations)

N/A

Exercise ID or Expert judgement	Benefits contribution to PUN1	Benefits contribution to PUN2
EXE-xx	***N/A***	***N/A***
Add additional rows for all the Exercises from your Solution		

Table 30: Punctuality benefit per Exercise

OI step	Relative benefits contribution to PUN1	Relative benefits contribution to PUN2
XX-XXXX	***N/A***	***N/A***
Add additional rows for all the OIs from your Solution		
TOTAL	100%	100%

Table 31: Punctuality relative benefit per OI step

4.11.3Extrapolation to ECAC wide

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PUN1 Average departure delay per flight	min/flight	Average delay (AOBT – SOBT) per flight due to reactionary delays, ATM and weather-related delay causes.	YES	*N/A*	*N/A*
PUN2 % Flights departing within +/- 3 minutes of scheduled departure time due to ATM and weather related delay causes	%	% Departures so that |AOBT – SOBT| < +/- 3 min. Difference in Actual Departure Time vs. Scheduled Time due to ATM and weather-related delay causes.	YES	*N/A*	*N/A*

Table 32: Punctuality benefit for Mandatory KPIs /PIs

Table 33 is showing the impact on flight phases (provided when it is possible).

	Taxi out	TMA departure	En-route	TMA arrival	Taxi in
PUN1 Average departure delay per flight	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
PUN2 % Flights departing within +/- 3 minutes of scheduled departure time due to ATM and weather related delay causes	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*

Table 33: Punctuality benefit per flight phase.

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

If yes, does the S2020 Wave2 performance comes in addition to S2020 Wave1 or replace it? ***N/A***

4.11.4Discussion of Assessment Result

N/A

4.11.5Additional Comments and Notes

N/A

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

Does the Solution impact this KPA? ***No***

4.12.1Performance Mechanism

Is there a Benefit Mechanism available? ***No***.

4.12.2Assessment Data (Exercises and Expectations)

N/A

Exercise ID or Expert judgement	Benefits contribution to CMC1.1	Benefits contribution to CMC1.2	Benefits contribution to CMC1.3	Benefits contribution to CMC1.3.1	Benefits contribution to CMC1.3.2	Benefits contribution to CMC1.4.1	Benefits contribution to CMC1.4.2	Benefits contribution to CMC2.1
EXE-xx	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***
Add additional rows for all the Exercises from your Solution								

Table 34: Civil-Military Cooperation and Coordination benefit per Exercise

OI step	Relative benefits contribution to CMC1.1	Relative benefits contribution to CMC1.2	Relative benefits contribution to CMC1.3	Relative benefits contribution to CMC1.3.1	Relative benefits contribution to CMC1.3.2	Relative benefits contribution to CMC1.4.1	Relative benefits contribution to CMC1.4.2	Relative benefits contribution to CMC2.1
XX-XXXX	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***
Add additional rows for all the OIs from your Solution								
TOTAL	100%	100%	100%	100%	100%	100%	100%	100%

Table 35: Civil-Military Cooperation and Coordination relative benefit per OI step

4.12.3Extrapolation to ECAC wide

N/A

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Category	PIs	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
Impact of ATM Solutions on the effectiveness of military mission	**CMC1.1** Allocated vs. Requested ARES duration	%	It is calculated as proportion between the time allocated for ARES after completing the ASM planning phase (including the civil-military CDM process for airspace configuration) and the time initially requested by the user: Time allocated / time requested for airspace reservation/restriction. It could be calculated for an individual ARES or for a group of ARES depending on the validation scenario objectives and specifications. It is applicable to Variable Profile Area (VPA), Dynamic Mobile Area (DMA), and modular types of design for ARES. The indicator supports the assessment of the impact of ASM planning and civil-military decision-making processes on the training time for military mission inside ARES.	When relevant	**N/A**	**N/A**
	CMC1.2 Allocated vs. Requested ARES dimension	%	It is calculated as the proportion between the volume of the ARES allocated after completing the ASM planning phase (including the civil-military CDM process for airspace configuration) and the volume initially requested by the user: (Allocated ARES surface/ Requested ARES Surface) x (Allocated FL band/Requested FL band). It could be calculated for an individual ARES or for a group of ARES depending on the validation scenario objectives and specifications. It is applicable to VPA, DMA, and modular types of design for ARES. It provides an indication on how closely the allocated ARES conforms to the required airspace dimensions for the execution of the training inside ARES.	When relevant	**N/A**	**N/A**

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Category	PIs	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
	CMC1.3 Deviation of Transit Time to/from airbase to ARES	+/- Minutes	It represents the difference between the transit time in the initial request of the military Airspace User and the transit time resulting from the airspace configuration processes (including the civil-military CDM for ASM). Transit time is defined as the time to be flown from the airbase of departure to the entry point in ARES or from a reference point specified by the military user to the entry point in ARES. It is applicable in situations where a time/distance constraint is defined by the military airspace user for the location of ARES. It could be calculated for individual ARES and then the results could be summed up to provide a global figure for the entire military airspace use plan. It is applicable to VPA, DMA type 1, and modular types of design for ARES. It provides an indication on the effectiveness of ARES location.	When relevant	**N/A**	**N/A**
	CMC 1.3.1 Allocated ARES duration vs. total mission duration	%	It is calculated as the difference in mean values of the ratios between time spent in DMA(s) versus total mission time (based on mid-speed) before (initial military request) and after the completion of airspace configuration (ARES allocation throughout civil-military CDM) processes. It could be calculated for individual ARES or a group of ARES depending on the missions defined in the exercise scenarios. It is applicable to VPA, DMA, and modular types of design for ARES. It supports the assessment of the achievement of military training objectives inside ARES.	When relevant	**N/A**	**N/A**
	CMC 1.3.2 Deviation of total mission duration by iOAT FPL validation	+/- Minutes	It is calculated as the difference between the duration of the mission in the validated iOAT FPL (Reference Mission Trajectory RMT) and the duration of the mission in the submitted iOAT FPL (Shared Mission Trajectory SMT). It could be calculated for a single or the total FPLs submitted by WOC to the Network Manager (NM). It supports the assessment of the impact of NM flight plan validation processes on the effectiveness of military Mission Trajectory planning, especially for cross border flights.	When relevant	**N/A**	**N/A**

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Category	PIs	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
	CMC 1.4.1 Rate of iOAT FPLs acceptance by NM systems	%	The indicator it is calculated as a proportion between the number of FPLs submitted by WOC to NM and the number of FPLs validated by NM systems against the flight planning and ATM route network rules. The measurements could include both of the validation and tactical flow management systems of NM or could be limited to one of them. It supports the assessment of the acceptability of military requirements and exemptions by NM systems.	When relevant	**N/A**	**N/A**
	CMC 1.4.2 Rate of iOAT FPLs acceptance by ATC systems	%	The indicator is calculated as a proportion between the number of FPLs distributed after processing by NM to ATC systems and the number of FPLs accepted by the ATC systems. It supports the assessment of the viability of IOAT FPL to ATC as well as of the ability of ATC systems to provide services to OAT flights.	When relevant	**N/A**	**N/A**
Contribution of CMCC to ATM performance gains	**CMC2.1** Fuel and Distance saved by GAT	Kg and NM	Kg of fuel and distance saved by GAT due optimisation of the ATM network through Demand Capacity balancing and to the new ARES design and management	When relevant	**N/A**	**N/A**

Table 36: Civil-Military cooperation and coordination benefit for Mandatory KPIs /PIs

Table 37 is showing the impact on flight phases (provided when it is possible).

	Taxi out	TMA departure	En-route	TMA arrival	Taxi in
CMC1.1 Allocated vs. Requested ARES duration	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***
CMC1.2 Allocated vs. Requested ARES dimension	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***
CMC1.3 Deviation of Transit Time to/from airbase to ARES	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***
CMC 1.3.1 Allocated ARES duration vs. total mission duration	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***
CMC 1.3.2 Deviation of total mission duration by iOAT FPL validation	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***
CMC 1.4.1 Rate of iOAT FPLs acceptance by NM systems	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***

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CMC 1.4.2 Rate of iOAT FPLs acceptance by ATC systems	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***
CMC2.1 Fuel and Distance saved by GAT	***N/A***	***N/A***	***N/A***	***N/A***	***N/A***

Table 37: Civil-Military cooperation and coordination benefit per flight phase.

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

If yes, does the S2020 Wave2 performance comes in addition to S2020 Wave1 or replace it? ***N/A***

4.12.4Discussion of Assessment Result

N/A

4.12.5Additional Comments and Notes

N/A

4.13Flexibility

Does the Solution impact this KPA? ***No***

4.13.1Performance Mechanism

Is there a Benefit Mechanism available? ***No***.

4.13.2Assessment Data (Exercises and Expectations)

N/A

Exercise ID or Expert judgement	Benefits contribution to FLX1
EXE-xx	***N/A***
Add additional rows for all the Exercises from your Solution	

Table 38: Flexibility benefit per Exercise

OI step	Relative benefits contribution to FLX1
XX-XXXX	***N/A***
Add additional rows for all the OIs from your Solution	
TOTAL	100%

Table 39: Flexibility relative benefit per OI step

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4.13.3Extrapolation 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	***N/A***	***N/A***

Table 40: Flexibility benefit for Mandatory KPIs /PIs

Table 41 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***	***N/A***	***N/A***	***N/A***	***N/A***

Table 41: Flexibility benefit per flight phase.

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

If yes, does the S2020 Wave2 performance comes in addition to S2020 Wave1 or replace it? ***N/A***

4.13.4Discussion of Assessment Result

N/A

4.13.5Additional Comments and Notes

N/A

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4.14Cost 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).

4.14.1Performance Mechanism

Is there a Benefit Mechanism available? ***Yes***

The solution gives full guidance assistance to mobiles using ***'follow-the-greens'*** procedures based on airfield ground lighting. The solution enhances SESAR1 solution "***Guidance assistance through airfield ground lighting***" by automating the prioritization of mobiles along their cleared route on the whole airport movement area.

This is automation of ATCO tasks resulting in lower workload and higher productivity.

Even with SESAR1 Guidance assistance through airfield ground lighting the ATCO will have to assess the traffic situation on taxiways and make appropriate instructions to Flight Crew (by radiotelephony) to about prioritization of traffic – who will give way to who – or specific instructions on where to stop taxiing.

When automating traffic conflict detection and resolution and using this to automatically guide aircraft without the need to issue any instructions to the flight crew, the ATCO workload is reduced.

The reduced workload increases the productivity because it might be the opportunity to manage the traffic easily in safe and secured manner and so it will allow the possibility to increase the number of flights the ATCO can handle, obviously without provide any CAP improvements but simply by increasing the CAP throughput.

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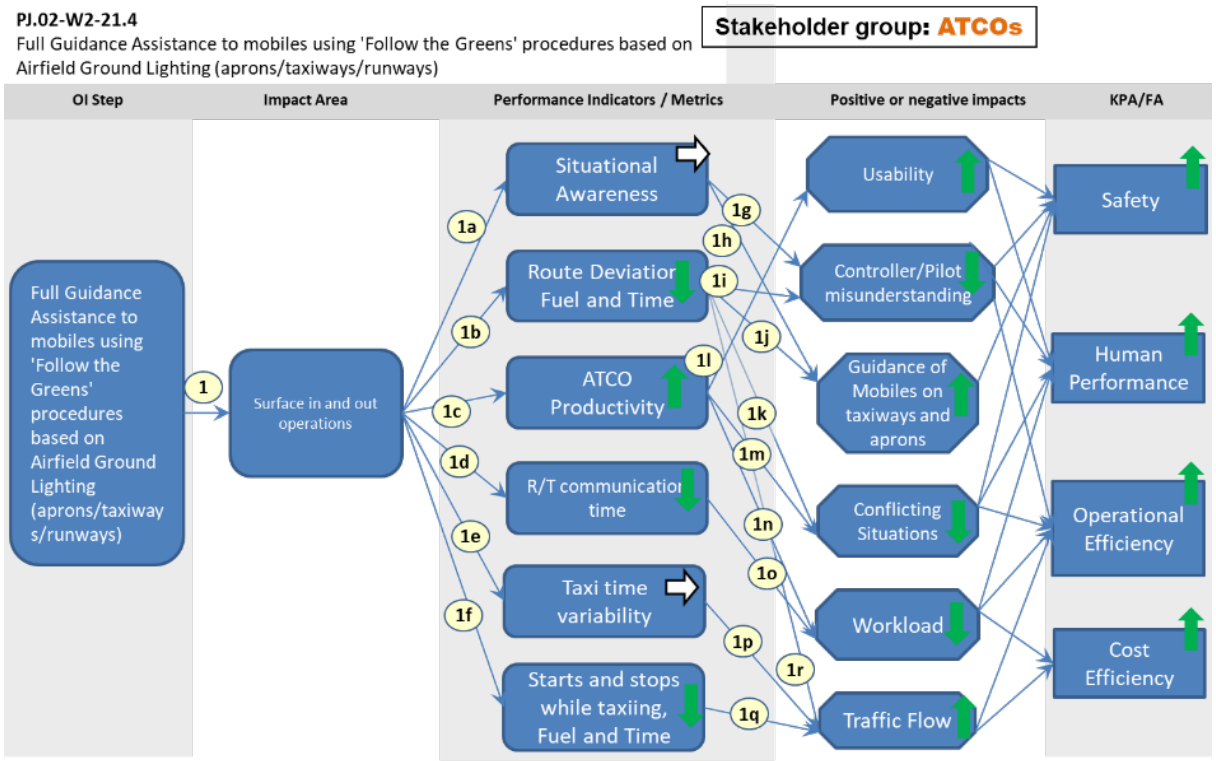

N°	Mechanism descriptions
	Full Guidance Assistance to mobiles using "Follow-the-Greens" procedures Using Airfield Ground Lighting, mobiles will be guided along their cleared route
1	**Taxi in and Taxi out operations** Taxi in and Taxi out operations are expected to be impacted by the definition of Full Guidance Assistance to mobiles using "Follow-the-Greens" procedures
1a	**Situational Awareness** The higher level of automation is expected. The task of conflict detection and resolution is somewhat shifted to the machine which may lead to reduced situational awareness, especially in dense traffic situations. However, ATCO would be able to modify the route if the conflicting situation could be solved more efficiently. His/her active involvement would be essential to stay in the loop. Note that the stakeholders in this BIM are the ATCOs- the flight crew SA is expected to increase.
1b	**Route deviations, Fuel and Time** The precise guidance of the follow the greens concept will ensure that mobiles adhere to the route that ATCOs has assigned leading to less route deviations, optimised fuel consumption and taxi time
1c	**ATCO Productivity** The solution is expected to support the ATCO's efficiency as it will take on the conflict detection and resolution tasks by automatically switching the TCL and Stop bars. It is

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	expected that the number of managed aircraft by one ATCO will be higher thus it will have a positive impact on the ATCO productivity.
1d	**R/T communication time** Availability of automated switching of AGL and the related "Follow-The-Greens" procedures is expected to result in less R/T communication time when giving taxi instructions. This supports the ATCO in being efficient, thus has an indirect link to Cost Efficiency KPA.
1e	**Taxi time variability** Availability of AGL may have an impact on taxi time variability, however, the exact direction of the change is not yet established.
1f	**Starts and Stops while taxiing, Fuel and Time** Availability of AGL may result in less stops and starts while taxiing, if the ATCO is sufficiently engaged in finding more optimal taxi routes, optimised fuel consumption and taxi time.
1l	**Usability** The system functionalities and the HMI has the potential to support ATCO's work as the system will take on the conflict detection and resolution tasks by automatically switching the TCL and Stop bars. Reduction in workload is hypothesized, however, only when trust in the system is established. Safety nets like CMAC and CATC can help ATCO's in the management of the traffic. However, intuitive route editing functionality is imperative, and also a correct sequencing logic should be included in the system. Those impacts are related to Safety (SAF) and Human Performance (HP) KPA.
1g 1i	**Controller / Pilot misunderstanding** The expected increase of situation awareness of the flight crew, as well as the reduction of route deviation occurrences, are linked to a reduction of ATCO / pilot misunderstanding. The described impacts are linked to the Safety (SAF) and Human Performance (HP) KPA and also on Operational Efficiency.
1h 1j	**Guidance of Mobiles on taxiways and aprons** Automated switching of TCL and stop bars will guide mobiles more efficiently and expeditiously on the airport surface. The AGL is only switched on in front of mobiles that are moving instead of on all equipped taxiways regardless of traffic movements. The improved guidance is expected to have a positive impact on both Safety (SAF) and Human Performance (HP) KPAs
1k 1m	**Conflicting situations** The automated switching of AGL will de-conflict converging and opposing traffic. This expects to have an impact on both Safety (SAF) and Human Performance (HP) KPAs and also on Operational Efficiency.
1n 1o	**Workload**

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	The reduction of R/T communication time, and the increased ATCO productivity will have a direct impact on workload, which is linked to Human Performance (HP). The decrease of the workload has also a link to Operational and Cost Efficiency (i.e., the number of flights to be handled/hour may increase due to the workload and R/T reduction). Obviously the new technology tested by the Solution has a real impressive added value to help and to increase the improvement in traffic management by the ATCOs on duty, during unusual weather situation with reduced capacity on the airfield, and so it allows the direct improvement in ATCO productivity due to additional number of aircraft handled within the same operational scenario, when compared with the Reference. Reduction in workload is hypothesized, however, only when trust in the system is established, even if it has been validated by multiple SESAR Solutions and validation Exes tested on different ECAC Airports
1p 1r	**Traffic flow** Reduction in the frequency of stops and starts while taxiing and route deviation should result in a more efficient and smoother traffic flow. This would be further supported if the solution was to positively impact taxi variability, and in traffic management by the ATCOs. Overall, the optimised traffic flow would have an impact on Operational Efficiency KPA and on Cost Efficiency KPA (i.e. with smooth traffic flow the ATCO may take on more flights /hour.)

4.14.2Assessment Data (Exercises and Expectations)

In the validation exercise post-run questionnaires on workload was filled in by the participating ATCOs reporting workload on a Bedford scale. There were several RTS runs with different ATCOs with using both SESAR1 method, and new solution method, and the results could be compared.

As the solution will be used in normal visibility conditions and in low visibility conditions when low visibility procedures are used there were also several RTS runs under LVP with using both SESAR1 method, and new solution method, and the results could be compared. Degraded and abnormal conditions was also scenarios was also run, but only to validate the robustness of the solution.

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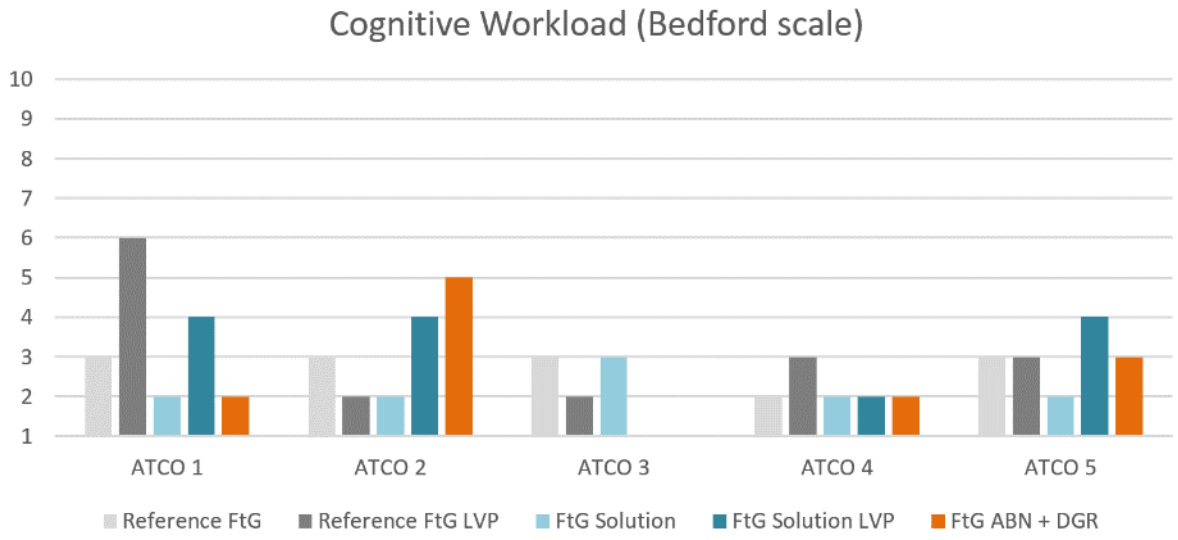

Figure 1. Post-run questionnaire. Bedford scale results per ATCO in the different experimental conditions. Total no. of subjects: 5.

On a Bedford scale the cognitive workload reported through questionnaires and averaged between the ATCOs was as follows:

SESAR 1 solution in normal visibility condition: 2,8

SESAR 2020 full guidance solution in normal visibility condition: 2,2

SESAR 1 solution in LVP condition: 3,2

SESAR 2020 full guidance solution in LVP condition: 3,0

Hence, the workload reduction was 21,4% in normal visibility condition, and 6,3% in low visibility condition.

The SESAR Performance framework [3] provides the following formula to convert workload into a productivity variation calculate a corresponding potential productivity change:

Increase in productivity (%) = (1/ (1-0.75*workload reduction[10]/2) -1) x100

Using this formula, the increase in ATCO productivity can be expressed as:

8,7% in ***normal visibility condition***, and

2,4% in ***low visibility condition.***

[10] Where the workload reduction is expressed as a decimal fraction (i.e. 10% = 0.1)

It is opportune to underline and put in evidence that, while calculating the CEF benefits from the RES PI (both values above reported), LVC are used 10% of the time in ECAC and, in particular, that the percentage is calculated by considering all the airports as a whole, without any particular "sectorization" due to the geographic localization (and the related weather conditions) of the considered airports where the LVC are reported.

For these main reasons, when we must consider the benefits addressed to the RES PI that is addressed at local level only, it is opportune to specify the expected RES benefits in LVC too. Instead of, when we have to convert that benefit (RES PI) to CEF KPA benefit (by using the reverse formula), in that case we cannot consider the LVC case for the reasons above specified and so we will have the CEF2 KPI by considering the RES PI calculated in NORMAL Weather conditions only.

Concluding, the increase in ATCO productivity can be expressed as:

8,7% increase in productivity (at local level and in NORMAL weather condition)

Exercise ID or Expert judgement	Benefits contribution to CEF2	Benefits contribution to CEF3	Benefits contribution to CEF1
TVAL.21.5	**1,39%** increase in ATCO productivity	***N/A***	***N/A***

Table 42: Cost Efficiency benefit per Exercise

OI step	Relative benefits contribution to CEF2	Relative benefits contribution to CEF3	Relative benefits contribution to CEF1
OI-0222-B	***100%***	***N/A***	***N/A***
TOTAL	***100%***	***N/A***	***N/A***

Table 43: Cost Efficiency relative benefit per OI step

4.14.3Extrapolation to ECAC wide

Although it was not possible to obtain a direct benefit from the post analysis for the KPA CEF2, thanks to the optimization of traffic management and therefore to the increase in capacity, assuming that the reduction was due to the contingent situation at the airport (RESilience PI) , taking the benefit of the reverse engineering mechanism, it was possible to define and then quantify a positive effect in terms of ATCO Workload reduction which made it possible to obtain a benefit for the ATCO Productivity, extrapolated at ECAC Level (the RES always remains a value not expendable for PAGAR and therefore not "exportable" at a level higher than the scenario where the operating performance was measured).

The extrapolation process of the CEF2 value, first obtained at Local level and then projected at ECAC Level and functioning as a Performance value of CEF2 (ATCO Productivity) for airports with OE that classifies them similar to the Budapest airport (where it was developed and tested the Validation EXE of the Solution), it was based on the classification of Airports and EnRoute ATC Sectors released by the PJ20-CI for Wave 2 of SESAR 2020.

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Obviously, considering both the estimate of the CBA (in economic range) and the performance expectations (PAR) as well as the other Deliverables which evaluate, in operational domain, the enabler and the implementations were tested by the Solution with the horizon to 2043.

Then, the classification of Budapest airport (currently in 2022 it is classified as Medium because of it is based on the current amount of traffic handled by the airport itself, even if contextually it has a classification of High Complex Airport due to the configuration of the airport layout) for the purpose of the assessment of the CEF2 KPI, it has been raised to Large Airport and consequently the ECAC calculation is resolved considering Budapest as one of the 40 airports (20 classified Large and 20 Very Large) which will be classified as such in 2043.

KPIs / PIs	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
CEF2[11] Flights per ATCO-Hour on duty	No	Count of Flights handled divided by the number of ATCO-Hours applied by ATCOs on duty.	YES	***0,35%***	***1,39%***
CEF3 Technology cost per flight	EUR / flight	G2G ANS cost changes related to technology and equipment.	YES	***N/A***	***N/A***
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	***N/A***	***N/A***

Table 44: Cost Efficiency benefit for Mandatory KPIs /PIs

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

If yes, does the S2020 Wave2 performance comes in addition to S2020 Wave1 or replace it? ***N/A***

4.14.4Discussion of Assessment Result

Performance targets from PJ19:

PJ19-W2: Validation Targets - SESAR2020 Wave 2 & Wave 3 [8] set a target for CEF2 as “Impact level 1”, as it has been reported at the above Table 44.

Confidence in the results:

[11] 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).

The validation was performed using Real Time simulation techniques, the Controller Working position was not what the ATCOs was using daily, but ATCOs were familiar with the Working position. All the ATCOs were very familiar with the airport. This gives good confidence in the results.

To be able to have two SESAR solutions (SESAR 1 guidance and the new full guidance) in the same validation platform is challenging. To emulate the SESAR1 solution the conflict detection algorithm was disabled for the Reference scenarios. This approach could have negative impact on confidence but is what is possible without having truly two validation platforms.

Even though "Guidance assistance through airfield ground lighting" is a published SESAR1 solution, none of the ATCOs had experience in such Follow-the-greens operation in real life. The lack of experience could be regarded as negative for the confidence in the results, however when comparing two solutions it is actually positive that the ATCO have similar knowledge about both.

All in all the confidence in the results were pretty good and classified as ***MEDIUM***

Referred to the Solution, there is no direct benefit effect measured for this KPA coming out from the post analysis.

But, in any case, the benefit counted and above reported in CEF 2 table will be provided by the improvement of the enabler tested by the Solution and the related post analysis of the HP output.

4.14.5Additional Comments and Notes

The operational maturity level of the enabler, achieved with the technological development subsequent the requests coming from specific operational needs and resultant by the output from the RTS, has demonstrated the feasibility and positive support that its implementation in operations would guarantee in terms of improving the management of traffic on the movement area of the airport, of optimization of the ATCO workload and, not less, of improving benefits to the Network itself at ECAC level.

For this purpose, the proposed recommendation is to continue developing and upgrading it in the R&D perimeter but at the same time to implement the installation on one or more airports in order to detect the benefits even more in detail and improve its performances also on local needs.

4.15Airspace User Cost Efficiency

Does the Solution impact this KPA? ***No***

The Airspace User Cost Efficiency metrics capture monetized operational and non-operational airspace user benefits that are not already assessed through the other KPIs, meaning, benefits other than ANS cost improvements, fuel efficiency improvements, etc.

4.15.1Performance Mechanism

Is there a Benefit Mechanism available? ***No***.

4.15.2Assessment Data (Exercises and Expectations)

N/A

Exercise ID or Expert judgement	Benefits contribution to AU3	Benefits contribution to AU4	Benefits contribution to AU5
EXE-xx	***N/A***	***N/A***	***N/A***
Add additional rows for all the Exercises from your Solution			

Table 45: Airspace User Cost Efficiency benefit per Exercise

OI step	Relative benefits contribution to AU3	Relative benefits contribution to AU4	Relative benefits contribution to AU5
XX-XXXX	***N/A***	***N/A***	***N/A***
Add additional rows for all the OIs from your Solution			
TOTAL	100%	100%	100%

Table 46: Airspace User Cost Efficiency relative benefit per OI step

4.15.3Extrapolation to ECAC wide

N/A

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PIs	Unit	Calculation	Mandatory	Absolute expected performance benefit in SESAR2020	% expected performance benefit in SESAR2020
AUC3 Direct operating costs for an airspace user	EUR	Impact on direct costs related to the aeroplane and passengers. Examples: fuel, staff expenses, passenger service costs, maintenance and repairs, navigation charges, strategic delay, landing fees, catering.	Yes, where an impact is foreseen on AU cost efficiency	***N/A***	***N/A***
AUC4 Indirect operating costs for an airspace user	EUR	Impact on operating costs that don't relate to a specific flight. Examples: parking charges, crew and cabin salary, handling prices at Base Stations.	Yes, where an impact is foreseen on AU cost efficiency	***N/A***	***N/A***
AUC5 Overhead costs for an airspace user	EUR	Impact on overhead costs. Examples: dispatchers, training, IT infrastructure, sales.	Yes, where an impact is foreseen on AU cost efficiency	***N/A***	***N/A***

Table 47: Airspace User Cost Efficiency benefit for Mandatory KPIs /PIs

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

If yes, does the S2020 Wave2 performance comes in addition to S2020 Wave1 or replace it? ***N/A***

4.15.4Discussion of Assessment Result

N/A

4.15.5Additional Comments and Notes

N/A

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4.16Security

4.16.1The SecRAM 2.0 methodology and the Security Performance Mechanism

A Security assessment was conducted in SESAR 2020 Wave 1, and updated for Wave 2, and security requirements are part of the SPR and TS/IRS.

4.16.2Security Assessment Data Collection

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, 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, Y*
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	*Low*

Table 48: Security benefit for Mandatory PIs

4.16.3Extrapolation to ECAC wide

There is no ECAC wide extrapolation required for this KPI.

4.16.4Discussion of Assessment Result

For confidentiality issues the SRA carried out cannot be circulated nor shared with partners external to the Solution.

4.16.5Additional Comments and Notes

N/A.

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4.17Human Performance

The full guidance FtG supported ATCOs in performing their tasks in a timely and efficient manner most of the times and was considered highly acceptable. At the same time, the Operating methods introduced by the automated switching of AGL function and A-SMGCS Routing Service could be followed accurately, efficient and in a timely manner in all the operational conditions. However, in the degraded scenario run, a couple of ATCOs commented that in the traffic complexity was too low to properly evaluate the impact of a system malfunction. In future activities this aspect should be investigated with a traffic sample which contains more traffic.

4.17.1HP arguments, activities and metrics

PIs	Activities & Metrics	Second level indicators	Covered
HP1 Consistency of human role with respect to human capabilities and limitations	Real-Time Simulation (Observations, questionnaires and debriefings) Main metrics: Acceptability and workload	**HP1.1** Clarity and completeness of role and responsibilities of human actors No changes in roles and responsibilities.	**Yes**
		HP1.2 Adequacy of operating methods (procedures) in supporting human performance Operating methods introduced by the automated switching of AGL function and A-SMGCS Routing Service could be followed accurately, efficient and in a timely manner in all the operational conditions. The de-icing scenarios and RWY direction change were not addressed in the scenarios because they were considered more relevant scenarios to the routing service validation which was within the scope of PJ.02-W2-21.6 In the degraded scenario the traffic complexity was too low to properly evaluate the impact of a system malfunction. This operational scenario should be further investigated, also the collection of quantitative logs would further support the obtained the outcomes.	**Yes/Open**
		HP1.3 Capability of human actors to achieve their tasks in a timely manner, with limited error rate and acceptable workload level. According to ATCOs cognitive workload ratings (bedford scale) the full guidance FtG solution results both in good visibility (2.2 vs 2.8) and in LVP (3 vs 3.2) were not only acceptable but were slightly lower compared to the refence runs (with FtG). During the debriefing ATCOs considered that compared with current operations, the FtG solution greatly improved their workload level, the conflict detection features were highly appreciated, and they were the aspect that mostly contributed to the workload reduction. The full guidance FtG reduce ATCOs effort to search for possible conflict because of the alerts in place.	**Yes/Open**

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PIs	Activities & Metrics	Second level indicators	Covered
		In the degraded scenario the traffic complexity was too low to properly evaluate the impact of a system malfunction. This operational scenario should be further investigated, also the collection of quantitative logs would further support the obtained the outcomes.	
HP2 Suitability of technical system in supporting the tasks of human actors	Real-Time Simulation (Observations, questionnaires and debriefings) Main metrics: Usability, trust, workload and situational awareness	**HP2.1** Adequacy of allocation of tasks between the human and the machine (i.e. level of automation). Overall, ATCOs considered that compared with current operations, the full guidance FtG solution greatly improved their workload, the conflict detection features were highly appreciated and they were the aspect that mostly contributed to the workload reduction. Overall, ATCOs mentioned that they really appreciated the conflict resolution logic and the support provided by the tool.	**Yes**
		HP2.2 Adequacy of technical systems in supporting Human Performance with respect to timeliness of system responses and accuracy of information provided All ATCOs agreed that the overall usability of the full guidance FtG HMI was adequate. ATCOs also agreed that the overall timeliness and accuracy of the full guidance FtG supported their tasks. However, they also mentioned some specific aspects in which they would have liked to see improvements.	Yes
		HP2.3 Adequacy of the human machine interface in supporting the human in carrying out their tasks. All ATCOs agreed that the overall usability of the full guidance FtG HMI was adequate. ATCOs also agreed that the overall timeliness and accuracy of the full guidance FtG supported their tasks. However, they also mentioned some specific aspects in which they would have liked to see improvements. Alerting features: The alerts were considered very useful and reduced the ATCOs' scanning load. All ATCOs agreed that the 'No taxi' and the 'route deviation alert' were triggered timely and accurately. Conflict detection and resolution: 4/5 ATCOS reported that it was not immediate to understand the a/c who had priority from the label symbol. ATCOs would have preferred a more conspicuous representation of the a/c with priority. ATCOs would have liked to have the priority information more immediate and in a more intuitive way. Namely, seeing the priority number on the flight label or a colour coding in the label corresponding to the order of the flights and having the information without having to hoover with the mouse over the label/conflict.	Yes

PIs	Activities & Metrics	Second level indicators	Covered
HP3 Adequacy of team structure and team communication in supporting the human actors	Real-Time Simulation (Observations, questionnaires and debriefings) Main metrics: Communication, Trust, workload and acceptability	**HP3.1** Adequacy of team composition in terms of identified roles No changes in team composition in terms of identified roles.	
		HP3.2 Adequacy of task allocation among human actors No changes in task allocation between human actors.	**Yes**
		HP3.3 Adequacy of team communication with regard to information type, technical enablers and impact on situation awareness/workload The FtG full guidance phraseology was considered appropriate but for the degraded scenarios some ATCOs mentioned that further wording might need to be implemented and simplified in order to better manage workload related to communication and avoid miscommunication in general.	**Yes**
HP4 Feasibility with regard to HP-related transition factors	Real-Time Simulation (Observations, questionnaires and debriefings) Flight crew and vehicle drivers workshop	**HP4.1** User acceptability of the proposed solution The operating methods introduced by the full guidance FtG were well accepted and could be followed accurately, efficient and in a timely manner by ATCOs in all the operational conditions. During the debriefing ATCOs considered that compared with current operations, the FtG solution greatly improved their workload level, the conflict detection features were highly appreciated and they were the aspect that mostly contributed to the workload reduction. The full guidance FtG reduce ATCOs effort to search for possible conflict because of the alerts in place. In case of emergency ATCOs might close certain part of the taxiway or manoeuvring area and fire brigades can easily be guided to certain locations without the risk of causing a conflict. Therefore, the FtG was also considered and advantage for this type of operations.	Yes
		HP4.2 Feasibility in relation to changes in competence requirements The changes in competences requirements were considered acceptable by all actors. During the workshop discussions, pilots and vehicle drivers agreed that training and familiarization is the most important aspect to build trust in the system and, consequently, improving acceptance of the new operating method (procedures).	Yes
		HP4.3	Yes

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PIs	Activities & Metrics	Second level indicators	Covered
		Feasibility in relation to changes in staffing levels, shift organization and workforce relocation. No changes in staffing level, shift organization and workforce relocation.	
		HP4.4 Feasibility in relation to changes in recruitment and selection requirements . Both ATCOs and pilots recommend that procedures and operating methods of the full guidance FtG must be addressed in detail in training to make sure that they are clear. Training greatly contributes to improve trust and acceptability by all actors.	Yes
		HP4.5 Feasibility in terms of changes in training needs with regard to its contents, duration and modality. The new competences will be introduced to ANSPs, airspace user and airport operators should preferably be created by a unique European standard body or safety agency.	Yes

Table 49: HP arguments, activities and metrics

4.17.2Extrapolation to ECAC wide

There is no ECAC wide extrapolation required for this KPI.

4.17.3Open HP issues/ recommendations and requirements

Please list here any important issues that might have a major impact on the performance of the solution. For more detail please refer to the HP Assessment Report and HP log.

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PIs	Number of open issues/ benefits	Nr. of recommendations	Number of requirements
HP1 Consistency of human role with respect to human capabilities and limitations	3	1	4
HP2 Suitability of technical system in supporting the tasks of human actors	1	8	9
HP3 Adequacy of team structure and team communication in supporting the human actors	1	1	0
HP4 Feasibility with regard to HP-related transition factors	2	2	0

Table 50: Open HP issues/ recommendations and requirements

4.17.4Concept interaction

The list of projects and links with other projects/concepts has been in the change request.

4.17.5Most important HP issues

Please list here any important issues that might have a major impact on the performance of the solution.

In case issues that impact other solutions are envisaged please list them here to facilitate the aggregation of data into deployment scenarios

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	The full guidance FtG supports ATCOs in performing their tasks in high workload scenarios (high traffic).	
	The full guidance FtG supports ATCOs degraded mode operating methods are acceptable for all actors in high workload scenarios (high traffic).	
	The operating procedures specify that that ATCOs should avoid doing sudden priority swaps between mobiles or re-routings when they are too close to the converging points.	
HP2 Suitability of technical system in supporting the tasks of human actors	The full guidance FtG supports ATCOs in maintain an acceptable workload in RWY direction change scenarios.	
	The HMI does not lead to confusion and increased time to find the relevant information.	
	The HMI support the ATCO in understanding the guidance system current status will behave and restrict traffic.	

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PIs	Most important issue of the solution	Most important issues due to solution interdependencies
	The alerts support the ATCO situation awareness on non-conformance and conflicting ATC clearances.	Conflicting clearances are part of the routing function.
HP3 Adequacy of team structure and team communication in supporting the human actors	The phraseology is considered adequate adequate to cover all actors needs.	
	Sudden priority swap between converging mobiles or re-routing should be covered by adequate phraseology.	
HP4 Feasibility with regard to HP-related transition factors	The TCL being lit in small blocks in order to control speed should be assessed and acceptable from all actors point of view.	
	Training implementation can have a great impact on all actors acceptability and on the safety.	
	Not frequent training on the concept can create error prone situations and confusion for flight crews and vehicle drivers.	

Table 51: Most important HP issues

4.17.6Additional Comments and Notes

No additional comments.

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4.18Other PIs

Further PIs from the Performance Framework update are assessed qualitatively, or, if possible, quantitatively, in Table 52

KPA	PIs	Benefit mechanism (text only)	Qualitative Impact[12]
N/A	*N/A*	*N/A*	*N/A*

Table 52: Qualitative assessment of QoS KPIs

Detailed descriptions of these PIs can be found in the Performance Framework [3].

NOTE: These PIs are preliminary, and the table currently serves as a placeholder!

4.18.1Performance Mechanism

N/A

4.18.2Assessment Data (Exercises and Expectations)

N/A

4.18.3Additional Comments and Notes

N/A

[12] --, -, 0, +, ++

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Gap Analysis

KPI	Validation Targets – Network Level (ECAC Wide)	Performance Benefits at Network Level (ECAC Wide or Local depending on the KPI)[13]	Rationale[14]
SAF1: Safety - Total number of estimated accidents with ATM Contribution per year	***N/A***	***N/A***	***N/A***
FEFF1: Fuel Efficiency - Actual average fuel burn per flight	***14,8 kg Medium Expectation (VT_"2" was assigned by PJ19.4)***	***-14,8 kg x AC***	***The Solution, by the Validation EXE, did not provided any value to calculate any benefit in Fuel Efficiency, as reported above in the dedicated paragraph and within the lines of the other Solution Deliverables.***
CAP1: TMA Airspace Capacity - TMA throughput, in challenging airspace, per unit time.	***N/A***	***N/A***	***N/A***
CAP2: En-Route Airspace Capacity - En-route throughput, in challenging airspace, per unit time	***N/A***	***N/A***	***N/A***
CAP3: Airport Capacity – Peak Runway Throughput	***N/A***	***N/A***	***N/A***

[13] Negative impacts are indicated in red.

[14] 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). **Please contact your PJ19.04 Solution Champion to clarify when the Gap Rational is needed.**

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(Mixed mode).			
TEFF1: Gate-to-gate flight time	***0,12 mins. Medium Expectation. (VT_"2" assigned by PJ19.4)***	***-0,12 mins x AC***	The Solution, by the Validation EXE, did not provided any value to calculate any benefit in Time Efficiency, as reported above in the dedicated paragraph and within the lines of the other Solution Deliverables.
PRD1: Predictability – Average of Difference in actual & Flight Plan or RBT durations	***2,49%. High Expectation. (VT_"3" assigned by PJ19.4)***	***-2,49% x AC***	The Solution, by the Validation EXE, did not provided any value to calculate any benefit in Predictability, as reported above in the dedicated paragraph and within the lines of the other Solution Deliverables.
PUN1: Punctuality – Average departure delay per flight	***N/A***	***N/A***	***N/A***
CEF2: ATCO Productivity – Flights per ATCO -Hour on duty	***0,35%. LOW Expectation (VT_"1" assigned by PJ19.4)***	***+1,19% x AC***	***The Solution, by the Validation EXE, exceeded the target benefit in ATCO Productivity by roughly a factor of four*** *(For any Benefits have a look at the RES paragraph).*
CEF3: Technology Cost – Cost per flight	***N/A***	***N/A***	***N/A***

Table 53: Gap analysis Summary

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5 References

This PAR complies with the requirements set out in the following documents:

[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)[15]

[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

[6] PJ19-W2: Validation Targets - SESAR2020 Wave 2 & Wave 3, Edition 00.01.00, 4 May 2021

Content Integration

[7] SESAR ATM Lexicon

Performance Management

[8] PJ19.04 D4..0.1 Validation Targets SESAR 2020- Wave 2 & Wave 3 04 May 2021

Validation

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

Safety

[10]SESAR, Safety Reference Material, Edition 4.0, April 2016

https://stellar.sesarju.eu/jsp/project/qproject.jsp?objId=1795089.13&resetHistory=true&statInfo=Ogp&domainName=saas

[11]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&statInfo=Ogp&domainName=saas

[12]SESAR, Final Guidance Material to Execute Proof of Concept, Ed00.04.00, August 2015

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

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[13]Accident Incident Models – AIM, release 2017

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

Human Performance

[14]16.06.05 D 27 HP Reference Material D27

[15]16.04.02 D04 e-HP Repository - Release note

Environment Assessment

[16]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

[17]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

[18]16.06.02 D103 SESAR Security Ref Material Level

[19]16.06.02 D137 Minimum Set of Security Controls (MSSCs).

[20]16.06.02 D131 Security Database Application (CTRL_S)

Appendix A Detailed Description and Issues of the OI Steps

OI Step ID	Title	Consistency with latest Dataset
N/A	*N/A*	*N/A*
N/A	*N/A*	*N/A*
N/A	*N/A*	*N/A*

Table 54: OI Steps allocated to the Solution

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Appendix B Title of the appendix

N/A

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