



Safer Airports and Flights for Europe



SESAR Solution PJ.03b-05 V3 SPR/INTEROP-OSED - Part V - Performance Assessment Report

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SAFE

TRAFFIC ALERTS FOR PILOTS FOR AIRPORT OPERATIONS

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Abstract

This performance assessment report addresses 4 KPA: safety, security, human performance & cost efficiency. Hence, this document gathers the results also available in:

- D4.1.190 - SESAR PJ03b-05 V3 OSED-SPR-INTEROP part II: safety assessment report
- D4.1.190 - SESAR PJ03b-05 V3 OSED-SPR-INTEROP part III: security assessment report
- D4.1.190 - SESAR PJ03b-05 V3 OSED-SPR-INTEROP part IV: human performance assessment report
- D4.1.210 - SESAR PJ03b-05 V3 CBA: cost benefits analysis

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1 Executive Summary

This document provides the Performance Assessment Report (PAR) for solution PJ.03b-05 - Traffic alerts for pilots for airport operations.

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

Description:

In the airport environment, there can be instances today where conflicting ATC clearances are given to aircraft or where flight crews do not comply with ATC clearances. These situations are generally identified and resolved but can result in last minute and urgent actions for the controllers and/or pilots. This Solution aims to provide the pilots with alerts detecting the risk of collision with another aircraft operating on the same area (runway or taxiway). It deals with a pure safety net for pilots involving a reaction from pilots.

According to 2018 IATA Safety Report, runway incursions are identified as a major threat. Indeed, about one runway incursion event per day is reported.

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 [18]. 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.

KPI	Validation Targets – Network Level (ECAC Wide)	Performance Benefits Expectations at Network Level (ECAC Wide or Local depending on the KPI) ¹	Confidence in Results ²
FEFF1: Fuel Efficiency – Fuel burn per flight	N/A	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
PRD1: Predictability – Variance of Difference in actual & Flight Plan or RBT durations	N/A	N/A	N/A
PUN1: Punctuality – % Flights departing within +/- 3 minutes of scheduled departure time due to ATM and weather related delay causes	N/A	N/A	N/A
CEF2: ATCO Productivity – Flights	N/A	N/A	N/A

per ATCO -Hour on duty			
CEF3: Technology Cost – Cost per flight	0	0	0
SAF1: Safety - Total number of fatal accidents and incidents with ATM Contribution per year	-1.46%	-7.5% RWYs -5% TWYs	medium

Table 1: KPI Assessment Results Summary

Mandatory PI	Performance Expectations at Network Level (ECAC Wide or Local depending on the KPI) ³	Benefits at Network	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	-7.5%		Medium
SAF4.X: RWY-excursion accident	N/A		N/A
SAF5.X: TWY-collision accident	-5%		Medium
SAF6.X: CFIT accident	N/A		N/A
SAF7.X: Wake related accident	N/A		N/A
SEC1: A security risk assessment has been carried out	2		X
SEC2: Risk Treatment has been carried out	N/A		N/A

³ Negative impacts are indicated in red.

⁴ High – the results might change by +/-10%

Medium – the results might change by +/-25%

Low – the results might change by +/-50% or greater

N/A – not applicable, i.e., the KPI cannot be influenced by the Solution

SEC3: Residual risk after treatment meets security objective.	N/A	N/A
SEC7: Personnel (safety) risk after mitigation	N/A	N/A
SEC8: Capacity risk after mitigation	N/A	N/A
SEC9: Economic risk after mitigation	N/A	N/A
FEFF2: CO2 Emissions.	N/A	N/A
FEFF3: Reduction in average flight duration.	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
RE5: Number of cancellations.	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: Available/Required training Duration within ARES	N/A	N/A
CMC1.2: Allocated/ Optimum ARES dimension	N/A	N/A
CMC1.3: Transit Time to/from airbase to ARES	N/A	N/A
CMC2.1: Fuel and Distance saved (for GAT operations)	N/A	N/A
CMC2.2: GAT planning efficiency of Available ARES	N/A	N/A
HP1: Consistency of human role with respect to human capabilities and limitations	40-70%	Medium
HP2: Suitability of technical system in supporting the tasks of human actors	40-70%	Medium
HP3: Adequacy of team structure and team communication in supporting the human actors	N/A	N/A
HP4: Feasibility with regard to HP-related transition factors	N/A	N/A
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

2 Introduction

2.1 Purpose of the document

The Performance Assessment covers the Key Performance Areas (KPA) 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

This document is mainly intended to be read by project PJ03b-05 partners concerned by “Traffic alerts for pilots for airport operations” and its validation. It is also of interest at the level of PJ03b “Safer Airports and Flights for Europe”, and also at the level of PJ03a “Integrated Surface Management”.

- a) Internal to PJ03b-05 “Traffic alerts for pilots for airport operations”
- b) Internal to SESAR 2020 and external to Solution PJ03b-05:
 - a. The project members concerned by future function development and standardization,
 - b. Involved PCIT and EPMB members
 - c. PJ19 and PJ22 projects
- c) External to SESAR
 - a. Avionics systems and subsystems designers
 - b. Avionics equipment suppliers
 - c. Airlines, Business Aviation, Flight Crew
 - d. Air Traffic Centre, ATM designers and controllers

2.3 Glossary of terms

Term	Definition	Source of the definition
Advisory	Alert level that requires crew awareness and potential subsequent crew action as defined per DO323 D-4	

	.	
Alerts	A signal to the crew intended to draw their attention to the existence of an abnormality, system fault or aircraft condition and to identify it.	
Caution	Alert level that requires crew awareness and potential subsequent crew action. Used in Optional version version (DO-323).	
Indication	(cf. DO-323 definition).	
SURF IA	Enhanced Traffic Situational Awareness on the Airport Surface with Indications and Alerts. SURF IA is the RTCA application DO-323.	
SURF-A	Surface Traffic Alerts on runways for pilots without display (CDTI) (Warning alerts only on ground)	
SURF-ITA	Surface Traffic Alerts & Indication for pilots with optional display (CDTI) (Caution and Warning alerts)	
SURF-ITA+	Surface Traffic Indication & Alerts on runways and taxiways for pilots including both applications SURF-ITA and TWY-ITA.	
Runway Status Indication (RSI)	(cf. DO-323 definition).	
Traffic Indication (TI)	(cf. DO-323 definition).	
TWY-A	Surface Traffic Alerts on taxiways for pilots (Caution alerts only, no display traffic indication)	
TWY-ITA	Surface Traffic Indication & Alerts on taxiways for pilots (Caution alerts only)	
Warning	Immediate recognition and corrective or compensatory action by the crew is required	

Table 3: Glossary of terms

2.4 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
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
SESAR	Single European Sky ATM Research Programme
SJU	SESAR Joint Undertaking
SESAR2020 Programme	The programme which defines the Research and Development activities and Projects for the SJU.

Table 4: Acronyms and terminology

3 Solution Scope

3.1 Detailed Description of the Solution

Solution is described in D4.1.190 - SESAR PJ03b-05 V3 OSED-SPR-INTEROP part I.

3.2 Detailed Description of relationship with other Solutions

As identified in EATMA, PJ.03b-05 traffic alert for pilots is linked to both following solutions:

- Solution PJ.03a-01 — Enhanced Guidance Assistance to Aircraft and Vehicles on the Airport Surface Combined with Routing
- Solution PJ.13-02-03 — GA/R Specific Surveillance Systems

However, it shall be highlighted that PJ.03b-05 is prototyping airborne safety nets, which can be deployed independently of any other ATM solutions without any change to current ground or cockpit procedures & responsibilities (see more detail beginning of §4.15 Human Performance).

4 Solution Performance Assessment

4.1 Assessment Sources and Summary of Validation Exercise Performance Results

SESAR Validation Exercises of this Solution are listed below.

Exercise ID	Exercise Title	Release	Maturity	Status
PJ.03b-05 – EXE01	Fast-time simulations	Final	V3	Done
PJ.03b-05 – EXE02	Real-time simulations (mainline)	Final	V3	Done
PJ.03b-05 – EXE03	Real-time simulations (business)	Final	V3	Done
PJ.03b-05 – EXE04	Flight test (business & mainline)	Final	V3	Done

Table 3: SESAR2020 Validation Exercises

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

Exercise	OI Step	Exercise scenario & scope	Performance Results	Notes
PJ.03b-05 – EXE01	AUO-0605 AUO-0615	PJ28 ADS-B data performance assessment + Monte-Carlo	Acceptable	Reference to SESAR PJ28 ADS-B collected data (CRT-VLD-28-023-001) and data analyses (CRT-VLD-28-023-002)
PJ.03b-05 – EXE02	AUO-0605	Simulator evaluations (human performance & operational) in mainline cockpit	Acceptable	
PJ.03b-05 – EXE03	AUO-0605 AUO-0615	Simulator evaluations (human performance & operational) in business cockpit	Acceptable	
PJ.03b-05 – EXE04	AUO-0605 AUO-0615	Flight test mainline + business solutions Taxiways	-0605 Acceptable -0615 Partially Acceptable with recommendation	Taxiway part results differs from HF RTS validation results.

Table 4: Summary of Validation Results.

4.2 Conditions / Assumptions for Applicability

The following Table 5 summarises the applicable operating environments.

OE	Applicable sub-OE	Special characteristics
Airport surface	All airports	SURF-A/ITA & TWI-A/ITA complementary to ground safety net, regardless of the airport equipment

Table 5: Applicable Operating Environments.

The following Table 6 summarises the essential deployment details.

Benefits assessment date	Specific geographical and/or stakeholder deployment
01.01.2022	Any airport operated by aircraft equipped with SURF-A/ITA or TWY-A/ITA
	Airbus A320/A330 families as a first target. Relatively easy adaptation to A350/A380 or other manufacturers.

Table 6: Deployment details.

Equipment details and how equipment influences benefits in the ramp-up phase is given below.

When a conflicting situation between two aircraft occur, only one aircraft needs to be equipped with SURF-A/ITA or TWY-ITA solution to solve the conflict.

As shown by the following chart, even a partial equipment with the SURF-A/ITA solution results in a significant reduction of the probability of relevant runway conflict / collision (e.g. 50% of fleet equipped solves 75% of conflicts)

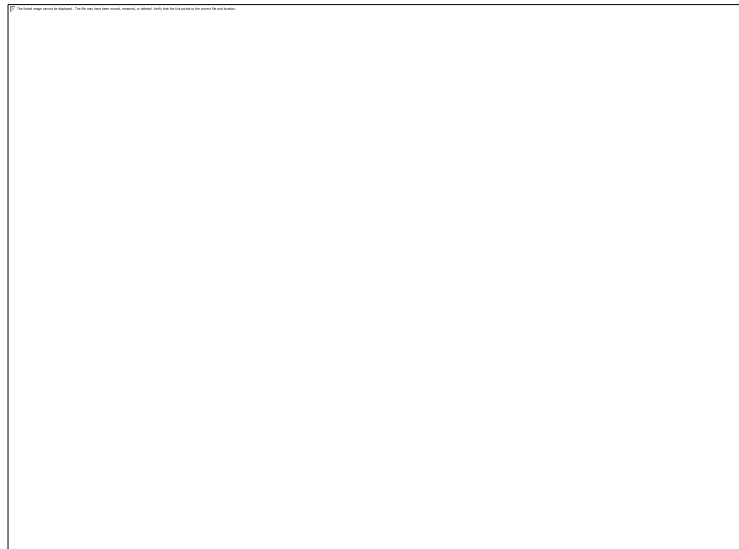


Figure 1: Impact of SURF-A

4.3 Safety

PJ.03b-05 traffic alert for pilots is a SESAR solution addressing safety threat on ground. Safety enhancement is the purpose of SURF-A/ITA & TWY-ITA.

In D4.1.191 - SESAR PJ03b-05 V3 OSED-SPR-INTEROP part II Safety Assessment Report is described in details the assumptions and methodology supporting the safety criteria results. Here are the main outcomes:

SAC#1 : There shall be an improvement 7,5 % of barrier B1 (Pilot Runway Collision Avoidance) to reduce runway collisions per year due to the introduction of the PJ.03b-05 runway solution, despite of the traffic increase till 2035.

In this safety criterion, both implementations SURF-A/ITA are considered.

SAC#2 : There shall be an improvement 5 % of barrier B1 (Pilot Taxiway Collision Avoidance) to reduce taxiway collisions per year due to the introduction of the PJ.03b-05 taxiway solution, despite of the traffic increase till 2035.

In this safety criterion, TWY-ITA implementation is considered

NB: it must be highlighted that assumptions on technology equipment rate & conflict resolution share between ground and airborne safety nets support these figures.

For a single aircraft equipped with the technology, pending the traffic broadcast eligible ADS-B signal, the detection rate of runway collision risk is targeted to be above 95%.

4.4 Environment / Noise and Local Air Quality

Not applicable.

4.5 Airspace Capacity (Throughput / Airspace Volume & Time)

Not applicable.

4.6 Airport Capacity (Runway Throughput Flights/Hour)

Not applicable.

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

Not applicable.

4.8 Predictability (Flight Duration Variability, against RBT)

Not applicable.

4.9 Punctuality (% Departures < +/- 3 mins vs. schedule due to ATM causes)

Not applicable.

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

Not applicable.

4.11 Flexibility

Not applicable.

4.12 Cost Efficiency

Some elements for cost efficiency is provided in D4.1.210_CBA.

Here are some qualitative elements regarding the costs of the solution:

- Costs are mostly system development costs (non-recurring costs).
- SURF-A/ITA is a function that does not require specific hardware development.
- Only software development is needed. As mentioned in SAR - D4.1.190_OSED-SPR-INTEROP part II, Design Assurance Level C is considered.

4.13 Airspace User Cost Efficiency

Some qualitative elements for cost-benefits analysis is provided in D4.1.210_CBA.

Here are some qualitative elements regarding the costs of the solution for airspace users:

- Implementation on aircraft is limited to software upload and limited wiring.
- This can be done in parallel with other updates in order to minimize the aircraft immobilization time.
- SURF-A/ITA is a safety net which does not change the current procedures or workload. Crews are not relying on it to operate, and the change in cockpit HMI is completely unchanged.
- The expected level of training is C, meaning the reading of operational documentation (Flight crew operating manual, flight crew technique manual) and a dedicated training support (PowerPoint, video). However, no specific training in simulator will be required. Hence, the costs for airlines will be minimal.

4.14 Security

4.14.1 The SecRAM 2.0 methodology and the Security Performance Mechanism

Based on the SecRAM guidelines have been defined security assessments of the PJ.03b-05 solution and risks summarized in the security reports (see D4.1.190 - SESAR PJ03b-05 V3 OSED-SPR-INTEROP part IIIA/B).

In reference to the PMP PJ.03b-05 a document was produced by PCG32, Action Paper “Cybersecurity for S2020”[8] to analyse the how the SESAR 2020 projects would be potentially impacted by Security aspects. As a result of this analysis, a score was given to each solution to reflect this impact. The solutions with a score higher than 2.5 are considered as potentially more impacted than the other ones. As shown is the figure below, all PJ03b solutions have a score lower than 2,5.



PJ03b	Airport Safety Nets	
PJ.03b-01	Enhanced Airport Safety Nets for Controllers	2,2
PJ.03b-03	Conformance monitoring safety net for Pilots	1,6
PJ.03b-05	Traffic alerts for Pilots for airport operations	2
PJ.03b-06	Safety support tools for runway excursions	1,4

Figure 2: Extract from PCG32 Action Paper

4.14.2 Security Assessment Data Collection

There are two OI steps within PJ.03b-05 solution with security assessment:

- AUO-0605 “Traffic alerts for pilots during runway operations” for mainline and business aircraft,
- AUO-0615 “Traffic alerts for pilots during taxiway operations” for business aircraft;

Runway function under AUO-605 is identified as the most critical solution in reference to safety and security assessments.

The key elements of the PJ.03b-05 solution for security assessment is other traffic ADS-B data (Information – identified as a primary asset) provided to Aircraft (System) processing this data and providing traffic alerts to the Flight Crew (Human) in case of collision threat. Based on pilot decision the flight crew can take a resolution action that is communicated to ATC within standard phraseology and operational procedures.

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 mandatory for different prioritization and maturity levels)	2
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)	1
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
SEC7 Personnel (safety) risk after mitigation	Risk 3 levels are possible: high, medium or low	Qualitative assessments are derived from application of the SESAR2020 Security Risk Assessment Methodology (SecRAM 2.0). The PI is the maximum risk evaluated for the SESAR Solution after application of the recommended controls and considering the Personnel Impact Area only.	According to the SESAR Solution prioritization list and to the maturity level of the solutions	Low
SEC8 Capacity risk after mitigation	Risk – 3 levels are possible: high, medium or low	Qualitative assessments are derived from application of SecRAM 2.0. The PI is the maximum risk evaluated for the SESAR Solution after application of the recommended controls and considering the Capacity Impact Area only.	According to the SESAR Solution prioritization list and to the maturity level of the solutions	Low
SEC9 Economic risk after mitigation	Risk – 3 levels are possible: high, medium or low	Qualitative assessments are derived from application of SecRAM 2. The PI is the maximum risk evaluated for the SESAR Solution after application of the recommended controls and considering the Economic Impact Area only.	According to the SESAR Solution prioritization list and to the maturity level of the solutions.	Low

The solution security assessment provides acceptable results with low security impacts and existing system requirements.

4.14.3 Extrapolation to ECAC wide

There is no ECAC wide extrapolation required for this KPI.

4.14.4 Discussion of Assessment Result

Reflect on the outcome, summarise main issues, and provide a confidence estimate for the assessment result.

4.14.5 Additional Comments and Notes

N/A

4.15 Human Performance

The human performance assessment is detailed in D4.1.190 - SESAR PJ03b-05 V3 OSED-SPR-INTEROP part IV – Human Performance Assessment Report (HPAR) [41].

- **Controllers**

Controller responsibilities are unchanged by the implementation of the SURF-ITA/TWY-ITA application. The alerts provided to the flight crews are supplemental to the ATC services they receive and provide a potential safety net should either ATC or flight crew errors occur.

- **Flight crews**

The flight crew's roles and responsibilities with respect to conducting aerodrome surface operations and maintaining traffic awareness for safety and collision avoidance will not change because of the SURF-ITA/TWY-ITA implementation. However, in case a risk of incursion or collision on runway/taxiway appears, the new SURF-ITA/TWY-ITA function works as a safety net i.e. it comes in addition of current barriers by presenting specific information to support the flight crew in managing the situation. For the crew, it does not supersede any existing procedure and prescribed task like expecting clearance, monitoring traffic visually using the out-the-window scan. This will be associated with procedures that include crew actions: check traffic operating on runway or about to operate on runway, stop, go-around, traffic operating on taxiway and to contact ATC. These actions are not new, so do not request specific skills.

In addition, as it deals with a new function:

- From a human factor's standpoint, it has to be demonstrated that the function does not involve inadequate errors or reactions from the crew that can be counterproductive, so, its implementation does create any risk.
- Training is necessary to make pilots aware of the function specificity and the expected reaction; the function is designed in such a way it follows current cockpit principles and minimizes training needs.

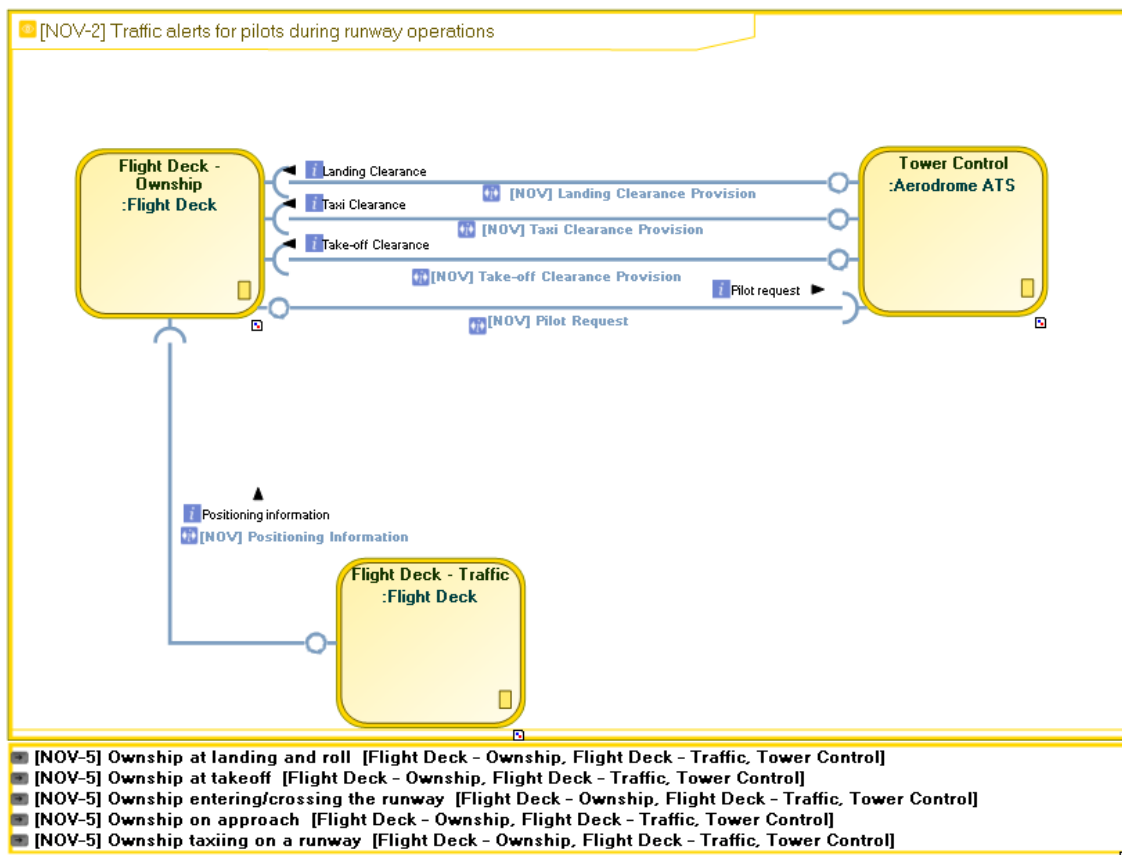


Figure 3: [NOV-2] Traffic alerts for pilots during runway operations – Operational View (MEGA Tool)

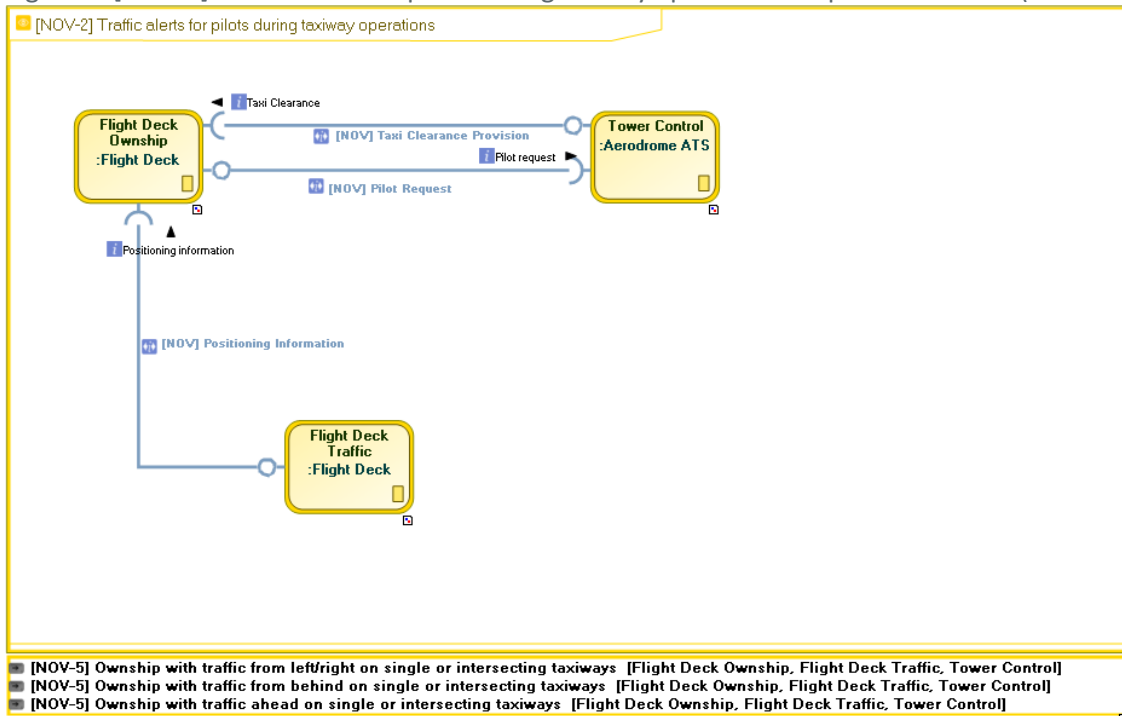


Figure 4: [NOV-2] Traffic alerts for pilots during taxiway operations – Operational View (MEGA Tool)

4.15.1HP arguments, activities and metrics

The Table below summarises the HP arguments identified with respect to the major changes introduced by PJ03b.05 solution and the actors mainly affected.

HP argument branch	Change & affected actors
1. ROLES & RESPONSIBILITIES	
1.1 ROLES & RESPONSIBILITIES	There may be impact on pilots understanding of the situation and their reaction to the alerts if they receive contradictory resolution by ATC. Pilots may rely on ATC instruction while the alerts give another information. There is a need to clarify what will be the role of pilots when facing a conflicting situation between ATC and SURF-A/SURF-ITA/TWY-ITA.
1.2 OPERATING METHODS	The flight crew may detect a traffic conflict not detected by ATC, therefore it implies that specific procedures need to be defined between air and ground to manage the operating methods towards ATC when the aircraft detects a conflict thanks to its new system and need to communicate it to ATC. This is valid for cases where the aircraft cannot avoid the conflict but just inform ATC about it, which bring an improvement compared to the current situation.
1.3 TASKS	No changes are foreseen
2. HUMAN & SYSTEM	
2.1 ALLOCATION OF TASKS (HUMAN & SYSTEM)	No changes are foreseen
2.2 PERFORMANCE OF TECHNICAL SYSTEM	No changes are foreseen
2.3 HUMAN – MACHINE INTERFACE	There will be an HMI for alerts but this one will be consistent with the design philosophy of the aircraft and in line with certification requirements (EASA regulation).
3. TEAMS & COMMUNICATION	
3.1 TEAM COMPOSITION	No changes are foreseen.
3.2 ALLOCATION OF TASKS	No changes are foreseen.
3.3 COMMUNICATION	To manage case where an alert triggers onboard but the aircraft is stopped and cannot avoid the conflict, there will be a need of communication between flight

	crew and ATC, or flight crew and other aircraft. As time critical situations, it is necessary to define a clear phraseology applied and understood by all actors.
4. HP RELATED TRANSITION FACTORS	
4.1 ACCEPTANCE & JOB SATISFACTION	No changes are foreseen
4.2 COMPETENCE REQUIREMENTS	No new competences are required to use the system as procedures needed in reaction to the alerts are already known by pilots. However as the function needs to trigger reflex actions in the sense that when pilots will face such a warning alert (respective caution alert for [SURF-ITA] and [TWY-ITA]) the appropriate action is obvious to select. Therefore pilots would have to learn and train expected actions related to each alert/use case to trigger quick decision and reaction.
4.3 STAFFING REQUIREMENTS & STAFFING LEVELS	No changes are foreseen.

The HP activities carried out are:

- Real Time Simulations, where HP data have been collected by means of questionnaires, debriefings, interviews, 'over-the-shoulders' observations. The Table below details the PIs and the HP activities and metrics, including their coverage and status.
- Stakeholders workshop where opinions collected came from a mixture of operational experts from different aviation domains (RPAS, ATM, pilots, ATCO, Human Factors).

PIs	Activities & Metrics	Second level indicators	Covered
HP1 Consistency of human role with respect to human capabilities and limitations	- Real Time Simulations (Observations, Questionnaires, Interviews): - Situational awareness - Usability - Workload	HP1.1 Clarity and completeness of role and responsibilities of human actors	CLOSED
		HP1.2 Adequacy of operating methods (procedures) in supporting human performance	OPEN
		HP1.3 Capability of human actors to achieve their tasks in a timely manner, with limited error rate and acceptable workload level	CLOSED
	- Workshop Tasks and responsibilities description		

PIs	Activities & Metrics	Second level indicators	Covered
HP2 Suitability of technical system in supporting the tasks of human actors	- Real Time Simulations (Observations, Questionnaires, Interviews): - Suability (Timeliness of the alerts, time left to solve issues). - Workload - Trust - Situational awareness	HP2.1 Adequacy of allocation of tasks between the human and the machine (i.e. level of automation).	N/A
		HP2.2 Adequacy of technical systems in supporting Human Performance with respect to timeliness of system responses and accuracy of information provided	CLOSED
		HP2.3 Adequacy of the human machine interface in supporting the human in carrying out their tasks.	CLOSED
HP3 Adequacy of team structure and team communication in supporting the human actors	N/A	HP3.1 Adequacy of team composition in terms of identified roles	N/A
		HP3.2 Adequacy of task allocation among human actors	N/A
		HP3.3 Adequacy of team communication with regard to information type, technical enablers and impact on situation awareness/workload	N/A
HP4 Feasibility with regard to HP-related transition factors	N/A	HP4.1 User acceptability of the proposed solution	N/A
		HP4.2 Feasibility in relation to changes in competence requirements	N/A
		HP4.3 Feasibility in relation to changes in staffing levels, shift organization and workforce relocation.	N/A
		HP4.4 Feasibility in relation to changes in recruitment and selection requirements .	N/A
		HP4.5 Feasibility in terms of changes in training needs with regard to its contents, duration and modality.	N/A

[...]

4.15.2 Extrapolation to ECAC wide

There is no ECAC wide extrapolation required for this KPI.k

4.15.3 Open HP issues/ recommendations and requirements

Founding Members

PIs	Number of open issues/ benefits	Nr. of recommendations	Number of requirements
HP1 Consistency of human role with respect to human capabilities and limitations	5	10	-
HP2 Suitability of technical system in supporting the tasks of human actors	2	3	-
HP3 Adequacy of team structure and team communication in supporting the human actors	-	-	-
HP4 Feasibility with regard to HP-related transition factors	-	-	-

4.15.4 Concept interaction

No specific interactions with other SESAR2020 Solutions have been identified from a Human Performance perspective.

4.15.5 Most 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	PJ03b-05_ISS_03: With or without alerts provided to ATCO through ATC tools, potential issues of contradictory resolution instructions may occur and may impact pilots understanding of the situation and their reaction to the alerts that may at the end impact safety of operations. Consistency between the two alerts (air and ground) as well as authority sharing should be further investigated. ATC keeps usual authority for traffic de-confliction and pilots are able to decide if an avoidance maneuver is needed due to an issue onboard not perceptible by ATC (e.g. windshear, failure) but it has to be confirmed if onboard maneuvers in	No solution interdependencies identified regarding HP1

PIs	Most important issue of the solution	Most important issues due to solution interdependencies
	response to SURF-A alerts are in line with a decision ATC might make in parallel to solve the conflict (does not generate new conflicts, minimize impact on traffic management). PJ03b-05_ISS_04: Some conflicting situations generating alerts may let few manoeuvre possibilities to ownship aircraft and may require that pilots inform ATC or other aircraft of its presence or of a potential threat detected by aircraft systems. In a short timeline of safety net, if the phraseology between operators is not clear they may transmit confusing communication and reduce the possibility to solve the conflict in time. PJ03b-05_ISS_05: Depending on the use case and on the operational context (traffic density, low visibility conditions, equipment failure, etc.), traffic conflict situations understanding and subsequent decision making may be complex to do upon alert triggering. It has to be ensured that workload induced by the alerts is acceptable to make a decision and perform the action in time. PJ03b-05_BEN_01: Depending on the use case and on the operational context (traffic density, low visibility conditions, equipment failure, etc.), traffic conflict situations understanding and subsequent decision making may be complex to do upon alert triggering. It is expected that the alerting function support pilots' assessment of the situation and facilitate decision making in all situations and all contexts while enhancing safety. PJ03b-05_ISS_01: As a safety net, the alert system is designed to trigger in a last resort to cover ATC or pilots' error, it should not trigger in nominal operations (nominal aircraft separation and non-conflicting clearances), therefore triggering time is late and time to understand the situation and make a decision on the action to perform may be short in certain situations. Additionally, the decision making can depend on the context then delay the recovery action. It has to be ensured that pilots may respond to the alerts in time in all the cases and contexts.	

PIs	Most important issue of the solution	Most important issues due to solution interdependencies
	PJ03b-05_ISS_02: If alert information are not well understood by the crew, it can confuse pilots on the situation and lead to time-critical issues concerning expected actions to answer to the alert. Audio and textual messages have to be unambiguous and perceived by pilots in all operational contexts.	
HP2 Suitability of technical system in supporting the tasks of human actors	PJ03b-05_ISS_06: The CDTI is expected to support crew understanding of the SURF-ITA alerts (by providing surrounding traffic visualisation and providing additional information, monitored by the SURF-ITA function). Nevertheless, requiring the CDTI to allow the SURF-ITA functioning has strong impact on function KPA (costs, fleet equipment constraints, display information overload...). Then, is the CDTI information really required to ensure a efficient pilot's reaction when detecting a potential conflict?	No solution interdependencies identified regarding HP2
HP3 Adequacy of team structure and team communication in supporting the human actors		No solution interdependencies identified regarding HP3
HP4 Feasibility with regard to HP-related transition factors		No solution interdependencies identified regarding HP4

4.15.6 Additional Comments and Notes

N/A

4.16 Other PIs

Not applicable.

4.17 Gap Analysis

Cf. §1 – Executive summary.

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
- [3] PJ19.04 D4.4 Performance Framework (2018), Edition 01.00.00, August 2018
- [4] B.05 Guidance for Performance Assessment Cycle 2013
- [5] B.05 D72, Updated Performance Assessment in 2016
https://stellar.sesarju.eu/servlet/dl/ShowDocumentContent?doc_id=1669873.13&att=attachment&statEvent=Download
- [6] B05 Data Collection and Repository Cycle 2015
- [7] Methodology for the Performance Planning and Master Plan Maintenance (edition 0.13)
https://stellar.sesarju.eu/servlet/dl/ShowDocumentContent?doc_id=4731333.13&att=attachment&statEvent=Download

Content Integration

- [8] B.04.01 D138 EATMA Guidance Material
- [9] EATMA Community pages
- [10] SESAR ATM Lexicon

Content Development

- [11] PJ19.02.02 D2.1 SESAR 2020 Concept of Operations Edition 2017, Edition 01.00.00, November 2017

System and Service Development

- [12] 08.01.01 D52: SWIM Foundation v2
- [13] 08.01.01 D49: SWIM Compliance Criteria
- [14] 08.03.10 D45: ISRM Foundation v00.08.00
- [15] B.04.03 D102 SESAR Working Method on Services
- [16] B.04.03 D128 ADD SESAR1
- [17] B.04.05 Common Service Foundation Method

Performance Management

- [18]PJ19.04.01 D4.5 Validation Targets (2018), Edition 01.00.00, April 2018
https://stellar.sesariu.eu/servlet/dl/ShowDocumentContent?doc_id=6784461.13&att=attachment&statEvent=Download
- [19]16.06.06-D68 Part 1 –SESAR Cost Benefit Analysis – Integrated Model
- [20]16.06.06-D51-SESAR_1 Business Case Consolidated_Deliverable-00.01.00 and CBA
- [21]Method to assess cost of European ATM improvements and technologies, EUROCONTROL (2014)
- [22]ATM Cost Breakdown Structure_ed02_2014
- [23]Standard Inputs for EUROCONTROL Cost Benefit Analyses
- [24]16.06.06_D26-08 ATM CBA Quality Checklist
- [25]16.06.06_D26_04_Guidelines_for_Producing_Benefit_and_Impact_Mechanisms

Validation

- [26]03.00 D16 WP3 Engineering methodology
- [27]Transition VALS SESAR 2020 - Consolidated deliverable with contribution from Operational Federating Projects
- [28]European Operational Concept Validation Methodology (E-OCVM) - 3.0 [February 2010]

System Engineering

- [29]SESAR Requirements and V&V guidelines

Safety

- [30]SESAR, Safety Reference Material, Edition 4.0, April 2016
<https://stellar.sesariu.eu/jsp/project/qproject.jsp?objId=1795089.13&resetHistory=true&statInfo=Ogp&domainName=saas>
- [31]SESAR, Guidance to Apply the Safety Reference Material, Edition 3.0, April 2016
<https://stellar.sesariu.eu/jsp/project/qproject.jsp?objId=1795102.13&resetHistory=true&statInfo=Ogp&domainName=saas>
- [32]SESAR, Final Guidance Material to Execute Proof of Concept, Ed00.04.00, August 2015
- [33]Accident Incident Models – AIM, release 2017
https://stellar.sesariu.eu/servlet/dl/ShowDocumentContent?doc_id=3658775.13&att=attachment&statEvent=Download

Human Performance

[34]16.06.05 D 27 HP Reference Material D27

[35]16.04.02 D04 e-HP Repository - Release note

Environment Assessment

[36]SESAR, Environment Reference Material, alias, “Environmental impact assessment as part of the global SESAR validation”, Project 16.06.03, Deliverable D26, 2014.

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

Security

[38]16.06.02 D103 SESAR Security Ref Material Level

[39]16.06.02 D137 Minimum Set of Security Controls (MSSCs).

[40]16.06.02 D131 Security Database Application (CTRL_S)

PJ.03b-05

[41] D4.1.190 - SESAR PJ03b-05 V3 OSED-SPR-INTEROP part IV – Human Performance Assessment Report (HPAR)

[42] D4.1.190 - SESAR PJ03b-05 V3 OSED-SPR-INTEROP part I

Appendix A Detailed Description and Issues of the OI Steps

The table below reminds the 2 OI steps & associated enablers is provided in appendix A.

SESAR Solution ID	SESAR Solution Description	Master or Contributing (M or C)	Contribution to the SESAR Solution short description	OI Steps ref. (from EATMA)	Enablers ref.(from EATMA)	Enabler definition
PJ03b-05 Traffic Alerts for pilots for airports operations	Traffic Alerts for pilots for airports operations refer to enhancing on-board systems in order to detect potential and actual risks of collision with other traffic during runway and taxiway operations. In all cases the flight crew are provided with appropriate alerts.	M	Runway part	AUO-0605: Traffic Alerts for Pilots during Runway Operations	A/C-43a1	Traffic Alerts for Pilots during Runway Operations
					A/C-24 Optional	Airport moving map and own aircraft position display in cockpit.
					A/C-48a	Air broadcast of aircraft position/vector (ADS-B OUT) compliant with DO260B
					A/C-25 Optional	Airborne Traffic Situational Awareness to support surface operations (ATSA-SURF), including reception (ADS-B in), processing and display
					A/C-67	ADS-B IN
					REG-0200 Optional	Safety Targets in Relation to Reductions of Runway Incursions

		M	Taxiway part	AUO-0615: Traffic Alerts for Pilots during Taxiway Operations	A/C-24 Optional	Airport moving map and own aircraft position display in cockpit.
					A/C-25	Airborne Traffic Situational Awareness to support surface operations (ATSA-SURF), including reception (ADS-B in), processing and display
					A/C-43a2	Traffic Alerts for Pilots during Taxiway Operations
					A/C-48a	Air broadcast of aircraft position/vector (ADS-B OUT) compliant with DO260B
					A/C-67	ADS-B IN

Table 1: SESAR Solution 03b-05 Scope and related OI steps

Project PJ.03b Members



Project PJ.03b Active Organizations

ADP	ENAV	LPS SR
AIRBUS SAS	EUROCONTROL	MICROSTEP-MIS
AIRBUS OPS	FREQUENTIS	NLR
ANS CR	HONEYWELL SAS	PANSA
BULATSA	HONEYWELL Inc.	TECHNO SKY
DASSAULT	HONEYWELL Sro	THALES LAS
DFS	INDRA	THALES AVIONICS
DLR	INDRA NAVIA	R-SYS
DSNA	INTEGRA	UNIWARSAW
EDISOFT	LEONARDO	UNIZA

End of the document